

Biogeosciences Discuss., referee comment RC2  
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## Comment on bg-2022-249

Anonymous Referee #2

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Referee comment on "Modelling the interactive effects of viral presence and global warming on Baltic Sea ecosystem dynamics" by Shubham Krishna et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-249-RC2>, 2023

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Review of "modeling the interactive effects of viral presence and global warming on Baltic Sea ecosystem dynamics"

### Summary

A 1D ecosystem model parameterized for the Baltic Sea is used to assess impacts of viral infection on biogeochemical processes (primary productivity, carbon export). A set of experiments are performed, with and without a combination of viruses and warming conditions. The study finds an interactive effect of warming and temperature on primary productivity, and carbon export.

### Main comments

The study is generally clearly written, and the results are novel and interesting. The findings have clear implications for our understanding of viral impacts on ocean biogeochemistry in a future ocean. I did find a few areas where results were presented confusingly. There are also some formatting issues that may need to be addressed, and one minor query about model structure. These are all outlined below.

### Specific comments

General comment: the manuscript says 'code available on request'. It would be nice to make this available in such a way that others might be able to reproduce the findings.

Page 2 line 50: "to our best knowledge..." a recent study assessed viral impacts on ocean biogeochemistry in a 1D setting at two ocean sites (Xie and Zhang 2022). I recommend including this citation and outlining how the present study differs.

Page 6, equation 19: it looks like this is linear w.r.t.  $P$ ? So, equivalent to Holling I, aka mass action? This implies the rate of grazing is unbounded, such that at very high  $P$  concentration, it can become quite large. It's a little unusual not to bound the rate of grazing with Holling II, Michaelis-Menten, or similar (e.g. Gentleman et al. 2003). Would be nice to see if including this makes a big difference to the results.

Page 7 line 159-161: "...qualitatively matches..." I'm fine with this sort of qualitative comparison, but am I right in saying that for me to evaluate the consistency, I need to

access Hjerne et al. 2019, and determine which of their data is being referred to? This seems like a heavy lift, and I suspect most readers will not make the effort. Can these data be recreated here, as you have with the Mojica 2016 data (Figure S7).

Page 7 line 166: "The maximum mortality...shorter than that caused by grazers". I was curious as to why this is. I couldn't find it explained in the discussion. My apologies if I missed it. If an explanation hasn't been provided, please consider including one.

Page 7 line 168: "(Fig S7)". Slightly pedantic on my part, but I expect the figure numbers to appear sequentially in the manuscript. This is the first supplemental figure and it goes straight to figure S7. Where are figures S1-S6 discussed? Are these discussed in the main text? Please make sure that all supplemental figures are discussed in sequence in the main text.

Page 8 line 176-180: "depth resolved ... detritus production" I don't understand the reasoning here. What does it mean to say that "higher temperatures seems to play a bigger role than stratification"? Surely temperature is mechanistically linked with stratification? Do you mean to say that, the effect of temperature on biological rates has a stronger impact than the effect of temperature on stratification? If so, how can you conclude this? It's not at all clear to me what is being said here.

Page 8 line 184-185: "The earlier onset .... Causes an earlier increase of virus biomass". I can't seem to find an explanation here or in the discussion for why this is the case. Apologies if I missed it. If an explanation isn't included, please provide one.

Page 8 line 196: "to our best knowledge" as above, there is one study with viruses in 1D (Xie and Zhang 2022). Please cite and explain how the present study differs.

## References

Gentleman, W., A. Leising, B. Frost, S. Strom, and J. Murray. 2003. Functional responses for zooplankton feeding on multiple resources: A review of assumptions and biological dynamics. *Deep. Res. Part II Top. Stud. Oceanogr.* **50**: 2847–2875.

Xie, L., and R. Zhang. 2022. Assessment of Explicit Representation of Dynamic Viral. *Viruses* **14**: 1–21.