Mandal, Norway 27.7.2016

Response to second review

Dear Editor

We have gone through the second revision, please find our comments to the points below.

Yours sincerely,

Kristian Spilling

Reviewer comments on MS No.: bg-2015-608

Reviewer comment #1

2nd REVISION: The revised version of the manuscript by Spilling et al. addresses both reviewer's comments in a satisfactorily manner, except for one point that I still think disserves more attention. Although I consider it a minor change, it shall be properly addressed.

1. Ln480-491. I do not see the rationale of still including discussion on vascular plants, despite of authors arguments in favour of doing it. For most of the phytoplanktonic species, rubisco is less than half-saturated under present CO2 concentrations in seawater and, that is the point, some species have developed ways to increase intracellular CO2 concentrations by using CCMs, possibly having a direct relationship with respiration. I insist, vascular plants behave in a very different manner than phytoplankton due to the particularity of the aquatic environment.

I do not agree with this sentence: "Phytoplankton lacks any specialized structures like root system and may consequently function more like plant foliage", which seems to be the "excuse" for not having removed the paragraph related to vascular plants. I think that suggesting that "phytoplankton may act as plant foliage" is going a bit too far...

Thus, as I said in my former report, mentioning embryophytes here is out place, when there are very relevant studies done in CCMs in phytoplankton that could have been used to better contextualize this

part of the discussion. Remove the mentioned-paragraph, and discuss your data attending to phytoplankton CCMs.

Author response:

We disagree somewhat on this topic, but this section is not critical for the discussion and we removed the paragraph in question.

We moved up, and expanded on the CCMs replacing the paragraph the reviewer pointed out (see also comment #2). The modified paragraph now reads:

"For primary producers in aquatic environment, changes in carbonate chemistry speciation affects the availability of the sole substrate, i.e. CO_2, at the site of photosynthetic carbon fixation. At present, marine waters typically have a pH of 8 or above, and most of the carbon is in the form of bicarbonate (HCO_3^-). Many phytoplankton groups have developed carbon concentrating mechanisms (CCMs) as a way to increase substrate availability at the site of carbon fixation (Singh et al., 2014), reducing the cost of growth (Raven, 1991). For phytoplankton with CCMs, increased CO_2 availability would suppress the CCM, freeing resources for growth, in particular under light limiting conditions (Beardall and Giordano, 2002). There are examples of experiments with ocean acidification that has indicated downregulation of CCM (Hopkinson et al., 2010) and photosynthetic apparatus (Sobrino et al., 2014), which could reduce respiration in phytoplankton."

Reviewer comment #2

Check the following refs please:

-Badger, M.R., Andrews, T.J., Whitney, S.M., Ludwig, M., Yellowlees, D.C., Leggat, W., and Price, G.D. (1998) The diversity and coevolution of Rubisco, plastids, pyrenoids, and chloroplast-based CO2 - concentrating mechanisms in algae. Can. J. Bot. 76: 1052–1071.

-Beardall, J. and Giordano, M. (2002) Ecological implications of microalgal and cyanobacterial CO2 concentrating mechanisms, and their regulation. Funct. Plant Biol. 29: 335–347.

-Emma Huertas, Brian Colman, and George S. Espie (2002). Mitochondrial-Driven Bicarbonate Transport Supports Photosynthesis in a Marine Microalga . Plant Physiol.130:284-291

-Nimer, N.A., Merrett, M.J., and Brownlee, C. (1996) Inorganic carbon transport in relation to culture age and inorganic carbon concentration in a high-calcifying strain of Emiliania huxleyi (Prymnesiophyceae). J. Phycol. 32: 813.818

-Raven, J.A. (1991) Physiology of inorganic C acquisition and implications for resource use efficiency by marine phytoplankton: relation to increased CO2 and temperature. Plant, Cell Environ. 14: 779–794

-Sültemeyer, D. (1998) Carbonic anhydrase in eukaryotic algae: characterization, regulation, and possible function during photosynthesis. Can. J. Bot. 76: 962–972

Author response: we have gone through the references and has expanded on the discussion on CCMs. We added references to Beardall and Giordano (2002) and Raven (1991)

Reviewer comment #3

2. Supplemental Figure 1S (very minor comment) showing the platforms used for primary production incubations does not read well. The font used to depict the different depths, buoys anchors, sediments traps etc. would do better in bold bigger size font on top of the green colour representing the water column.

Author response: We made a new version of the figure with larger text.