

Biogeosciences Discuss., referee comment RC2
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Comment on bg-2022-68

Anonymous Referee #2

Referee comment on "Physiological control on carbon isotope fractionation in marine phytoplankton" by Karen M. Brandenburg et al., Biogeosciences Discuss., <https://doi.org/10.5194/bg-2022-68-RC2>, 2022

The manuscript by Brandenburg et al. presents a compilation of stable carbon isotope fractionation data in phytoplankton experiments grown under various culture conditions (day length, nutrient availability, temperatures..) and teases out their contribution to the theoretically straightforward and expected demand/supply relationship on ep. The manuscript is an important contribution to the field, very well written and the data is presented nicely. I have therefore only a few comments and suggestions.

General comments:

1) The authors should clarify the statistical approach. If I understood correctly, their linear models predicting ep had three factors, i.e. POC production/CO₂, one influential condition (light, irradiance,.....), and species. While the influential condition and species factors have categorical or discrete factor levels, POC production/CO₂ has not. Is that something the lmer function in R can handle? I was under the impression that all levels would need to be categorical or distinct (not a continuum without groups), as it is basically an ANOVA. Please clarify.

2) The authors have chosen to test POC production/CO₂ as the main driving factor for ep (please see also comment 1). From a pale-reconstruction perspective, that would require estimating two physiological parameters, i.e. POC per cell and instantaneous growth rate, to infer ep. What about the more simple growth rate/CO₂ approach? The authors could test if they come to the same conclusions. I reckon they would but better to check.

3) Again, from a reconstruction perspective, the authors could calculate how much explanatory power a multiple linear regression approach would generate. Of course, some

of the factors would not work as being categorical (unless a generalised linear model would be used instead), but some could be retained (e.g. light, temperature) or changed over (nutrient concentration, e.g. nitrate as being a proxy for the degree of limitation). That could be done group-specific, and looking at the simple linear regression presented in Figure 2, I could imagine that it would be quite a success.

Specific comments:

1) L 241: either 'these systems' or 'this system'.