

Reviewer 1

I think the authors have made a good job revising the manuscript and I only have a few minor comment on the current version, but other than that I suggest it can be accepted for publication.

Authors' response (AR): We thank the reviewer for taking the time to go through the manuscript and time invested to improving the manuscript.

Maybe add southern to the title?

AR: Done

Lines 9, 25, 355 and more, I have not seen heterocytous before and would prefer heterocystous, but I see that reviewer 2 prefers the first one so that is up to you. I would argue they are generally called heterocysts.

AR: Heterocytous has been change to heterocyst

Lines 38-39 and 351, phosphorous should read phosphorus.

AR: Done

Lines 78-79, change measure to measured? Add a dot after spp.

AR: Done

Line 95, I still think you need to increase the range of *Aphanizomenon* salinities to either <10 or optimum at around 5 (if looking at Lehtimäki et al. 1997 that you refer to), it grows a lot on the northern Baltic Proper with salinities around 5-6 and is overall dominating in mainly salinities between 5-8 (Olofsson et al. 2020). Also you refer to a higher range at line 268.

AR: The sentence has been changed to the following:

"Typically, Aphanizomenon sp. dominates less saline waters (e.g., Bothnian Sea) and grow best with salinities around 5 (Lehtimäki et al., 1997). Aphanizomen sp., however, has also been frequently reported to grow at salinities reaching up to 5-8 such as the northern Baltic Proper (Olofsson et al., 2020). N. spumigena prefers the higher saline waters in southern part (e.g. the Southern Baltic Proper) with an optimum growth in salinities of 8-10 (Lehtimäki et al., 1997; Rakko and Seppälä, 2014)."

Lehtimäki, J., Moisander, P., Sivonen, K. and Kononen, K.: Growth, nitrogen fixation, and Nodularin production by two Baltic Sea cyanobacteria, *Appl. Environ. Microbiol.*, 63(5), 1647–1656, doi:10.1128/aem.63.5.1647-1656.1997, 1997.

Olofsson, M., Suikkanen, S., Kobos, J., Wasmund, N. and Karlson, B.: Basin-specific changes in filamentous cyanobacteria community composition across four decades in the Baltic Sea, *Harmful Algae*, 91(October 2019), 101685, doi:10.1016/j.hal.2019.101685, 2020.

Rakko, A. and Seppälä, J.: Effect of salinity on the growth rate and nutrient stoichiometry of two

Baltic Sea filamentous cyanobacterial species, Est. J. Ecol., 63(2), 55–70, doi:10.3176/eco.2014.2.01, 2014.

Line 141, what final percentage of ^{13}C ?

AR: Final concentration was around 3.8 atom %. This has been added to the text. It now says:
“...and $10\text{ }\mu\text{g mL}^{-1}\text{ H}^{13}\text{CO}_3$ (approximately 3.8 atom %).”

Lines 219 and 224, mol:mol? Maybe clarify by including in brackets.

AR: It is [$\mu\text{mol L}^{-1}$; $\mu\text{mol L}^{-1}$] and has been added to the text.

Line 315, what do you mean by “at the sampling locations monitored during our cruise”?

AR: Normally, *Rhodopseudomonas* require anoxia to fix nitrogen. At the sample location monitored, we had oxic condition. So, *Rhodopseudomonas* might not utilize the alternative nitrogenases. Nevertheless, I see that the sentence is confusing. I decided to delete the sentence, since I do not think it offers any significant relevance in the context.

Line 331, remove modelling? Neither Karlberg (laboratory study) or Olofsson (monitoring data) include modelling, but if you want a study of cyanobacteria modelling in the Baltic Proper you might want to refer to Hieronymus et al. 2020 in Biogeosciences but I am not sure it's a relevant reference here.

AR: Remove “and modelling approaches”. It now reads:

“While a study based on a compiled dataset (1979-2017) indicated that salinity does not affect the biovolumes of the filamentous *N. spumigena* but rather species-interactions (Karlberg and Wulff, 2013; Olofsson et al., 2020)”

Karlberg, M. and Wulff, A.: Impact of temperature and species interaction on filamentous cyanobacteria may be more important than salinity and increased pCO_2 levels, Mar. Biol., 160(8), 2063–2072, doi:10.1007/s00227-012-2078-3, 2013.

Olofsson, M., Suikkanen, S., Kobos, J., Wasmund, N. and Karlson, B.: Basin-specific changes in filamentous cyanobacteria community composition across four decades in the Baltic Sea, Harmful Algae, 91(October 2019), 101685, doi:10.1016/j.hal.2019.101685, 2020.

Line 386, feel free to include Malin Olofsson (or Dr. Olofsson to be consistent) here as well instead of anonymous, it will anyhow be listed once the paper is accepted.

AR: Done. The sentence now says:

“We thank Dr. Kuosa and Dr. Olofsson for reviewing the paper.”

Fig. S1. Is this really relative abundance? It looks more like some type of count measurement, and if it is it should have a unit. If relative I would assume it should be presented as % or 0-1? Based on replicates or one sample each? If replicates please include number of n.

AR: The figure has been remade so it shows relative abundance in %.

The references in table S3 should be listed somewhere? For example I still don't see Olofsson et al. 2021 in the reference list? Also Wasmund et al. 2001 and 2005?

AR: They have been added now. References were accidentally deleted when moving the table to supplementary.

Additional changes.

AR: Line 132 0.05 % $^{15}\text{N}_2$ was changes to 0.8%. Saw a error when calculating the final % of ^{13}C .

Editor

Dear authors

Please revise the manuscript according to the comments by reviewer #1. In addition, the text parts about future projections of salinity in the Baltic Sea should be updated. According to recent research, projected global sea level rise might counteract the freshening due to projected increases in precipitation (see the review article <https://esd.copernicus.org/articles/13/159/2022/>). Furthermore, projections are rather uncertain and it is unknown whether future salinity will increase or decrease (Meier et al., 2021).

Best wishes
Markus Meier

Reference:

Meier, H. E. M., C. Dieterich, and M. Gröger, 2021: Natural variability is a large source of uncertainty in future projections of hypoxia in the Baltic Sea. *Commun. Earth Environ.* 2, 50, <https://doi.org/10.1038/s43247-021-00115-9>

AR: The following text has been added to the text part about the future projection of salinity in the Baltic Sea.

“Latest studies, however, shows that projection of increased sea level rise counteracts freshening events in the Baltic Sea making it uncertain whether salinity increases or decreases in the future (Meier et al., 2021, 2022). Regardless, potential changes in salinity might impact the diazotrophic community as described above. The uncertainty in changing salinity makes it unclear in which extent diazotrophs might be impacted.”

Meier, H. E. M., Dieterich, C. and Gröger, M.: Natural variability is a large source of uncertainty in future projections of hypoxia in the Baltic Sea, *Commun. Earth Environ.*, 2(1), doi:10.1038/s43247-021-00115-9, 2021.

Meier, H. E. M., Dieterich, C., Gröger, M., Dutheil, C., Börgel, F., Safonova, K., Christensen, O. B. and Kjellström, E.: Oceanographic regional climate projections for the Baltic Sea until 2100, *Earth Syst. Dyn.*, 13(1), 159–199, doi:10.5194/esd-13-159-2022, 2022.