Interactions between DOC, microbial processes, and community structure in the mesopelagic zone of the northwestern Sargasso Sea

Carlson, Craig A., Stephen J. Giovannoni, Dennis A. Hansell, Stuart. J. Goldberg, Rachel Parsons, Kevin Vergin

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ABSTRACT: At the Bermuda Atlantic Time-Series Study (BATS) site, the field observations of dissolved organic carbon (DOC) dynamics indicate that seasonally produced "semilabile" DOC is resistant to rapid microbial degradation in the surface waters but available for microbial remineralization once it is delivered into the mesopelagic zone after convective overturn. In this study, we employed an experimental simulation of convective overturn events to determine whether the remineralization of semilabile DOC would occur in a controlled laboratory setting. Seawater culture experiments were conducted in which surface (≤10 m) and mesopelagic (250 m) 0.2-mm filtrates were inoculated with unfiltered water from ≤10 and 250 m in an assortment of combinations to simulate various mixtures of nutrients, DOC quantity and quality, and microbial assemblages. Results indicate that (1) microbial inocula from the upper euphotic zone were incapable of remineralizing the seasonally accumulated semilabile DOC (μmol C L^{-1} resolution) on the timescales of the incubations; (2) the utilization of semilabile DOC was greatest when the inoculum source was from 250 m and the filtrate source was from the upper 10 m; and (3) the decrease in bacterioplankton diversity, estimated with the Shannon-Wiener diversity index, was greater in treatments in which inoculum from 250 m was mixed with filtrate from 10 m than in treatments in which the surface inoculum was mixed with the surface filtrate. Our findings are that a portion of the surface semilabile DOC can be metabolized by microorganisms in a laboratory setting and that mesopelagic nutrients alone are insufficient to stimulate DOC drawdown >1.3 μmol L^{-1}. Transformations of microbial community structure were associated with the drawdown of surface DOC in simulated mixing events and suggest that microbial community structure is a factor in surface-layer DOC dynamics.