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13C/12C analysis of bacteria-specific fatty acids to assess the liability of terrestrial and marine organic matter in sediments of the St. Lawrence estuary

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The bottom waters of the St. Lawrence Estuary are characterized by low dissolved oxygen levels (hypoxia) that affect the health of this ecosystem. The progression of hypoxia since the beginning of the 20th century is due in part to an increase in the flux of terrestrial organic matter (OM) and inorganic nutrients (which leads to a higher in-situ primary productivity) discharged in this aquatic system primarily by the St. Lawrence River. The increase in concentrations and fluxes of dissolved and particulate OM in the water column results in higher consumption rate of oxygen by OM-degrading microorganisms compared to conditions that existed before the industrialization of the St. Lawrence River watershed. To improve our understanding of the relative importance of the terrestrial and marine OM sources in bacterial OM degradation and oxygen consumption in this system, we compared their in-situ biological lability through the analysis of the 13C/12C ratio of ubiquitous bacteria-specific fatty acid (iC15:0 and anteiC15:0) using GC-IRMS. We cultivated ubiquitous bacteria strains responsible for the degradation of OM in marine broth enriched in 13C at different levels to assess the relationship and isotopic fractionation between the 13C signature of the food source and that of the bacteria. Using this calibration and the isotopic signature of the terrestrial and marine OM end-members we determined the proportion of terrestrial and marine OM degraded by bacteria in surface sediments from different sites along the terrestrial-marine continuum in the St. Lawrence Estuary and Gulf.