Review Nauch et al 2016 Biogeosciences

Effects of CO_2 perturbation on phosphorus pool sizes and uptake in a mesocosm experiment during a low productive summer season in the northern Baltic Sea.

The authors conducted a mesocosm experiment in an upwelling area in the Gulf of Finland to investigate the impact of increased fCO_2 on phosphorus (P) pool dynamics. The experiment run for several weeks with repeat sampling of a variety of parameters.
The authors found no significant changes in the average P-pool sizes or composition for the study period in controls or treatment mesocosms. However, the correlation between chlorophyll and particulate P changed with increasing CO_2 loading. They also find that most P transfer is predominantly into the dissolved organic pool rather than into the particulate fraction.

Overall, this is an interesting study on P-dynamics in a brackish water system. Given the continued increase in CO_2 emissions and the paucity of studies on the effects on aquatic organisms this is a timely study. However, I think the manuscript can be shortened and made clearer in some parts, particularly the results sections that is quite heavy and confusing at times. I'm also curious as to why this location was targeted as the upwelling will bring rather high DIC concentrations into the surface waters naturally, perhaps making this study difficult to interpret in terms of effects of increased CO_2 in this system.

Detailed comments:
P 17545, ln 23-28. The statement that the "significant relationships".."vanished" in the CO_2 treatments seems contradictory to the next sentence - "Consequently, it can be hypothesized that.." Please clarify.

P 17548, ln 16. "CO_2 treatment started on day 0 and was repeated on subsequent 4 days.." This is a bit unclear. Was CO_2 injected during **the** "subsequent 4 days", i.e., day 1, 2, 3 and 4? Or was it one additional injection on day 4? I assume the former.

P 17553, ln 24-28. This sentence is hard to understand as written. I suggest omitting the "both" and rearranging the sentence slightly.."significant differences between the two methods..however, the difference between the means for the filter method and the aqueous method (0.19 ± 0.03 µmol L-1 and 0.16 ± 0.04 µmol L-1 respectively) where near the detection limit of the methods.

P 17556, ln 13-15. What was the rational of making three groups of two mesocosms each, rather than two groups with three each, or even just Control (M1, M5) versus high fCO2, low pH (M3, M8)? It seems to me that the middle group's (M7, M6) values are farther from one another in terms of fCO_2 or pH, than to either the lower or higher groups.

P 17557, ln 4-6. This sentence is confusing to me. It seems to say that an increase by 24% was statistically significant in phase III but 0.27 µg L^{-1} was not? What is the 24% in reference to? In Fig 4 it does not look like much happens to the higher CO_2 mesocosms between day 24 (midway into phase II) and day 40 (phase III)..maybe this is only because the figure is busy (?)

P 17565, ln 24. Why is the P-uptake rate a measure of gross uptake? And why would a change in net modify the retention in the POP? Isn't it likely that the size, and community structure changed (i.e. larger phytoplankton) and gross also increased i.e. the flux of P increased, and more biomass contained more P? I am not sure how you can distinguish gross versus net here if DOP production and PO_4 recycling weren't measured.

Minor technical, editorial comments:

P 17546, ln 7. "..predicted to rise to 750-> 1000 ppm.." What does the "->" mean? Up to?

P 17550, ln 19-20. Is a p=value of 0.026 not significantly different for the two methods used for PO4 analysis?

P 17550, ln 24. Should this be -20°C? (now it read 20°C).

P 17551, ln 16. 2 ml to 200 ml is 1% v/v.

P17554, ln 20. Of what materials where the 0.2 and 0.3 µm filters?

P 17557, ln 17, and 27. Does the 116 nmol L^{-1}, 0.12 µmol L^{-1} and 0.06 µmol L^{-1} have propagated error estimates?

P 17558, ln 6. Should this be table 2? (not 5?)

P 17558, ln 24. What is meant with "variations only in the nanomolar range"? Perhaps state something like number of standard deviations instead, or ±x.

P 17559, pg 3.1.4. Perhaps also use the median values here, where the range is large but the means seem to be skewed.

P 17560 ln 2. What is meant by degraded? Total hydrolysis of ATP, or P-incorporation into cells?

Table 5. What does the -, and + signs mean here?