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Biogeosciences Discussions

Interactive comment on "Impacts of elevated CO_2 on phytoplankton community composition and organic carbon dynamics in nutrient-depleted Okhotsk Sea surface waters" *by* T. Yoshimura et al.

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We appreciate the reviewer's encouraging comments and suggestions on our manuscript. In the following, we describe the changes we have made in response to the reviewer's comments.

Responses to the Major Comments

1. We added new results of microscope analysis on microzooplankton as Table 2 in the Results and Discussion section of the revised manuscript (P9, L269–301). We discussed the drawbacks of bottle incubation experiments, and also mentioned about the interaction between phytoplankton growth and microzooplankton grazing during a 14-

day incubation. Our results show that relatively high abundance of microzooplankton was maintained during the incubation. We assume that the decline of phytoplankton abundance was the result of the trophic cascade effects. Regardless of the bottle effect, changes in community composition and DOC accumulation were derived from the difference in pCO2 among the treatments. However, we should be careful in extrapolating the results to that of natural responses, and we clearly state this in the Results and Discussion sections (P10, L302–328).

Responses to Detailed Comments

2. Comments on P4145, L26–28: In the past studies using natural phytoplankton assemblages, Tortell et al. (2002) used a dilution with nutrient rich water; Kim et al. (2006) enriched N and P; Hare et al. (2007) enriched Fe or Fe, N, P, Si; Riebesell et al. (2007) enriched N and P; Tortell et al. (2008) used Fe enrichment and dilution with nutrient rich water. We changed the expression of the past studies in the Introduction of the revised manuscript (P3, L70–72).

3. Comments on P4147, L5: Our preliminary experiment showed that we need to bubble the air-CO2 gas at the flow rate of 100 or 50 mL min-1 to reach a stable pH within 24 hours and maintain that pH. We have no data for the direct impact of bubbles on planktonic organisms, and this should be addressed in future studies.

4. Comments on Section 2.2: We measured particulate nitrogen as well as carbon, so we described this in the Materials and Methods (P5, L138–143) and discussed the POC/N ratio in the Results and Discussion (P8, L244–246; P9, L279–281).

5. Comments on P4149: First, we used pCO2 as ppm throughout the revised manuscript. Second, the initial low pCO2 of 200 ppm was observed because that was the post spring bloom water. The low pCO2 is consistent with Andreev and Pavlova (2007). For the pCO2 in the gas cylinders, we did not confirm the actual pCO2. We cannot determine whether the reported pCO2 values are correct or not. We described this in the first paragraph of Results and Discussion sections (P6, L161–178).

6. Comments on P4150, L1–2: Liu et al. (2009) measured phytoplankton growth rate at the same site during the same cruise using a dilution method. We clearly mentioned this in the Results and Discussion sections (P9, L274–278). We cannot confirm whether the specific growth rate was maintained during the 14-day incubation. Our microscope data on microzooplankton suggest that grazing pressure was maintained during the experiment. We discussed this in the new paragraph in the Results and Discussion of the present manuscript (P9, L269–301).

7. Comments on P4150, L23 onwards: We changed the expression as diatom having a competitive advantage at low pCO2 (P7, L212–220). Our data suggested that a coupling of phytoplankton growth and microzooplankton grazing existed in the bottles throughout the experiment (P9, L269–301). The change in the phytoplankton community structure can be explained as the result of the change in pCO2. The higher amount of SiO2 consumption is consistent with the higher relative contribution of diatoms in the assemblage; we believe there is no discrepancy in the sentence of P4150, L25.

8. Comments on P4152: We agree with the reviewer's comment. In the revised manuscript, we shorten the speculative discussions and simplified the interpretation of our results (P8, L241–268; P10, L302–328).

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