Comment on bg-2022-157
Joshua Stone (Referee)

Referee comment on "Zooplankton community succession and trophic links during a mesocosm experiment in the coastal upwelling off Callao Bay (Peru)" by Patricia Ayón Dejo et al., Biogeosciences Discuss., https://doi.org/10.5194/bg-2022-157-RC2, 2022

Review of Dejo et al.

General comments:

The reviewed paper, “Zooplankton community succession and trophic links during a mesocosm experiment in the coastal upwelling off Callao Bay (Peru)” is an interesting experiment using impressive mesocosms to determine the effect of upwelling and shoaling OMZ on a zooplankton community. The research topic is pertinent, given the predicted increases in upwelling and OMZ shoaling in the region due to climate change. The paper is well written, and I commend the authors on an impressive amount of work. While the experiment was thorough and the resulting samples carefully analyzed, a number of issues remain to be addressed. Based on the below comments, I recommend the paper for Major Revisions.

- The experiment did not have a true control, as all of the mesocosms had deep water added to them. While the surrounding Pacific waters can be used as a partial control, it would have been much more convincing to have several untreated mesocosms throughout the course of the experiment. This makes it difficult to interpret the results and attribute them directly to the treatment, as the containers themselves could have had a large impact on the zooplankton. Zooplankton are known to behave differently when confined in containers and frequently encountering walls, and this could have led to the reduced feeding seen in the results.
- Most of the results (abundance, copepod community composition, biomass, fatty acids, isotope ratios) did not show any significant differences between treatments or across the experiment. While this is understandable and often occurs in mesocosm experiments, the authors draw conclusions that are not fully supported by the results or highly speculative. Specifically, the authors argue that the presence of a shallow oxycline led to decreased reproduction of copepods, but their results could have been from lack of reproduction due to starvation or container effects. They do point this out
somewhat in the conclusions, but I believe that the evidence presented is too variable and unclear to make any strong assertions about the causes of low nauplii and egg abundances. The main basis for the assertion that shoaling OMZ reduces egg survival seems to be the observations outlined in Lines 345-352 and 586-591. However, the authors do not provide statistical tests or strong support for this observation. It certainly is worth mentioning, but it is not strong enough evidence to base the bulk of the conclusions on, especially given the high variability of the observations.

- It seems much more supported that the copepods were simply starving throughout the experiment. It would be interesting for the authors to explore more fully why that may be. Was it a change in phytoplankton composition, low phytoplankton abundances, reduced feeding rates due to container effects, or something else?
- It would also be informative for the authors to describe what was present in the sediment trap material at the bottom of the mesocosms. If the copepod eggs and nauplii were indeed being produced but dying due to low oxygen, they would be present in the sediment trap material in high concentrations.

Specific comments:

Line 38 – How shallow and intense is the OMZ?

Line 93 – What is the size of mesh that makes up the walls of the mesocosms? Can water move through the mesocosm walls?

L100-101 – For clarity, is station 3 considered your “extreme OMZ addition” (M2, M3, M6, M7) and station 1 your “moderate OMZ addition” (M1, M4, M5, M8)?

L101-102 – I’m not sure what you’re referring to here when you say “from/into corresponding depth ranges”. Please clarify.

L119 – On each tow in the mesocosms, the net sampled 0.77 m$^3$ of water. Two tows per sampling day and 10 sampling days means that you could have removed zooplankton from up to 15.4 m$^3$ of water total or 28% of the total volume of the mesocosm. Do you think this could have had an effect on your experiment, or is it a small enough volume to not make a difference?

L122-123 – What is meant by “quantitatively rinsed”? 
L173 – split using a Motoda splitter?

L301-304 – What was the zooplankton community abundance and composition in the different deep waters and how did it differ between the two different deep waters and the existing mesocosm community? Was this difference quantified?

Figure 3 – Should label the x-axis in the upper panel.

Line 311-317 - The variability in the “other” zooplankton abundances between days 1, 8, and 10 is perplexing. Why did you find lots of euphausids and Mollusca on day 8, but not day 1 or 10? You mention that the numbers of Chordata increased, but do you think that they hatched and grew, or is the sampling volume too low to accurately measure them? How many individual ichthyoplankton did you count in these samples? It may be more informative to give actual abundances (ind. m$^{-3}$) in this paragraph instead of percentages of the total.

Line 345 – Do you think that all nauplii were retained by a 100 um mesh net?

Line 349-350 – Here and throughout, you say there was an “exceptional peak of nauplii”, but was that due to an increase in the abundance of nauplii or a decrease in the abundance of other copepod categories?

Line 393-395 – Are the generation times of the dominant taxa short enough to allow for observable changes in abundance and biomass over the 50 days of the experiment?

Figures throughout – It would be nice if you added a vertical line to each figure or x-axis at day 10/11 denoting when you added nutrients to the experiments.

Table 2 – You should remind the reader what the difference phases correspond to in the table caption.

Table 2 – Are the confidence limits from the pooled copepods across all mesocosms in each treatment, or is it from the average differences between mesocosms within a treatment?

L534-535 – What was the zooplankton abundance in the water that was added? In the
water that was removed? If you calculate the difference between the zooplankton additions and subtractions, is it comparable to the change in abundance you see within the mesocosm? If the dilution effect disappeared after a single day, what caused it to disappear? How could numbers of zooplankton change so quickly?

L542-555 – How specifically did your Hemicyclops differ from descriptions of H. thalassius? This whole section really is mostly new results that were not referenced in the prior results section. A description of a potentially new species warrants its own paper, and this is not particularly relevant to the current paper. I suggest removing this section and submitting it as a separate paper, as it needs much more background description of Hemicylops taxonomy, anatomy, and ecology to support the authors’ conclusions.

L572 – What depth was the oxycline in the surrounding Pacific?

L574 – Is the “entire water column” to the max depth of the mesocosms or to the bottom of the ocean?

L580-585 – Did you observe eggs attached to adults? Where the females actively producing eggs? Or were they not producing eggs at all due to starvation?

L635 – Can starvation also influence isotopic signatures? If so, how?

L663-665 – It seems that the evidence presented in the paper more strongly suggests that the copepods starved, which led to lack of reproduction. At the very least, it’s difficult to disentangle the two potential factors leading to lack of copepod reproduction.

L666-667 – How shallow is the OMZ predicted to shoal? Is it close to the ~10-15m depth used in this experiment?