Heterotrophic bacterial utilization of nitrogenous and nonnitrogenous substrates, determined from ammonia and oxygen fluxes

Rodrigues, Rubina M. N. V., Peter J. le B. Williams

Limnol. Oceanogr., 46(7), 2001, 1675-1683 | DOI: 10.4319/lo.2001.46.7.1675

ABSTRACT: We describe a simple procedure to allow the broad nature of the organic substrates used for planktonic bacterial growth to be determined. The method analyzes the coupled oxygen and ammonia fluxes in terms of the relative proportions of nitrogenous and nonnitrogenous substrates assimilated by the microheterotrophs. The model uses a stoichiometric equation that requires the knowledge of the respiratory quotient, substrate C/N ratio, cell C/N quota, and bacterial carbon growth yield and the assumption that nitrification was not occurring. We discuss the uncertainties associated with the attribution of values for these constants and illustrate the use and limitations of the approach in the interpretation of field observations on bacterioplankton metabolism in a temperate coastal ecosystem. With the exception of a single observation, we were able to interpret the data using the proposed model. Our findings are that during the spring bloom, nitrogenous substrates made up 40-80% of the total, falling to <20% in the postbloom period. Thus, with essentially routine methods for determining oxygen and ammonia fluxes, we have been able to determine a fundamental aspect of the cycling of organic material by the bacterioplankton.