

Interactive comment on “Interactive effects of and light on growth rates and RUBISCO content of small and large centric diatoms” by G. Li and D. A. Campbell

Anonymous Referee #1

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Comments on “Interactive effects of and light on growth rates and RUBISCO content of small and large centric diatoms”

Li and Campbell examined the interactive effects of nitrate and light on the carbon fixation-related physiology using two *Thalassiosira* species in the laboratory. Although their rigor experiments are very good such as measurement items and number of replicates, experimental setup specifically nitrate levels made this study difficult to understand. In the low nitrate media, nitrate remained amply in terms of the nitrate uptake affinity of diatoms (reviewed by Sarthou et al. 2005, J Sea Res) as the authors recognized in page 16657 lines 6–10. As a result, the results and discussion of this study

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concerning *T. punctigera* are hard to understand. There have not been reported before that the high concentration of nitrate inhibit phytoplankton growth as far as I know (e.g., Admiraal 1977, Mar. Biol.). Given the high-nitrate inhibition of diatom growth is a new finding, please discuss the mechanisms in detail. Except the careful discussion, results and discussion of this study could not be understood properly by readers. I recommend additional culture experiment to confirm the relationship between nitrate concentrations (e.g., ranging 0.1 to 10 mmol L⁻¹) and specific growth rate. Effects of nitrogen levels and light conditions on the photophysiology of two diatom species were scarcely discussed, which may improve understanding the results of cellular nitrogen dynamics. Many parts of discussion is no good. This study need significant revisions or reexaminations before accepting in Biogeosciences.

Specific comments I confirmed title correction.

P. 16646, L. 13: Hard to understand of the inhibition of growth by the high-nitrate concentration without detailed discussion in the manuscript.

P. 16648, L. 6: Cell size of *T. punctigera* seems odd; probably it is small one order. Please check. If the size of *T. punctigera* is correct, intracellular concentrations of bioelement are higher more than one order of magnitude in *T. pseudonana* than those in *T. punctigera* indicating that *T. punctigera* is mostly (~90%) composed of vacuole. This value seems too high.

P. 16648, L. 20: Culture medium reported by Berges et al. (2001), originally Harrison et al. (1980) is ESAW not EASW. Please replace.

P. 16649, L. 21: Spell out OD680 here.

P. 16651, L. 20–23: Unclear sentence. "... for three cycles of 60 s at 6.5 ms⁻¹" using any instruments?

P. 16654: Decreasing Chl a quota with increasing light levels were not mentioned in this paper.

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P. 16655, L. 10: Emotional words such as “surprising” is your opinion, and thus unnecessary in the result.

P. 16655, L. 20–25: Hard to follow. Suggest divide sentence into two.

P. 16655, L. 29: The terms “PSII photochemistry” include not only Fv/Fm but also σ PSII, ETR and $1/\tau_1$. Please specify.

P. 16656, L. 1–2: Here the authors described “with no significant effect” but regression curve was written in the figure. Please clarify.

P. 16656, L. 14: Please indicate the method for estimating RUBISCO turnover rate in the method section.

P. 16656, L. 16–17: Suggest “The $1/\tau_1$ shows a saturating ...” (remove redundant words which should already be explained in the method section)

P. 16656, L. 18: Is Zorz et al., 2015 necessary here? Please describe only result in the result section as far as possible.

P. 16656, L. 25, 26: Hard to find the consistency between Wu et al. (2014) and this study. According to the Fig. 2g and h, closed symbols represents LN media but the authors mentioned high nitrogen media here. In the high growth light conditions, I could not find the clear pattern of allocation of cellular nitrogen to RUBISCO. Large species of *T. punctigera* has smaller RUBISCO-N:total-N ratio compared to the small species of *T. pseudonana*, which is opposite trend as demonstrated by Wu et al. (2014). Please clarify. And the following discussion concerning cellular RUBISCO-N:total-N ratio (till P. 16657, L. 14) is no good. Need thorough rewriting.

P. 16657, L. 11 and more elsewhere: Do not show only unit but describe words such as RUBISO turnover rate.

P. 16657, L. 24–27: Hard to understand. I assume that the abundance of N-containing protein such as RUBISCO should be limited by low nitrogen availability. However,

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LN condition could not be enough to limit the growth of *T. punctigera*. If high-nitrate inhibition is true, the authors should explain the mechanisms in detail as far as possible to make persuasive discussion. I recommend additional incubation experiment to confirm this. Furthermore, previous studies demonstrated that increasing RUBISCO abundance to overcome dissolved inorganic carbon-limited conditions under nitrogen-replete condition, whereas this study showed increasing RUBISCO-N under N-limitation (not exactly). The DIC condition is not available in this study. RUBISCO cannot degrade nitrate and so the sentence become complicated. Please clarify the logic.

P. 16658, L. 12–22: The lack of detailed discussion concerning high-N induced growth inhibition make this paragraph as skeptic.

Fig. 3: Label of Y axis for E and F should be ETR (e- PSII-1 s-1)

Table 1: Replace attomoles with amol

Table 1: Replace M with mol L-1

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