Wishner: Initial response to reviewers. bg-2019-394.

We appreciate the time and attention of the reviewers. Below, we discuss our responses to their suggestions and what we intend to do.

Reviewer 1

I think the paper would benefit from a better presentation of the data in tables and figures, and perhaps a summary diagram or two, as well as a summary table.
This would be a useful way to summarize the data: a table and/or diagram showing how each of the 4 categories (generally) responds to both habitats.

We will prepare a summary diagram and consider a summary table.

Fig. 2 Reviewer 1: Figure 2 is somewhat confusing with different vertical and horizontal scales for the same data. The zoomed aspect is a good idea, but I think that the graphs should at least be rearranged, with shallower graphs above deeper one, and perhaps the deeper ones should have a depth minimum at the place where the shallower ones end. Also, a box around the region that is zoomed in could be usfeul, e.g. for the upper layer oxygen data, so that it looks more like an inset. For the TO plots on the bottom, I think a box around the region that is zoomed in will be helpful too.

Fig. 2 Reviewer 2: This is a very large and very busy figure, mainly due to the many different colors. First, I recommend using the mean profile instead of a chosen single profile for each station (maybe with shaded error, but this might overcrowd the graphs). Second, choose three colors that are the same or similar for the three regions. Try to make the figure fit into a page (lower panels are wider, legend is out of the figure). Oxygen profiles in these would be helpful. Plot area lines could be removed to make some space, but tick marks added because difficult to read with just one tick mark.

We will add boxes to make these diagrams easier to understand. We prefer to have the full water column profiles at the top for overview, and the zoomed upper water column region below, however. We think that it is important to show individual station profiles, hence the different colors, one for each station. (What are the "3 regions" of Reviewer 2)? Mean data would obscure the variability and nuances in distributions that we are trying to show (see also next comment below). The lower panels in Fig 2 are wider (square) because they plot two hydrographic variables (salinity and temperature or oxygen and temperature), not depth. (We don't understand the "oxygen profiles in these" comment of Reviewer 2). Given the complexity of Fig. 2, we think that more tick marks would introduce too much clutter, but we will evaluate adding some.

I also wondered about the variability in a given station, because the CTD data is shown as one line from a representative cast, while the zooplankton data is an aggregate. Some comment or presentation of the variability, at least of O2 would be useful. As thin lines of the same color, or a shaded region around the O2 perhaps. This may not be possible and may make the graphs too busy, so even just a note in the text or some supplementary figures would help alleviate concerns about that variability.

Understanding the variability of oxygen is a valid concern. We will provide some supplementary figures in which all oxygen profiles from a particular station are shown to give a sense of variability. At each station, there were multiple MOCNESS tows to different depths that we used to construct the full

abundance profiles (see Table 1 and methods text). However, adding all of the oxygen profiles to the abundance profile figures would really clutter them.

The point of the abundance figures is to highlight the depth of maximum abundance (DMA), i.e. where the species is most abundant, and the nuances of their distributions relative to the different shapes of the oxygen profiles. Depth, oxygen, and temperature ranges for the single net at the DMA are presented in Table 3. We believe that ranges, rather than means, are the most valid way to interpret their habitat because MOCNESS tow nets sample over a depth interval and consequently over a range of oxygen and temperature. We do not know where within that interval the animals were actually located. This is explained in the text.

For figures 4-10 it might be helpful to have a title to the overall figure, describing which category each group of species belongs to and/or what type of data it represents, simply for quick reference, as they are all very similar. In the published manuscript the caption will be with the figure so this may not be necessary, but because they are all so similar, there might be a way to set them apart.

We will add titles to the figures.

Table 3 appears unfinished. I think the first column with data names should be reformatted and split into multiple columns for the different metadata and using actual words and not abbreviations (e.g. "D" and "N")

We will break up the first column into several component columns to be more easily understood. We will look into gray shading for the night value rows (if allowed by the journal). We are trying to make this table fit into 1 page for the journal.

The discussion of oil presence in E. inermis is interesting, but the text presents data not shown in any figures, and it would be better to note that this data is not shown or show it. In particular the inclusion of the percentages of individuals with oil in them should be cited in some way, and perhaps an indication of how many individuals were observed. If this is not a fully quantified number (e.g. if it is anecdotal) it may still be important and worthy of inclusion but it needs some documentation.

We will include exact numbers of individuals examined in the text. This was quantitatively done only for the SJ07 cruise.

Reviewer 2.

The strength of the manuscript is also a weakness: it contains quite a lot of high-quality data (which is valuable to the scientific community) but as is, it does not well concatenate information, and a statistical analysis is entirely lacking. Given that mean T, S, O2, Chl-a values are available for each sample, it should be attempted to tease out the main environmental drivers regulating the vertical distribution at day and night, and to present a physiological niche in which the respective species is to be found.

A statistical model as described above is beyond the scope of this paper, which focuses on a descriptive presentation of individual species distributions. The data are available to a modeler in the future who would like to do this sort of analysis. Supplementary table S1 presents abundance data for each net and is available in digital spreadsheet form at the URI Digital Commons (presently available only for reviewers

but will be made open access when the paper is published). MOCNESS event logs are in the BCO-DMO database. MOCNESS hydrographic data are available by request from the first author. As described above, we believe that hydrographic ranges for a net, rather than means, are more pertinent to individual species distributions and better represent the uncertainty inherent in MOCNESS sampling and the nuances of the distributions.

Also, in the absence of physiological data for most species, it is not possible to tease out the causes of the vertical distributions, day or night. Depending on species-specific physiology, aerobic scope (a key determinant of biogeography) may be variably oxygen-limited, cold-limited, heat-limited, or irrelevant.

Since the metabolic implications are discussed in some detail, I was wondering why environmental oxygen concentrations, rather than pO2, are reported throughout the paper. It would be much easier for the reader to understand the constraints, in particular for those species where pcrit data are available (consider extrapolation as a function of temperature).

Oxygen concentration is included in the datastream of the MOCNESS and thus is readily available and is the common parameter used in most hydrographic literature. We will provide PO2 for comparison parenthetically at a specified temperature.

Only a few of these species have been kept alive in a lab for Pcrit measurements. For those species for which Pcrit has been measured at more than one temperature, we can discuss constraints but are not comfortable extrapolating too far given the inverse temperature effect in *L. hulsemannae* and the limited temp range (5 to 8°C). We have Pcrit data for only 3 of these species. Among them, the effect of temperature is normal, inverse and zero. We will add more about those species to the metabolic discussion.

Fig. 1: This map does not reveal much oceanographic information to the reader. Consider including e.g. oxygen contours or average annual surface productivity. Lat/Lon grid should rather be equally spaced (I understand that the goal was to add the approximate lan/lon values for the sampling stations, but the exact values are given in the metadata table, and linear axes make it easier for the reader to visually grasp area size and distances.

Fig. 1 is intended to be a simple schematic showing the geographic locations of the stations. We will change the axis labels to even lat lon values. Contours of environmental parameters are not pertinent. We did not conduct regional surveys, and this work was done on 4 separate cruises over a time period of 10 years. We provide references to the literature on the basic oceanography of the Eastern Tropical Pacific.

Fig. 2. See combined Reviewer 1 and 2 comments above.

Figure 4-10: These are way too many figures, they are difficult to read, and they don't convey as much information as they could. Sometimes the panels are organized in a confusing way (e.g. plots from the same area are not next to each other). I suggest to move the majority of these into a supplement, and only keep more integrative figures in the manuscript (which could be, e.g., scatter plots of multivariate analyses or histograms of abundance distribution against oxygen and/or temperature rather than single station profiles).

Plots from the same area are arrayed vertically in columns, not horizontally (see station labels at the top of each column).

As noted elsewhere, the focus of this paper is on the descriptive presentation of how a number of copepod species respond to OMZ extent and the nuances of their responses to both the oxygen values and the shape of the oxygen profiles. Thus, these figures are the crux of the paper. A scatterplot based on means would not adequately illuminate the many possibilities of how individual species respond to both large and subtle changes in these profiles at particular times and places. This paper provides a comprehensive abundance and distributional framework that will hopefully inspire further analyses in the future. As noted above for Reviewer 1, we will develop a summary schematic diagram to highlight basic conclusions.

As for the stacked bar charts, I recommend variable bar width so that the bar covers the entire depth stratum sampled as there are no "gaps" between nets (this way, also the colors are more visible). Bar area then is proportional to integrated abundance in the respective depth layer. Day/Night plots of the same station should be scaled the same, and might be mirrored against each other to save space and facilitate comparison.

We will work on these figures.

I have added some additional, specific comments to a marked-up version of the pdf.

We note the textual suggestions recommended by the reviewer.