Response to referee comments on 'The Arctic picoeukaryote *Micromonas pusilla* benefits synergistically from warming and ocean acidification' under review for Biogeosciences

D. Campbell (Referee #2)

This is a worthwhile study of an important issue. It is topical and well conducted. I am late with this review, so will offer some quick input on units and figures.

We thank the reviewer for these kind words.

Abstract: Fine

Introduction: Line 51, I think: "In this region, temperatures are rising more than twice as fast as the rest of the globe (Miller et al., 2010)."

Agreed and done.

Table 2: There are discrepancies, real or apparent, in the table. Line 1: growth rate d-1, 0.75, implies more than one division per day (0.693 d-1). POC production is 178 fmol cell-1 d-1, but POC quota is 239 fmol cell-1

How can growth rate exceed 1 generation per day, when cells are producing less than a cell quota of carbon per day. At 6C, growth rate constant of 1.06 d-1 implies a generation time of 16 h. But POC production is only 261 fmol cell-1 d-1, while cell quota is 245 fmol cell-1. So cells need a full day to produce a cell worth of carbon, but they are apparently dividing in 16 h. The discrepancies are larger than the quoted error bars on the determinations, so something is going on here with discrepancies among the determinations.

*We thank the reviewer for pointing out these apparent discrepancies. They are due to the fact that POC production rate was calculated by multiplying the POC quota with the growth rate constant µ, which gives the e-folding (2.72) and not the doubling rate of the cell numbers. We agree with the reviewer that this can be confusing. We think that it is more appropriate to use k instead of µ for these calculation, even though µ*POC is commonly used in our scientific community. In the revised manuscript, we now show both µ and k in Table 2, and calculate POC production based on k.*

Table 3: ETRmax does not have to be dimensionless. I x sigmaPSII x phiPSII/(Fv/Fm) or some similar equation can give e- PSII-1 s-1 in absolute units. Likewise for alpha. Figure 1: This figure might be more informative if plotted as cell specific exponential growth rate (panel A, as presented) and C specific exponential growth rate (an arithmetic transform of panel B). This comes back to my concerns about Table 2.

We thank the reviewer for this remark, which we agree with. We have thus changed the units of ETRmax and alpha accordingly throughout the manuscript and in the tables.

Figure 2: Panel D: why switch to a mass:mass expression, when other panels use molar comparisons. Mole:Mole is more informative, to my mind. Panel A vs. Panel B 200 fmol C cell-1 25 fmol Chl cell-1. But: Each Chl a contains 55 C (not sure if Chl indicates Chl a, or Chl a + c). Either way: 25 fmol Chl cell-1 x 55 C/chl = 1375 fmol C in the chl per cell. So, there is something wrong here with the unit conversions or calibrations. You have more C in the chl per cell, than in the total C per cell. Impossible. Unit conversion error or calibration error somewhere.

Thanks for pointing this out. When reviewing figure 2, we realized that we have accidentally used the wrong units for the Chl a quota, which should be [fg cell^{-1}] instead of [fmol cell^{-1}], as correctly used in Table x. When converting these to molar units and accounting for the mentioned 55 carbon atoms per Chl a, we find that Chl a

accounts for about 1% of the total POC measured in the cell, which seems feasible. Regarding the suggestion to convert the ratio of C:Chl a to molar units, we prefer to stick to the commonly used weight-based ratios. To clarify that we always refer to Chlorophyll a when using the abbreviation "Chl", we now consistently use "Chl a" throughout the manuscript.

None of this affects the response patterns, but people will use these results for multiple purposes, so reconciling unit issues is worthwhile.

We fully agree with the reviewer and thank him for pointing out these inconsistencies in the units used.