

Biogeosciences Discuss., author comment AC1
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Reply on RC1

Hanna M. Kauko et al.

Author comment on "First phytoplankton community assessment of the Kong Håkon VII Hav, Southern Ocean, during austral autumn" by Hanna M. Kauko et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-45-AC1>, 2022

This manuscript describes the phytoplankton assemblage observed in a relatively understudied region of the Southern Ocean, based on a variety of analytical tools that together highlight the contributions made via different methods, strengths and weaknesses, and interprets these data within their broader oceanographic context. The authors do an excellent job displaying their data in ways that make sense and do an equally strong job describing patterns in the results. The results section is very detailed, and at first it was a bit slow going to get to the heart of the interpretation. However, I found myself going back to the results and the figures as I was reading the discussion. The strength of this paper lies in the discussion, where the authors key in on the most interesting parts of their complex data set. I do not recommend changes to this manuscript, though I have some suggestions for potential future work, based on their data, and a request for publication of the microscope imagery to assist other researchers, though that may be beyond the scope of this manuscript, and more appropriate for another venue.

Thank you very much for the positive feedback and for the appreciation of our work!

Section 4.1. While light microscopy may be the most time-consuming, this tool is critical as a complement to the HPLC/CHEMTAX work, and flow cytometry. The benefit of multiple tools is shown in section 4.1, where coccoliths are suggested by the CHEMTAX, though not observed under the scope, nor are they likely to be present in high numbers so far south, as noted by the authors. In this case, the authors identify the source as "Haptophyte-6-like" – an appropriate decision and one that suggests there is more to learn in this area. I think this is an important lesson for all, that the biochemical work is best combined with old-fashioned microscopy.

Thank you for the thoughts – we agree that multiple methods are needed to give a holistic picture of the communities, as mentioned shortly in the conclusions, and that "old-fashioned" microscopy is still a very valid approach.

Section 4.2. I appreciate the difficulties in interpreting depth-related differences, whether these are related to distinct living assemblages, settling assemblages sinking through the water column, either from directly above or from upstream. Consideration of all is important, and this snapshot study simply doesn't provide all the answers – which would instead require repeated temporal sampling, either via CTD casts or via sediment trap studies, or both. This kind of work has been done in the Ross Sea, as well as other areas

of the Southern Ocean, and might provide a template for future work in this less well-studied region.

Thank you for the advice. We have now also pointed out in the manuscript in the section 4.2 (currently on lines 477-478) that different sampling schemes are needed to properly resolve these patterns.

Section 4.3. Chaetoceros dicaeta – excellent summary of the oceanographic character of the region and the role of seeding and grazing, in guiding the diatom community – two factors that are often left out of discussion – combined with iron fertilization.

Section 4.4. Astrid Ridge pennates – long history of studies in Antarctica/Southern Ocean, besides those few referenced, that describe the relationship between sea ice algae and marginal ice zone blooms, and the dominance of pennate diatoms within sea ice. Papers by David Garrison, Kurt Buck, Ryszard Ligowski, Sarah McGrath Grossi and Neil Sullivan - for example - might be referenced here.

Thank you for these suggestions to strengthen the literature review. We have added articles from the mentioned authors to the manuscript section 4.4 which discusses the relationship between sea ice and pelagic algal communities, as well as to the section 4.1 on general phytoplankton community structure of the region.

(line 564, coastal instead of costal)

Thank you for pointing this out, the error is now corrected.

Section 4.5 Flagellate-dominated post-bloom community – I like the “complete” phytoplankton assemblage study as presented. I think this kind of approach, looking at more than just the diatoms, is going to be increasingly important as environmental change, dominated by warming, but accompanied by factors such as changes in stratification of the upper ocean, nutrient availability, and sea ice extent and duration, becomes more and more critical in driving change in the phytoplankton community at the group level.

Thank you for the comment and acknowledgement of the work – we agree on the importance of studying the different phytoplankton groups.

General comments:

I realize this may be a big “ask” for this paper, but I think images from the inverted microscopy would be very helpful for other researchers who would like to do similar research, with most phytoplankton researchers familiar with diatom identifications, but less so with the other algal groups. This may be something for a future publication - I think it would be a great contribution.

Thank you for the suggestion. Unfortunately, we consider this beyond the scope of the manuscript, also because images were not taken systematically, but we will keep it in mind for future publications. We have included an image of the cyanobacteria present in the samples in the supplementary figures in the appendix.

Any consideration of future sediment coring to address longer-term changes in this sector? It would be a great addition to our background understanding how oceanographic and climatic changes have influenced the ecosystem over time.

Very few paleo records exist from the Kong Håkon VII Hav (e.g. Forsberg et al., 2003, doi: 10.1016/S0031-0182(03)00402-4), but colleagues at the Norwegian Polar Institute are indeed planning new sediment coring in future proposals and projects.

Figure 1: contour interval for map?

This information has now been added to the figure caption.