On behalf of all the authors of this paper, we would like to express our sincere gratitude to the Editor, and two Reviewers for their efforts reviewing and improving this manuscript.

**COMMENTS TO THE AUTHORS**

Dear Dr. Śliwińska-Wilczewska,

The reviewers appreciated the quality of the work you accomplished and made some suggestions for improvement. Please address their comments to the fullest extent possible in your revised manuscript.

Sincerely,

Steeve Pepin

Response: Thank you for these positive statements. We have treated all comments with due attention. We hope that this new version of the manuscript will be satisfactory.

We thank Reviewer 1 for their time and valuable comments. The changes in the manuscript addressing comments from Reviewer 1 are marked in blue.

Reviewer\_1

Comments to the author

General Comments

Comment: The manuscript titled “Coastal picocyanobacteria can exploit low oxygen habitats” by Śliwińska-Wilczewska an Coauthors reports the results of a rigorously conducted laboratory experiment with growth measurements of two *Synechococcus* strains, isolated from the Baltic Sea, with different accessory pigments. The hypothesis behind the experiment is that different oxygen concentrations may affect, as do different light conditions and other parameters the photosynthetic characteristics and ultimately the growth of the two *Synechococcus* strains.

Response: We appreciate these positive comments.

Comment: Indeed, the results show a difference between the two strains with Syn PE growing better at low oxygen concentrations than Syn PC. As I said above, the experiment is well designed and the methods very detailed, however I noticed that little is said about the selected strains. It would have been useful to study the sequences (most likely available) to know more about the genes that determine the different pigment composition. Especially for marine strains, there are different types of phycoerythrins and the pigment composition of the strains used could give interesting information on the results and explain some controversial findings.

Response: We thank the reviewer for this insightful comment. We agree, and await the genomic sequencing of these strains for the relevant comparisons.

Comment: It seems to me that from an experiment with two Synechococcus strains, it is a bit excessive to come to general conclusions in the environment. I think both the title and the conclusions should be changed and referred more on the results of the experiment. A hypothesis can certainly be made, but very carefully and with caution about what can happen in the oceans or in fresh water.

Response: Thank you. We chose a more specific title: "Coastal *Synechococcus* strains can exploit low oxygen habitats".

We revised the paragraphs lines L434-448 and L488-499 to soften the generalities of the interpretations and focus attention on the strains we studied.

Comment: In the introduction I would also add literature on lake environments or experiments done with freshwater Syn strains on which a lot of work has been done. Please add more references also on pigment compositions of Syn.

Line 58. Add:Doré, H.; Farrant, G.K.; Guyet, U.; Haguait, J.; Humily, F.; Ratin, M.; Pitt, F.D.; Ostrowski, M.; Six, C.; Brillet-Guéguen, L.; et al. Evolutionary mechanisms of long-term genome diversification associated with niche partitioning in marine picocyanobacteria. Front. Microbiol. 2020, 11, 2129.

Line 60-61. Add: Sanchez-Baracaldo, P.; Bianchini, G.; Di Cesare, A.; Callieri, C.; Chrismas, N.A. Insights into the evolution of picocyanobacteria and phycoerythrin genes (mpeBA and cpeBA). Front. Microbiol. 2019, 10, 45.

Line 63.  Add: Callieri, C., Cronberg, G., and Stockner, J. G. (2012) Freshwater picocyanobacteria: single cells, microcolonies and colonial forms. In Ecology of Cyanobacteria II, Whitton, B. A. (ed). New York, NY: Springer, pp. 229–269.

Voros et al 1998 Hydrobiologia 370.

Response: Thank you. We have added literature on lake environments or experiments done with freshwater *Synechococcus* strains.

We thank Reviewer 2 for their time and valuable comments. The relevant changes in the manuscript are marked in green.

Reviewer\_2

Comments to the author

Comment: This manuscript presents highly valuable results, obtained by state-of-the-art methods and techniques, demonstrating the importance of light quality on the sensitivity of two *Synechococcus* phenotypes to O2. It appears that for growth wavelengths from 470 to 660 nm, low 02 concentration (2,5 μM), compared to 250 μM 02, has no detrimental effect on growth of both PC- and PE-rich phenotypes, and is even beneficial for the PE-rich one. In other words, high (normal?) 02 concentration is detrimental for PE-enriched, which may explain its restriction to lower light and lower O2 niches.  The expansion of OMZ with global warming may therefore benefit this phenotype in the future.

I have only significant comment. As mentioned above, the photophysiological measurements of the two phenotypes grown under different wavelengths and 02 concentration are impressive. However, they don’t fully explain the difference between the two strains. It is confusing to read that “In spite of …superior electron performance under 250 μM 02, the PE-rich strain grew faster under 2.5 μM 02…” (li. 486-488, also li. 18 of the abstract).  I think that it is more “because” than “in spite of”. Higher electron flow to O2 may overwhelm the capacity of the ROS scavenging, thereby increasing photoinhibition and decreasing growth. This interpretation was made to explain the lower growth rates observed in the blue region (li.427-428) – besides a direct effect of blue light on OEC-, and it can apply also for PE-rich strain at high O2 under different wavelengths. I think that it may be reasonable to suggest, at least discuss the possibility, that the PE-rich strain has a lower ROS scavenging capacity than PC-rich strain. A future study could test this hypothesis by correlating oxidative damage and slower growth under high O2.

Response: We thank the reviewer for this insightful comment; indeed, more electrons are not necessarily better!

We added a line:

"...In spite of this faster electron transport performance under 250 µM [O~2~] the PE-rich strain grew faster under 2.5 µM [O~2~], showing an increase in the growth return upon electron transport, possibly because of a decreased metabolic burden through suppression of ROS formation under lower [O~2~]..."

to the paragraph to make this point, and added an acknowledgement of the anomymous reviewer for the helpful insight.

We await the genomic sequences of the strains to compare their capacities for ROS metabolism, and potential future analyses of cumulative ROS toxicity.

Comment: A comment of secondary importance would be, in line 476-478, to better explain why σPSII under 535 and 590 nm rose to a peak… reflecting the state transition. If I am correct, σPSII should decrease at moderate and high light due to state transition, redirecting light excitation from PSII to PSI.

Response: Thank you for the comment we edited paragraph (L469-475) to add this thought.

Comment: Also, see line 98 for silicone x2.

Response: Thank you, we made the correction.