

Dissolved inorganic carbon sources for epipellic algal production: Sensitivity of primary production estimates to spatial and temporal distribution of ^{14}C

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Abstract

Estimates of epipellic algal primary production using ^{14}C are sensitive to whether the presumptive source of dissolved inorganic carbon (DIC) is the overlying water, the interstitial water, or both. To determine the source of DIC, we compared ^{14}C uptake among intact sediment cores exposed to different ^{14}C ratios between interstitial and overlying water. In addition, we evaluated the effect of varying time between addition of ^{14}C and light incubation (preincubation time) and the effect of photosynthetic uptake on final distribution of ^{14}C . Both preincubation time and photosynthetic uptake affected final ^{14}C distribution, but the magnitude of the photosynthesis effect was larger. Estimates of primary production ranged between 50 and 200 $\text{mg C m}^{-2} \text{ h}^{-1}$, depending on the presumed DIC source and whether we accounted for differential photosynthetic depletion of ^{14}C and DIC. Using nonlinear regression, our best estimate of epipellic production was 114 $\text{mg C m}^{-2} \text{ h}^{-1}$, and the fraction of DIC sequestered from overlying water was 0.5 ($R^2 = 0.84$). Similar assessments should be applied in other systems for accurate ^{14}C estimates of epipellic algal production.