Biogeosciences Discussions

Biogeosciences Discuss., author comment AC1
https://doi.org/10.5194/bg-2021-226-AC1, 2021

Reply on RC3

Yuan Dong et al.

Author comment on "Biophysical controls on seasonal changes in the structure, growth, and grazing of the size-fractionated phytoplankton community in the northern South China Sea" by Yuan Dong et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2021-226-AC1, 2021

Response to Anonymous Referee #3

General comments

- The authors showed the size-fractioned phytoplankton community growth and grazing based on the result from dilution experiments. The authors also explained the biophysical factors which controlled the growth and grazing rates of micro-, nano- and pico-phytoplankton. In general, this manuscript is novelty and a board international interest. The experiment was well designed and conducted, the data interpretation was sufficient and accurate. However, the statistical analysis and some data interpretation should be revised and improved.

Response: We thank the reviewer for overall positive comments.

Specific comments

- Introduction:

Please add information about phytoplankton community in the study area.

Response: Done. The background information of phytoplankton community has been added to the revised manuscript as "Previous studies have suggested that phytoplankton community in the coastal waters near Wanshan was dominated by

diatoms with intense blooms occurring in response to strong eutrophication (e.g. Li et al., 2013). The dominant diatom species here wereSkeletonema costatum in the summer and *Eucampia zoodiacus* in the winter. There were also intense grazing of phytoplankton by microzooplankton (mainly ciliates and dinoflagellates) and mesozooplankton (mainly copepods) (Chen et al., 2015)".

- Materials and Methods:

in the estuary system, the ammonium is important nutrient for phytoplankton. So please explain why not analyses ammonium as the control factor?

Response: The reviewer is right about the importance of ammonium in coastal waters. Unfortunately, we did not have ammonium measurements. Nitrate concentration is generally higher than ammonium throughout the year in the PRE (Chen et al., 2009). Thus, we only examine nitrate as a control factor in this study. Further study may need to consider ammonium as well.

- line128-130,'' Ten incubation bottles were enriched with dissolved inorganic nutrients of 5 μmol l-1, $NaNO_3$, 0.5 μmol l-1 KH_2PO_4, and 5 μmol l-1, Na_2SiO_3 to ensure the constant growth of phytoplankton (particularly to avoid nutrient limitation during winter).'' As we know, the N/P Redfield ratio is 16, Could you explain why you determine this N:P ratio (10) in your manuscript?

Response: We did not choose the Redfield N:P of 16 in our nutrient-enriched experiments as the N:P ratio about 10 is sufficient for a large phytoplankton growth due to a persistent high N/P ratio of the local surface seawater driven by river discharge, similar to those used by Chen et al (2009).

- Results:

Line 238-239, "Generally, the annual average of the nutrient-enriched growth rate (1.68 d-1) was higher than that of the natural growth rate (1.22 d-1), indicating a nutrient limitation of phytoplankton even in this highly eutrophic system", i think the conclusion needs to be taken with caution, especially in the estuary system.

Response: Agree. We have replaced "limitation" with "deficiency".

- Discussion:

Line 261, "It is surprising to find negative intrinsic growth rates of nanophytoplankton during April and May 2019". The authors explained that "nanophytoplankton by itself tends to be limited by phosphorus". However, there were some similar situations in the

Dec. and Feb., and the intrinsic rates of nanophytoplankton was higher. Could you give more information to explain the different results?

Response: We should not expect to get a negative specific growth rate (u0 >=0). A negative specific growth rate of nano-autotrophs during April and May should imply that the dilution technique may not work for nano-cells in these two months So, it is inappropriate to directly compare growth rates of nano-cells between Dec (or Feb) and April (or May).

- Line 283-284, "Interestingly, we found nanophytoplankton was more controlled by light than the other factors.", this experiment was conducted in the surface (2m), light should not limit phytoplankton growth. So please explain the reasons why nanophytoplankton was more controlled by light than the other factors.

Response: The reviewer is right about that there should not be light limitation in the surface seawater. Previous study suggested that phytoplankton growth on the west coast of Spitsbergen could be predominantly controlled by solar irradiance on seasonal and inter-annual timescales (van de Poll et al., 2021). The cycle of warming and freshwater discharge in the coastal regions could be driven by solar radiation (van de Poll et al., 2021). This may be a possible explanation why nanophytoplankton in our system was more controlled by light than the other factors.

van de Poll, W.H., Maat, D.S., Fischer, P., et al. (2021), Solar radiation and solar radiation driven cycles in warming and freshwater discharge control seasonal and inter-annual phytoplankton chlorophyll a and taxonomic composition in a high Arctic fjord (Kongsfjorden, Spitsbergen). Limnol Oceanogr, 66: 1221-1236.

- in the 4.1, there was a strong negative correlation between salinity and phytoplankton growth, but the authors did not discuss the salinity how to influence the phytoplankton. A reasonable explanation may be obtained in terms of salinity.

Response: Coastal phytoplankton species can tolerate a much larger range of salinity than estuarine and oceanic species (e.g. Brand 1984). The negative relationship between salinity and phytoplankton growth should be attributed to nutrients given the tight negative relationship between salinity and nutrients. The correlation between nutrient and salinity at this station was due to the seasonal input of eutrophic freshwater (higher nutrient but lower salinity compared to the offshore oligotrophic seawater).

- Technical corrections

in the Fig.2, the legend of NO3 and PO4 is not the standard format, please revise it.

Response: Done. We have revised the legend as suggested.