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Biogeosciences Discussions

Interactive comment on "

Carbon fluxes in natural plankton communities under elevated CO_2 levels: a stable isotope labeling study" *by* A. de Kluijver et al.

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The authors thank the referee for the valuable comments that helped to improve the manuscript.

The referee argues that the research questions and rationale of our study need to be communicated in a clearer way. The manuscript addresses two central issues: (1) the carbon coupling between phytoplankton and bacteria and (2) the effect of ocean acidification on carbon fixation by phytoplankton and on the transfer of recently fixed carbon

to bacteria. The referee feels that ocean acidification dominates the introduction and that key features related to phytoplankton-bacteria coupling are not clearly explained. We agree with the referee about the unbalance between the two central themes of our paper. We will therefore rewrite the introduction so that the focus will shift from ocean acidification towards carbon transfer from bicarbonate via phytoplankton to bacteria. The rationale of the manuscript will be explained in more detail. This will also improve the connection between the introduction and the discussion. Studies of phytoplankton-bacteria coupling are traditionally based on correlations of phytoplankton and bacterial biomass or correlations of primary production and secondary bacterial production. Very few studies have directly examined the transfer of carbon between phytoplankton and heterotrophic bacteria using tracers and none has studied the effect on ocean acidification on this coupling, while it is an important issue in ocean acidification research. Enhanced carbon consumption in the upper ocean accompanied with increasing production of dissolved organics (TEP) at elevated CO2 levels has been observed in CO2 enrichment studies. The extra carbon is an important source for heterotrophic bacteria and could therefore be remineralized in the microbial food-web, transferred up in the food web, or exported to the deep ocean and the balance between these processes determines the CO2 uptake capacity of the upper ocean. Thus, looking at the effect on phytoplankton-bacteria coupling is as relevant as looking at sinking rates to examine the ocean feed-back to atmospheric CO2. It is also relevant for ocean acidification effects on food web functioning.

The referee believes that some basic features of the experiment are not fully described. We agree, because we deliberately left it out and referred to the paper of Schulz et al. 2008 and other papers in that special issue, where the experimental setup has been described in detail.

The referee is under the impression that the growth rates we showed were based on standing stocks. Apparently our text was not entirely clear, because growth rates are based on tracer dynamics rather than stock. The main advantage of the 13C labeling

technique is that the increase in label in phytoplankton biomass during the bloom is a measure of growth, comparable to the 14C technique. Although loss and sinking take place, we can assume that these processes do not influence the tracer ratio of phytoplankton biomass and thus the calculated influence growth rates. The referee feels that we over-interpreted non-significant CO2 effects; this applies to phytoplankton growth rates and bacterial fractions derived from phytoplankton. The referee is right that the small differences were not significant and shouldn't been given much interpretation. In response, we will shorten the discussion, but will retain the data because non-significant effects should be reported as well.

The referee finds the link between bacterial turn-over and bacterial growth efficiency (BGE) unclear. In the revised manuscript, the link will be explained in more detail.

The referee comments on the lack of information about zooplankton. The obtained data on zooplankton were too limited to draw conclusions. Therefore, the zooplankton part will be removed in the revised paper.

References Schulz, K. G., Riebesell, U., Bellerby, R. G. J., Biswas, H., Meyerhöfer, M., Müller, M. N., Egge, J. K., Nejstgaard, J. C., Neill, C., Wohlers, J., and Zöllner, E.: Build-up and decline of organic matter during PeECE III, Biogeosciences, 5, 707-718, 2008.

Interactive comment on Biogeosciences Discuss., 7, 3257, 2010.