

The article studies the impact of life stage of diatoms on their vertical export in the Svalbard area. The article would confirm the hypothesis that unhealthy diatoms are sinking whereas the healthy ones maintain better buoyancy and rather stay at surface.

I quite enjoyed the reading and I found it very instructive.

First, the topic is highly strategic and interesting. Diatoms dominate the primary production in this very productive region. However, very few (or no?) studies have in situ measurements. The hypothesis that senescent diatoms sink is often used without proper in situ proof. For these reasons, I think this article could potentially provide a valuable contribution.

However, I could just agree with the other reviewers. I have concerns about the significance of the results which are based on a very limited dataset. Yes, the authors found significant differences between photic and aphotic communities but still, this is a very weak. I acknowledge that the authors have done a great effort to re-frame their results during the review process and that there is not much more information to extract from the data set. I recommend say 'moderate' revisions to address remaining issues.

About the rate of mortality, I agree with most of the authors answer to reviewer #2. But I deeply encourage authors to be more specific. For example, it was not clear, before I read the answer to reviewer #2 the subtlety in the terminology of "survival". Please clarify that you only consider vegetative cells here. Because this is clear there is survival of (resting) cells in the dark for a long period of time.

Perhaps it could serve also in the discussion to understand that your approach is different from other studies. I have to admit I had exactly the same reaction than reviewer #2 during my first read of the revised manuscript (first appeared contradictory with the literature I know)

I was also surprised some major references were not listed in your study. As global critic, this article still lacks of contextualization. Some articles (see below in gray) that I found related (you are not obliged to cite those but it could help you to improve the discussion).

See for example

Kvernvik et al. 2019, <https://doi.org/10.1111/jpy.12750>. They say for example: "Our results suggest that some Arctic autotrophs maintain fully functional photosystem II and downstream electron acceptors during the polar night... This could allow Arctic microalgae to endure the polar night without the formation of dormant stages, enabling them to recover and take advantage of light immediately upon the sun's return during the winter-spring transition.". I am really surprised the authors did not take more precaution while discussing this still debated topic.

In Berge et al. 2015:

“Many Arctic phototrophic plankters are able to persist during unfavorable conditions as resting stages such as spores or cysts (Garrison, 1984; Smetacek, 1985; Krempand Anderson, 2000), and diatoms are known for their potential to survive long periods of darkness (Antia and Cheng, 1970; Smayda and Mitchell-Innes, 1974; Palmisano and Sullivan, 1982; Sakshaug et al., 2009; Quillfeldt et al., 2009). The survival strategies of the various plastidic flagellates of Arctic waters throughout the dark period, however, are largely unknown.”

Lacour et al. (2019) also suggest the opposite
(<https://link.springer.com/article/10.1007%2Fs00300-019-02507-2>)

“*Chaetoceros neogracilis* was not able to grow in the dark but cell biovolume remained constant after 1 month in darkness. Rapid resumption of photosynthesis and growth recovery was also found when the cells were transferred back to light at four different light levels ranging from 5 to 154 $\mu\text{mol photon m}^{-2} \text{s}^{-1}$. This demonstrates the remarkable ability of this species to re-initiate growth over a wide range of irradiances even after a prolonged period in the dark with no apparent lag period **or impact on survival.**”

As well as the extensive synthesis by Wulf et al. 2008
(<https://www.tandfonline.com/doi/abs/10.1080/0269249X.2008.9705774>)

“Based on the rapid increase in F_v/F_m we safely draw the conclusion that although the cells probably were physiologically resting in the dark they were not forming resting stages such as spores or cysts. Physiologically resting cells are morphologically similar to the vegetative cells, but are physiologically dormant and can be induced when cells are transferred to cold and dark conditions (Anderson 1975a). Like in our study, these cells have condensed protoplasts which are transformed back to the former state (within hours) upon re-exposure”

How the authors can be 100% confident that their unique culture experiment was reliable?
Did something else than darkness could have killed the algae (i.e. contamination?) ?
Could you discuss that ?

Also, there is many syntax, grammar and terminology issues in the text (lot of them were introduced during the revision process, that is a pity). I recommend to carefully correct the text because it makes the understanding sometimes difficult (I had to re-read many sentences many times). I have tried to list them in the specific comments but it became quickly overwhelming.

I encourage the authors to continue their efforts.

Specific comments:

PAGE9 (abstract).

L.23: specify phytoplankton bloom, it could be sea ice algae. Or if no distinction, just microalgae.

L.26: regional = specify Svalbard or Northwest Barents Sea

L.27-28: very awkward sentence. Change “occurrent with” something like “together with”.

L.29: SE= Standard Error ? I don't think you could use undefined abbreviation in the abstract. Need confirmation from editor.

PAGE11 (2.1)

L.23: you cannot say MLD is an indicator of stability. Stability is usually related to stratification. Stratification is basically the density gradient which you don't measure here. MLD is an indicator of mixing, this is it. People know what is MLD (or UPM), I suggest you just erase "an index of the stability of the water column" and also later in the text.

PAGE12 (2.3)

L.32 Move "expected" before "mortality".

L.35: I can understand but this is not well written. Perhaps change ", this simulated" par "simulating" ? or "which simulated" ?

PAGE13 (3)

Please be consistent and use either r or R² throughout the manuscript.

PAGE14

L.10: N or n ?

L.13: "from station 6 to station8"

L.14: a E is missing in the verb were. Change "these wre also the areas with" by something like "and where"

L.31-32: this is interpretation, should be moved in discussion.

PAGE 15, LINE 5 and PAGE 16 LINE 7: please do not use the term trend in this context. This is not appropriate, please re-word.

PAGE16

Line 23: among out ??? among OUR ?

Line 35-37: weird wording, had to re-read several times. I guess you wanted to say sedimentation is enhanced BY higher quotas for polar diatoms. Please re-word.