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Interactive comment on "Rates and drivers of Red Sea plankton community metabolism" *by* Daffne C. López-Sandoval et al.

Anonymous Referee #1

Received and published: 21 December 2018

General comments: The authors describe a dataset of environmental variables related to the metabolism of planktonic communities along a depth and latitudinal gradient in a seasonal resolution in the Red Sea. The authors conclude that gross primary production relates positively to sea surface temperature and nutrient availability. The dataset is extensive, and the research questions (for this part of the Red Sea), to my knowledge, are novel and worthy of publication. The abstract is clear and reads well, but shows a different narrative than the rest of the manuscript. Thus, I suggest for the authors to consider rewriting the manuscript. As mentioned in the author contributions, the manuscript is written by several people and this is noticeable (see specific comments). The abstract mentions the latitudinal gradient but the ms introduces two more variables, i.e. depth and seasonality. While interesting variables, they make the

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story confusing at times and harder to disentangle the story the authors want to tell (according to the abstract).

Concerns about the methods used are mentioned in the specific comments and need to be addressed first. Proper description of statistical analyses is lacking.

My recommendation is that the ms needs major revisions, but only if methodological concerns can be addressed adequately. Then, I suggest a complete overhaul of the manuscripts narrative by focusing on 1 or 2 of the 3 major variables (latitude, water depth and seasonality) and stick with these in the entire narrative. Also, there needs to be a clear description of used statistics in the M&M section and figures and tables should be cut back and/or improved. Consistency in the presentation of the results (including the statistics) and the use of abbreviations (as well as changing them) is recommended.

Specific comments: - Title: Says Red Sea but Gulfs are not included. - Abstract: Line 10: Mentioning “Low productive waters” immediately brings down the importance of the story. - Page 2: The first paragraph is loaded with self-referencing while many others are not or less. - Page 2, line 4-5 and 11: Introduce abbreviations once (see technical corrections) and use them consistently throughout the ms. - Page 2: The abbreviations of GPP, CR and NCP are presented with units of daily oxygen produced or used. However, these abbreviations are normally used for daily production and use of carbon. I suggest the authors change the abbreviations for these processes and/or use a conversion factor to present daily carbon production and use. - Page 4, line 7-8: There are plenty of references that describe metabolism in the northern part of the Red Sea (e.g. Rahav et al. 2015 MEPS, Tilstra et al 2018 Frontiers, Levanon-Spanier et al 1979 Deep Sea Res.). - Page 5-6: Silicate is measured, mentioned in the results and in many figures/tables (with significant interactions) but nowhere mentioned in the Discussion. If not important, mention briefly in Discussion. - Page 6-7, line 20 and 1 (resp.): Was NH4 determined? If not, then you have NOx values, not DIN - Page 7, line 10: provide actual depths of PAR measurements. Also, I am confused

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about the use of 100%, 60-20 and 8-1 as table 1 and 2 give different ranges. Is the data comparable if different depths of sampling were used? - Page 7: Were samples for metabolic rates filtered? Does the planktonic community include both single and multicellular organisms? Were the optodes adjusted for salinity? - Page 7: A major, potential, flaw in the methods used for metabolic rates is that it appears as though net photosynthesis was measured for 24h. If correct, this includes an approx. 12-hour period of darkness and thus results in data that cannot be used for calculations for gross photosynthesis, i.e. O2 measurements will be severely lower due to dark respiration. net photosynthesis should have been measured only during daylight and respiration rates should have been measured in 2 phases; during the daytime and during nighttime, so approximately 12:12 h as respiration rates can have a diurnal rhythm. So extrapolating these data to daily rates could result in a wrong estimation of gross photosynthesis. Also, how was O2 production data extrapolated to per day? I suggest authors stick to hourly values for oxygen rates. If methods are used correctly, carbon budgets can be calculated using a conversion factor. If net photosynthesis was measured during daylight and respiration for 24 hours, the authors need to state assumptions of the values to their manuscript (potential over- or underestimation of rates). - Page 9, statistics: Need to be expanded with actual models used. - Page 9, line 11: NOx, not DIN. - Page 10, line 17: 56% of heterotrophs suggests dominance of this trophic strategy - Page 11, line 4: What models were used to test this? - Page 11, line 8: Which analysis? - Page 11, line 11: Introduction of this statistical method should be in the appropriate section - Page 11: How were AE values calculated? - Page 11: AE are presented as negatives, are they? Next page the authors mention a positive value. - Page 13, line 14: GPP is said to be low, compared to what? - Page 15, line 18: How was AE standardized to Chl-a? - Page 16, line 2: What is “the ocean”? - Page 16: Opens with “Surprisingly” and a discussion, then the next paragraph mentions a contradiction that is not surprising. What is the contradiction exactly the authors mean? - Page 16, line 6-7: Authors compare results with other references but need to mention actual values. - Figure 3: Thickness of the pink or green seems to say something about

how significant it is but this is said nowhere. In line with this, the diagonal dark green lines seem to signify extreme significance instead of same variable and thus not tested. DIN is NOx. Are variables tested at different depths than metabolic rates of plankton? If so, how can you relate the 2? - Figure 4-6: Lots of white space and hard to see with tiny colored dots anyway. Revise these figures. I suggest to distill from them the most important results you want to show and add the rest to the supplementary section. - Figure 7: could be mentioned with text in the results section. Suggest moving figure to supplements. - Figure 9: Same as Figure 7, B is missing a parenthesis on the y-axis - Figure 10: Same as Figure 7

Technical corrections: - Please use continues line numbers for the manuscript - Page 1, line 8-9: Please rewrite, it reads as if you want to understand their variability and their present and their future but you want to understand their variability in the present and the future - Page 2, line 4-5: Add community - Page 2, line 11: First mention of NCP, introduce abbreviation - Page 3, line 1: “The Red Sea is a semi-enclosed” - Page 3, line 3-5: Consider merging this sentence with the previous one - Page 3, line 9: “throughout the year” - Page 3, line 10: Delete the dot before the references - Page 4, line 12: Add “relatively” to “unproductive waters” - Page 4, line 18: Add “latitudinal gradient” to the sentence - Page 10, line 8-10: I suggest to start the Results section with this sentence. - Page 10, line 16: net autotrophic? - Page 12, line 8: Please stay consistent, use R2 - Page 13, line 9: Heterotrophic suggest no autotrophs, add “net” - Page 15, line 6-9: Please rewrite - Page 16, line 4: Add i.e. or parentheses after 32.5 °C - Page 19, line 6: Heterotrophic - Figure A1: Add axis titles to every part of the figure, having double axes without titles is confusing, especially since the 27 °N axis title (Temperature) is not on any axis. - Table 1: Add Silicate to the table description. Also, it is unclear which header belongs to which environmental variable. Also, I fail to see the benefit of the min and max values. Delete and/or add to supplements. Present data as mean ± SE - Table 2: N does not need decimals. What does “rank” mean? %PAR differs from Table 1. - Table 3: Upper part are, what seems to be, Pearson rank coefficients, not the units given in the description. The lower part seems to be p-values,

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mention this in the description. A hyphen is not the same as a blanc.

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