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Biogeosciences Discussions

Interactive comment on "Synergism between elevated pCO_2 and temperature on the Antarctic sea ice diatom *Nitzschia lecointei*" *by* A. Torstensson et al.

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Review of Synergisim between elevated pCO2 and temperature on the Antarctic sea ice diatom Nitzschia lecointei. By A. Torstensson, M. Hedblom, J. Andersson, M.X. Andersson, and A. Wulff

Review by Ken Ryan, Victoria University Wellington

This paper describes the effect of temperature and pCO2 on growth and productivity of the sea ice diatom Nitzschia lecointei. The paper describes interesting results that should be of general interest to our readers. Most of the discussion centres on bottom ice communities, so I suggest you use the term "bottom ice algae" throughout rather

than sea ice algae. You are probably aware that algae grow throughout the sea ice in brine channels, although they are usually in much lower concentrations there. Please delete Table 1, and incorporate the statistical data into the text. It saves a lot of space and is much easier to read and interpret. Most readers don't need f values and degrees of freedom. I assume you have that detail. Just quote the p value. L73. The word "offset" does not seem to be the right one. I am not sure what your meaning is here. Do you mean the development of bottom ice algal biomass in early spring is very important for grazers? If so please clarify this sentence. Remember that some algae exist in sea ice even in winter when there is no light. Not very many it is true, but it is not just ice. The use of the term "bloom" in reference to bottom ice algal growth may be confusing. Often, this term is reserved for a bloom of algae at the ice edge as the ice melts and the algae and nutrients are released into the water column. When you talk of a bloom in ice algae it is still not clear that you mean growth of bottom ice algae rather than a bloom of these ice algae at the ice edge. L280. You say that there was an increase in Fv/Fm and primary productivity with temperature. Was there any effect of pCO2? L282 At the end of this line you mention data from fig 1B saying that specific growth rate increased significantly with temperature. Firstly, if this is a significant increase, please provide statistical evidence. My reading of the ANOVA results posted in Table 1B however, indicates that there is an effect of temperature, but it does not say that there is an increase in growth rate with temperature. To claim that, you would need to show a regression fit with a significant slope, or perhaps a post hoc test to test for these changes (as described in the methods section). According to Fig 1B, at 5.6 OC, the specific growth rate drops to approximately the same value as at -1.8 OC. The trend goes up then down. Secondly, this observation should be described before Fig 2. L294. Take care with each claim you make. As it is written, this statement "Cellular PUFA content also decreased significantly with increasing pCO2" is not correct. It didn't change at 2.5 OC, only at -1.8 OC. L301. Having defined the fatty acids above, use the abbreviation ALA, rather than a complicated FA formula. At the end of this sentence my maths gives a total PUFA of only 80%. Please add that other PUFAs are

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listed in Table 2. L307 There was no reduction according to your stats. So you can't say that there was one! Simply state that there was no significant difference between treatments. L412. This paragraph is two pages long. Can you break it up into several paragraphs and please consider shortening this section. There are many instances where sentences can be shortened without losing content. Phrases like "a previous study by. . ." "It has been reported that. . ." can be deleted. L416. Your statement that PUFA concentration is high at optimum culture conditions, is not supported by your data. Fig 1B shows that optimum growth occurs between 2.4 – 5.1 OC. At the optimum temperature of 2.5 OC, PUFA concentrations are much lower than at -1.8 OC (Fig 4). L518. This is incorrect. Under warming scenarios the brine would likely become less saline not more saline. In fact you have just said this yourself on L515.

L534. Is it likely that these organisms may acclimate to higher temperatures?

Editorial Comments. Wording changes are underlined. L138 and L152. Give units for your salinity measurement. L153 You say five temperature treatments but you list only 4. L171. The temperature of the sample. . .. L173. The pH was determined using the calculations of . . . L251. Give the meaning of GC-MS. (perhaps this isn't necessary? Depends on the editors requirements!) I prefer to read the statistical justifications for each claim alongside the claim as below. L280. The growth rate was significantly higher in 960 uatm than at 390 uatm at 2.5 OC (SNK post hoc p=???). L291 FA contents were 65-76% lower at 2.5 OC compared to -1.8 OC (stats needed). L292 Fatty acid compositions for SAFA, MUFA, and PUFA are also shown in Fig 4. L299 More than 90% of the PUFA were the omega- fatty acids. . .. L311. This section refers to fig 1B, and should be described after the description of Fig 1A. This is the wrong place. L337. In the control temperature the growth rate was. . .. L359. Acclimation and the ability to benefit. . . L400. . . .suggested that low light stress may enhance the effect of low temperature on stored lipids. L402. . . .low light and low temperature may be a characteristic response. . . L408. Delete the words from "e.g. . . .." to the end of the sentence. Adds nothing to your statement L409. These findings suggest a major

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reduction of N. lecointei FA content is likely under future climate change scenarios of warmer water and thinner ice. I don't think the next bit about synergy is necessary. Are nutrient levels likely to drop under warmer conditions? L412. Sea ice algae contain high.... L416. Delete "noticeable". This word is unnecessary as your previous use of "revealed" means you saw them anyway! L419. 20-60% of what? L423. A percentage composition is not a concentration. Here you should cite the actual concentrations from Fig 4, not percentage of total FA. L424 Delete sentence starting "these results.." you have said this earlier, and cited the paper. Start a new paragraph after this to discuss the effect of pCO2. L487. Delete this sentence. You describe the study in the next sentence. L488 ...CCMs would benefit from elevated... L493 ...to be very taxon specific. The photosynthetic ... L494. ...brevis remained unaffected at... L496. Sentences shortened as follows. "The growth rate of T. pseudonana was unaffected by pCO2 at 1000 uatm, even though CCMs were down-regulated and photosynthesis up-regulated (Gao, 2012). This observation was explained by an increased rate of mitochondrial respiration..."

L500. The papers you cite are not "more recent" than the Gao 2012 paper.

L507. ...specific and depends on the concentration of the inhibitor...

L513. This might affect organisms dependent on sea ice algae L513. This might affect organisms dependent on sea ice algae more so than the algae themselves.

L515 However the upper and middle sections of the sea ice would become warmer...

L524. However, it will be important to consider the natural variability of pCO2, especially when ....

L530 ...optimum must be considered when assessing...

L534 ...future ocean warming event and this must be considered when assessing....

Interactive comment on Biogeosciences Discuss., 10, 6637, 2013.