Primary and bacterial production in lakes: are they coupled over depth?

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Abstract

The coupling of primary and bacterial production over depth was examined in three lakes which differed greatly in vertical patterns of primary productivity. We measured bacterial production, chlorophyll and light, and estimated primary production in Paul Lake (Gogebic County, Michigan) and Crystal and Trout lakes (Vilas County, Wisconsin) during the summer stratification period (May–September 1991). Bacterial productivity was measured using the [^{3}H]leucine incorporation method and primary productivity estimated from measured photosynthesis–irradiance relationships. Three distinct vertical patterns were observed. In Paul Lake, bacterial production was highest at the interface between the aerobic and anaerobic layers, well below the depth of maximum primary production. In Crystal Lake, bacterial production was uniform with depth, although primary productivity was highest in the hypolimnion. In the largest lake. Trout Lake, primary and bacterial production tended to co-vary with maximum rates of both processes occurring in the metalimnion. Overall, bacterial productivity was poorly related to contemporaneous primary production in the three lakes, suggesting that other factors, such as nutrient recycling, phytoplankton loss rates and allocthonous loading, determine patterns in the depth distribution of bacterial productivity.