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CO_2 influence on oxygen dynamics and net primary production of the microphytobenthos: an experimental approach

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ABSTRACT:

Production of organic matter by phototrophs requires inorganic carbon, which in aquatic systems is taken up from the water column, sediment or atmosphere. Observations on a microphytobenthic mat overlaid with 2 mm of water and atmospheric air showed a tight balance between consumption and production of oxygen and, therefore, a bimodal pattern in the Net Primary Production (NPP). Enrichment of the air with CO_2 led to an enhancement of the NPP of a community, while the removal of all CO_2 from the air resulted in no NPP and a linear O_2 gradient from the overlying water to the lower part of the mat. The distribution and rates of gross photosynthetic oxygen production, measured as the oxygen decline within one to twos after light-dark shifts, showed little response to CO_2 depletion, suggesting that the photosynthetic electron flow was primarily redirected from CO_2 fixation to photorespiration. In nature, the observed control of NPP by atmospheric CO_2 concentration should be most pronounced in shallow-water and intertidal systems, and the productivity in these ecosystems may therefore be steadily increasing along with the increase in atmospheric CO_2 concentration.

Keywords:

Microbial mat, Carbon dioxide, Oxygen profile, Gross oxygen production, Net primary production.

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