



Phytoplanktonic primary production in a nutrient-rich estuary - comparison of methods

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Phytoplanktonic primary production was investigated in the turbid and nutrient-rich Scheldt estuary (Belgium/The Netherlands) during two field trips in November 2002 and April 2003 (EUROTROPH project). Three common incubation methods for estimating primary production in aquatic ecosystems were used and compared: (1) the light-dark oxygen, (2) the ^{14}C and (3) the H_2^{18}O approaches. Four and five stations along the estuary were sampled in November and April, respectively, which corresponded to a salinity range of 0.5-21. Water was sampled at sunrise and incubated until sunset in bottles stored in a 5-compartment incubator kept at in situ temperature by flowing estuarine water. Irradiance was controlled in each compartment by filters having a shading capacity ranging from 0 to 100%. The contributions of oxygen consumption due to respiration and nitrification, were estimated by incubating samples in the dark compartment, with and without addition of nitrification inhibitors. Unexpectedly, the H_2^{18}O method provided lower gross primary production rates than the oxygen technique. Rates estimated by the ^{14}C approach were intermediate between these two. Ratios of O_2 vs. ^{14}C based rates were in the range of reported ratios in estuaries (1-1.7) indicating that the ^{14}C method provided estimates close to gross primary production. The ratio of O_2 vs. H_2^{18}O based rates varied between 1 and 4 with the highest values estimated for oligohaline stations. Interestingly, these ratios were strongly correlated with the nitrification rates. Although the reasons of such an impact of nitrification on ^{18}O remain unknown, this study clearly highlights the potential underestimation of gross primary production by the H_2^{18}O method in ammonium-rich systems.