

# ***Interactive comment on “Physiological responses of coastal and oceanic diatoms to diurnal fluctuations in seawater carbonate chemistry under two CO<sub>2</sub> concentrations” by Futian Li et al.***

## **Anonymous Referee #2**

Received and published: 5 September 2016

The manuscript “Physiological responses of coastal and oceanic diatoms diurnal fluctuations in seawater carbonate chemistry under two CO<sub>2</sub> concentrations” by Li/Gao et al presents very interesting and novel findings on the CO<sub>2</sub> response of *T. weissflogii* and *T. oceanica*. I’m very pleased that the authors aim to mimic the natural environmental conditions focusing on diurnal fluctuations in CO<sub>2</sub> availability (or pH) coastal species can experience. Based on their findings the authors discuss the niche distribution and their adaptation potential to certain habitats of different species. The study is well designed and the paper is well written. There are, however, a few shortcomings that should be revised before the study can be published. I also advise the authors to tone down some of their findings and try to generalize less.

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Comments on the methods:

- I could not find much information on the statistical replication in the MS text.

Photophysiology: - the 15s light acclimation applied seems to be very short. Can the authors cite studies using this short time in RLCs for determining NPQ? Did the authors also obtain rETR rates? These data should be available in the dataset given by the PAM and could give additional information on the physiological performance of the cells. For example one could compare rETR with O<sub>2</sub> evolution rates.

Photosynthesis and respiration: - please state for how long the O<sub>2</sub> rates were measured - why did the authors decide to measure respiration only in the middle of the day while they measured O<sub>2</sub> evolution/PS three times a day? - Did the authors check if the cells were physiologically OK after filtering (e.g. measuring Fv/Fm prior and post filtering)? This is critical information to obtain reliable data.

Carbonate chemistry: When one conducts CO<sub>2</sub> experiments it is usually preferred to measure more than the pH to constrain the carbonate chemistry. Although I agree with the authors that the difference and shifts in pH are caused by modulating the pCO<sub>2</sub>, it would be necessary to measure at least one other parameter such as total alkalinity or DIC to fully characterize the carbonate chemistry. The additional information would also help in the discussion regarding buffer capacities. Please add the missing information if available.

Comments of the discussion:

Line 272/273: please bring T. w. to the front of the sentence.

Line 275: the authors state that T.o. has a higher dark respiration. I don't understand why the authors did not measure a dark-respiration in the morning and evening when they also measured photosynthesis. The integration of the data could show a different scenario. What is the reason these data were not acquired or shown?

Line 278: the elemental production rates are depressed due to the reduced growth rate

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not due to the change in elemental composition – please make this more clear here.

Line 296: Why do the authors state that both species have lower Si requirements under OA? According to table 1, T.w. increases Si per cell in the HCs acclimation while the HCf acclimation is similar to the LC acclimations. T.o. only decreases Si per cell in the HCf acclimation. I understand that the Si:C ratio decreases! Ratios can be interpreted differently and this is sometimes confusing – but when you state that the Si requirement decreases I would normalize it on a cellular basis. Additionally – the term Si requirement seems to be improbably chosen in this context.

Line 315: I'm confused by the statement that T.w. benefit from the C acquisition pathways “as shown” in this study. I do not find any data on either HCO<sub>3</sub><sup>-</sup> or CO<sub>2</sub> usage nor CA activities, inhibitor studies on eCA or transport. Please be clearer. I assume that the authors mean that the general characteristics of C<sub>i</sub> uptake measured by others can explain some of the findings of this study.

Line 318 following: again – I really would have preferred to see diurnal measurements on respiration. I have one more concern here – respiration does not depend on the Chl a concentration but rather on the activity of mitochondria. As such, normalization based on per cell or per C might have been more appropriate for this study. Additional – regarding the O<sub>2</sub> evolution shown in Fig. 4 – please indicate if the integrated O<sub>2</sub> evolution differs between the treatments.

Line 331: why does this sentence start with “in contrast”? I see no reason for this here.

Line 349-351: Please indicate that the mentioned changes are based on the decrease in growth rate rather than a decrease in the elemental composition of the cells. The production rates (growth rate times elemental composition) are only affected due the change in growth and this should be highlighted.

Line 371: It would come handy here to have a well described carbonate system (2-3 measured parameters) to support this discussion on lower buffer capacity in an OA

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ocean.

Line 377: Please rephrase “poor physiological performance”. In my understanding T.o. has similar or higher Chl a content, similar POC/cell, similar PON per cell, similar BSi per cell, growth is similar (LC), POC and PON production rate is higher (LC), quantum yield is high (LC and HC), O<sub>2</sub> evolution is similar (HC). . . . Overall – the cells do pretty well (physiologically ) under fluctuating pH. I agree with the authors that there are some pathways and responses in which the fluctuating cells do not do well – but this does not give them a general poor performance. The NPQ response is also questionable since I’m not sure that a 15s light acclimation can give reliable data on NPQ. Where does *T. pseudonana* come from in the discussion here?

Additional comments:

Line 158: add a “the” to photoperiod

Fig. 1: Add error bars to the graph. Fig. 2: why are the different letters (statistics) lower case for T.w. and upper case for T.o.? This is true for all figures. The growth rate should also state “ $\mu$ ”

Fig. 3: I miss the error bar in d) and h) HCf. Although the error is small – it should be visible!

Fig. 4: The font size should be a little bigger for the x/y axis numbers x axis and descriptions. Please be aware that the super and sub script is messed up

Fig 5: same comment as for Fig. 4

Fig. 6: The data for T.o. below 400  $\mu$ E are not visible. Please change the size of the squares/circles that all data are visible.

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