

Ocean Sci. Discuss., author comment AC1
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Reply on RC1

Zhuo Chen et al.

Author comment on "Nutrient ratios driven by vertical stratification regulate phytoplankton community structure in the oligotrophic western Pacific Ocean" by Zhuo Chen et al., Ocean Sci. Discuss., <https://doi.org/10.5194/os-2021-67-AC1>, 2021

Dear Editors and Reviewers:

Thank you for your letter and for the reviewers' comments concerning our manuscript entitled "Vertical stratification-driven nutrient ratios regulate phytoplankton community structure in the oligotrophic western Pacific Ocean" (os-2021-67). Those comments are all valuable and very helpful for revising and improving our paper, as well as the important guiding significance to our researches. We have studied comments carefully and have made correction which we hope meet with approval. The article has been changed considerably, so it is not marked in red in the text. The main corrections in the paper and the responds to the reviewer's comments are as flowing:

Responds to the reviewer's comments:

Reviewer #1:

- Response to comment: (This manuscript reported the effect of vertical stratification on phytoplankton community structure in the western Pacific Ocean. The topic is interesting, especially under the current situation of global warming. Although the authors accumulated a large amount of data, they fails to provide a convincing story and a novel conclusion. The results and discussions are not closely related. The authors described a lot on the differences among four groups, but they did not discuss much on this point. In turn, some discussed points lacked the supporting results. The whole discussion part lacked depth and logic. It is more like a review rather than a discussion based on the obtained results. There are many errors in the figure legends. There are many errors in the figure legends. Also, there are lots of typos and format and gramma errors in the whole manuscript and need to be carefully checked and corrected.)

Response: Dear Reviewer, thank you very much for your kind letter and encouragement.

We also appreciate the time and effort that you have dedicated to providing valuable comments and suggestions, which helped us to improve the quality of our manuscript significantly. We have carefully studied these insightful comments and have made corrections which we hope meet with your approval. Knowing our limited English skills, we sought out a professional English language retouching company to revise the manuscript. If there is anything else we should do, please don't hesitate to let us know. Again, we deeply appreciate your efficient and professional review of our manuscript.

- Response to comment: (P2L1-2: Please revise the English in this sentence. "WPO is not only... but also suffer the highest number of")

Response: Dear Reviewer, we are very sorry for our poor description. We have revised the sentence: "As the world's largest and deepest ocean, the Pacific Ocean covers a vast area and has a complex geographic topography, with the deepest trenches on Earth and the highest absolute peaks."

- Response to comment: (P2L2: "Marine changes"?)

Response: Dear Reviewer, we are very sorry for our poor description. We have revised the sentence: "The study area is located in the western Pacific Ocean (WPO) because the equatorial current flows from east to west. Furthermore, warm seawater in the surface layer flows with the current to the WPO, and in the equatorial region, strong solar irradiation heats the seawater year-round. Under the influence of the dual factors, the average temperature of the ocean surface in the WPO region is higher than 28 °C throughout the year. Through heated seawater, radiant heat, and evaporative heat generated by heated seawater, radiative heat, and latent heat, the WPO is higher than the equatorial eastern Pacific by 3–6 °C, and it has a profound impact on global climate change, especially in China and Southeast Asia."

- Response to comment: (P2L9-10: Grammar mistake. Please re-write this sentence)

Response: Dear Reviewer, we are very sorry for our poor description. As your suggestion, we have carefully reworked the grammatical issues of our manuscript in the process of modification. Meanwhile, we have revised the whole manuscript with the assistance from polish company. Again, we deeply appreciate your efficient and professional review of our manuscript. We have revised the sentence: "In addition, the surface primary productivity is low, which is typical of oceans with high temperatures, low salinity, and poor nutrition."

- Response to comment: (P2L10-12: "Because of typhoon, upwellings and various kinds of physical mixing processes, vertical stratification of subtropical Pacific seawater"

Grammar mistake. The sentence is missing a verb.)

Response: Dear Reviewer, we are very sorry for our poor description. As your suggestion, we have carefully reworked the grammatical issues of our manuscript in the process of modification. As your suggestion, we have revised the sentence: "The subtropical Pacific is stratified vertically due to typhoons, upwellings, and various physical mixing processes."

- Response to comment: (P2L14-16: Please re-write the sentence. "wind-induced" is an adj, not a noun.)

Response: Dear Reviewer, we are very sorry for our poor description. As your suggestion, we have carefully reworked the grammatical issues of our manuscript in the process of modification. As your suggestion, we have revised the sentence: "It also causes the sea area to have a 100–150 m thermocline, and the high-temperature seawater in the surface layer transfers heat to the atmosphere through sea-air interaction, which generates large disturbances to the atmosphere, which is the area with the most tropical storms and typhoons formed worldwide."

- Response to comment: (P2L16: "Therefore, it is characterized by SCM regions by latitude." How did the authors draw this conclusion?)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. We are very sorry for your confusion due to our poor description, we have revised this sentence into "SCM distribution is closely related to the depth and intensity of the thermocline, and mixing caused by solar radiation and wind is the driving force for regional consistency and latitudinal differences in the thermocline."

- Response to comment: (P2L16-18: Please provide the reference. Moreover, "the TTS.." should be "The TTS..")

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. We have revised the capitalization of the first letter of the sentence. Thank you again for your insightful comments, and we will pay attention to this issue in our future writing.

- Response to comment: (P2L18-19: What is ternary input? Please explain.)

Response: Dear Reviewer, thank you very much for your careful and professional review

of our manuscript, and your valuable comments are very important for us to improve the accuracy and quality of our manuscript. We deleted this sentence due to inaccurate expression.

- Response to comment: (P2L19-20: "The SCM in the tropical WPO is 80 m (Dandonneau, 1979)." Please provide more evidence. I believe the SCM should be different in different regions in WPO.)

Response: Dear Reviewer, thank you very much for your insightful and constructive comments. Here you have raised a very important point, and we absolutely agree with your point. Thanks to your comments, we have revised the sentence: "During phytoplankton blooms, the subsurface chlorophyll maximum (SCM) usually occurs near or at the bottom of the light-permeable layer of stable seawater."

- Response to comment: (Method: Section 2.2: Although the authors cited some references, the method should be still described briefly.)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. The description of the method in the original text is too simplistic, and the method of investigation and experiment is not elaborated. We have supplemented it and read as follows:

2.2. Identification of Phytoplankton

After returning to the laboratory, the Utermöhl method was applied for phytoplankton analysis. A 1 L subsample was allowed to stand for 48 h; then 800 mL supernatant was removed carefully by siphoning through a catheter, taking care to prevent the catheter from touching the bottom of the bottle. Thereafter, the remaining 200 mL liquid was gently mixed and half of which was further concentrated with a 100 mL sedimentation column (Utermöhl method) for 48 h sedimentation. The phytoplankton species were identified and enumerated under an inverted microscope (AE2000, Motic, Xiamen, China) at 400× (or 200×) magnification. Phytoplankton identification was conducted as described by Jin et al. (1965), Isamu Y (1991), and Sun et al. (2002). The World Register of Marine Species (<http://www.marinespecies.org>). Species identification was as close as possible to the species level.

- Response to comment: (Result: I suggested the authors adding a paragraph to introduce the hydrographic features of the study area during the sampling years.)

Response: Dear Reviewer, thank you very much for your careful and professional review of our manuscript, and your valuable comments are very important for us to improve the accuracy and quality of our manuscript. We have added a paragraph to introduce the hydrological characteristics of the study area during the sampling years. "3.1 Hydrographic features of the study area during the sampling years."

- Response to comment: (Fig 1: The figure legend is not correct. There are no red, yellow and green triangles, and black dots in the figure. I guess fig b,c,d are sampling maps in 2016, 2017, and 2018, respectively?)

Response: Dear Reviewer, we are very sorry for your confusion due to our poor description, we have corrected the legend in Figure 1.

Figure 1. Stations in the western Pacific Ocean (WPO) of three cruises. (a): Current systems of the WPO; (b), (c), and (d): sampling stations of 2016, 2017 and 2018 cruises, respectively. The station at 130°E forms the section A, and the station at 20°N forms the section B. Map of the WPO shows the major geographic names and the surface currents, including the Subtropical Counter Current (STCC), the North Equatorial Current (NEC), the Northern Equatorial Counter Current (NECC), the South Equatorial Current (SEC), the New Guinea Coastal Current (NGCC), the Mindanao Current (MC), the Mindanao Eddy (ME), the Halmahera Eddy (HE).

- Response to comment: (Fig 2: I suggest the authors adding the taxa information in the Fig. 2. The figure legend is confusing. There were no subregions in the figures, but only three years. Also, a scale bar should be added.)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. We are very sorry for our poor description, we deleted Figure 2 and replaced it with Figure 3–5.

- Response to comment: (Fig. 3: How did the author average the phytoplankton community structure? By depth integration?)

Response: Dear Reviewer, we would like to express our great appreciation to your time and effort in reviewing our manuscript, and your insightful and constructive comments helped to improve the accuracy and quality of our manuscript significantly. We have studied these insightful comments and made careful revisions which we hope meet with your approval. We averaged the abundance of the 7-layer samples at each station. We have supplemented the formula used for averaging in the method section 2.4. If there is anything else we should do, please don't hesitate to let us know. Again, we deeply appreciate your efficient and professional review of our manuscript.

where P is the average value of phytoplankton abundance in water column, P_i is the abundance value of phytoplankton in layer i , $i + 1$ is the layer $i + 1$, D_n is the maximum sampling depth, D_i is the depth of layer i , and n is the sampling level.

- Response to comment: (Table 1: Please add the standard deviations.)

Response: Dear Reviewer, thank you very much for your professional and careful review of our manuscript and for giving constructive comments. We added the standard deviations to Table 1.

Table 1. The percentages (%) (average \pm standard deviations) of diatoms, dinoflagellates, cyanobacteria and chrysophyceae in the four groups respectively.

Species	Group A	Group B	Group C	Group D
Diatoms	1.09 \pm 0.79	4.25 \pm 1.57	21.83 \pm 11.45	43.71 \pm 10.12
Dinoflagellates	0.44 \pm 0.42	3.41 \pm 3.30	17.26 \pm 12.45	48.38 \pm 11.61
Cyanobacteria	98.45 \pm 1.10	92.08 \pm 4.79	59.05 \pm 20.38	6.06 \pm 4.93
Chrysophyceae	0.02 \pm 0.01	0.26 \pm 0.10	1.86 \pm 1.99	1.85 \pm 1.66

- Response to comment: (P5L19-20: PCoA analysis cannot explain the relationship between the environmental parameters and phytoplankton community structure.)

Response: Dear Reviewer, we are very sorry for your confusion due to our poor description. It is true as you presented that PCoA analysis cannot explain the relationship between environmental parameters and phytoplankton community structure. It can be used to analyze the differences between species groups. The revised sentence is: "The dendrogram showed that these populations were grouped into four groups, which were essentially identical to those determined by PCoA analysis (Figure 7). The horizontal and

vertical axes explain 51.87% and 21.41% of the phytoplankton community structure, respectively.”

- Response to comment: (Fig. 5: What are differences among the panels a,b,c,d? Please add the description for each panel.)

Response: Dear Reviewer, we are very sorry for our poor description. The four pictures represent the four Groups, the expression is not clear. We deleted this figure and replaced it with figures 4 and 5.

- Response to comment: (Fig. 6&7: I think these two figures only included surface temperature and salinity. Please add this information in the figure legend.)

Response: Dear Reviewer, we are very sorry for our poor description. As your suggestion, the figures only included surface temperature and salinity, we add this information in the figure legend.

- Response to comment: (P8L16-17& Fig.7: This figure did not make much sense, and it was not discussed in the discussion part.)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments, we deleted the figure.

- Response to comment: (P9L12: statistical analysis is needed to prove the “significant differences” in phytoplankton community structure across groups.)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. We added an RDA diagram of phytoplankton and the environment, and we re-describe the RDA (Results 3.5). We apologize for any inconvenience caused to your review.

- Response to comment: (Discussion P12L11-13: “It can be seen that the density of Trichodesmium in Kuroshio region was very high..”. I did not see the data of trichodesmium in the Kuroshio region. I suggest the authors providing the detailed phytoplankton community structure.)

Response: Dear Reviewer, thank you very much for your professional and careful review of our manuscript and for giving constructive comments. I apologized for any inconvenience caused to your review here, the area we surveyed is the Kuroshio source area, and we want to express the high abundance of *Trichodesmium* in the surveyed area. We previously focused on the effect of vertical stratification on phytoplankton, and did not have a large description of the horizontal distribution. We supplemented the horizontal distribution in the results section to better describe the phytoplankton community structure in the surveyed sea area (Figure 4 and 5). We have revised the sentence in discussion 4.1: "among which the abundance of *Trichodesmium* species was high."

- Response to comment: (P13L35-37: The result part did not show the change of VSI and phytoplankton community structure with latitude. If this is an important point of this paper, the relevant result should be added.)

Response: Dear Reviewer, we are very sorry for your confusion due to our poor description. It is true as you presented that we did not calculate VSI and phytoplankton community structure with latitude throughout the paper, but in the discussion, we kept focusing on it, this was indeed an oversight on our part. Thanks to your comments, we added the change of VSI and phytoplankton community structure with latitude (Result 3.1-3.3 and Figure 3-5).

- Response to comment: (P13L40-42L: Those results should be presented in figures and described in the result part.)

Response: Dear Reviewer, thank you very much for your professional and careful review of our manuscript and for giving constructive comments. We have added details in section 3.3 and 3.4. And we have revised the sentence into: "Our results demonstrated that the highly stratified region was more suitable for the growth of *Trichodesmium*, while the region with low vertical stratification seems to be more conducive to the survival of diatoms and dinoflagellates (Fig. 6 and 8)."

- Response to comment: (P13L43-44: Please provide the reference.)

Response: Dear Reviewer, thank you very much for your valuable and constructive comments. We have listed the reference and we have revised the sentence: "Due to their poor activity and high potential growth rate, diatoms can reproduce rapidly in the circulation and water with high nutrient content (Tilman et al., 1986)."

Tilman, D., Kiesling, R., Sterner, R., Kilham, S. S., and Johnson, F. A.: Green, bluegreen and diatom algae: taxonomic differences in competitive ability for phosphorus, silicon and nitrogen, *Arch Hydrobiol*, 106(4): 473-485, doi: 10.1029/WR022i007p01162, 1986.

Special thanks to you for your good comments.

Please also note the supplement to this comment:

<https://os.copernicus.org/preprints/os-2021-67/os-2021-67-AC1-supplement.zip>