Interactive comment on "Microbial Community Structure and Activity Changes in Response to the Development of Hypoxia in a Shallow Estuary" *by* Yunjung Park et al.

Anonymous Referee #2

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This paper describes a study conducted in a shallow, small (? no information of area given) semi-enclosed bay in south-eastern part of Korea peninsula. The authors measured temperature, salinity (although no results are shown for salinity) and oxygen weekly to biweekly from January to November in the water column at a single sampling station, of which no depth has been given, probably assumed to represent the general conditions in the bay. They also collected water samples for ammonium and nitrate analyses at "surface, middle and bottom" water depth (no actual depths given, also no information of how close to the sediment surface the bottom water sample, nor how close to the surface the surface sample was) 7 times. In addition, water and sediment samples were collected for oxygen consumption measurements and analyses of microbial communities, according to the methods on five occasions over the progressing hypoxia, although at least for process measurements, results are only shown for four sampling times. Process measurements were done in duplicate with start-stop concentration changes for water column samples and as a decrease in concentration over time for sediment samples. The results shown are probably average of the two replicates, although no information of that, nor of the variation between replicates is given. No information is given of the sediment sampling for the microbial community analysis, either. To which depth did the authors sample? just the top millimeters, or deeper? what is the oxygen penetration depth in these sediments in spring, when bottom water temperature is < 15 degrees and oxygen concentration in the bottom is > 250 μM? What is it in hypoxic conditions, when temperature is >15 degrees and oxygen concentration decreases? It makes no sense to even try to link any changes in microbial community to changes in oxygen at, for example, 1 m above the sediment surface, if the sediment sampled is hypoxic year round below 1 mm and the samples are from 2 cm layer. Al-

Thank you for the comments. We have published a paper (Lee et al. 2017, Dynamics of the Physical and Biogeochemical Processes during Hypoxia in Jinhae Bay, South Korea, J. Coast. Res. 33(4): 854-863) describing the hypoxia mechanism and quantitative oxygen budget in the same sampling stations and tried to avoid repetition. That's one of the reasons that some details was not presented. However, as reviewer suggested, we will add more details regarding the study area, sampling sites, and experiment procedure.

The annual bottom oxygen variation was described in Lee et al (2017) and shows bowl shaped variation this site (named An's bowl). We have sampled top 10 mm, which is the about double (5 mm) of the average oxygen penetration depth in normoxic condition (usually November to March, S5 and S1) measured with oxygen microelectrode. Of course oxygen penetration depth was zero during hypoxia (H2, H3, H4 period). We will add the details in the final version.

sampled is hypoxic year round below 1 mm and the samples are from 2 cm layer. Already describing the sediment in terms of "sand or mud" and giving the sampling depth in sediment would have helped the reader to imagine whether any changes could be linked at all. The results have been somewhat randomly organized into "hypoxia periods" without justification. For example, in Figure 1 bottom water oxygen saturation in the end of May does not differ from those measured in June, July and August, but May is labeled H3A and June sampling H3B, although the May sample itself is in H2 period. Figure 2 that gives actual measurement data has another classification, normoxic (May included) and hypoxic (June, July, September). September data shows a fully mixed water column, according to the temperature data, but still low oxygen concentrations that decrease towards sediment surface. Figure 1 shows 4 measurements of bottom water oxygen, but it is not possible to say which of these measurements is shown in the profile data in figure 2, as the actual sampling dates for any variable are missing. As the bottom water temperature varies from maybe 7 to about 25 seasonally, that also affects oxygen solubility a lot (Figures 1-2). There is a longish, rambling discussion about the ammonium and nitrate concentrations that the authors try to explain with

The study area is shallow coastal region in the influence of meso tidal range (~2 meter). Please understand that the semi-diurnal tide makes the ever changing condition of each environmental variable in different time scale. We are putting together results of environmental parameters and process measurements, which are measured in different time interval and platforms. Therefore, measured environmental data do not usually matches together unlike lab experiment data.

the abundances of nitrifying organisms. It is of course possible, even likely, that nitrifiers are active in the water column, but this data (concentration measurements and DNA data) is not enough to show it. How much light penetrates to the "middle depth" sampled? how much does the phytoplankton uptake affect the observed changes in nutrient concentrations over year? The authors even mention the different sensitivities of archaeal and bacterial nitrifiers to H2S, but fail to mention whether they ever detected any in their own samples. Far too much speculation is based on very little data, with single high values read as "tendencies" in system. Already in the abstract and later in discussion the authors mention "similarities in composition and activity of N-cycling microbes between the seasonal hypoxia and permanent oxygen minimum zones". I do not see these claimed similarities. It may, of course, be due to sloppy description of the experiments, but I would advise the authors to read more about coastal hypoxia and its effects on nutrient cycling, also on microbial communities. Coastal areas are increasingly affected by eutrophication-related hypoxia all over the world and such literature is piling up. The authors are more likely to find similarities to those systems than to completely different oceanic ones.

Please understand that we are trying to achieve combined interpretations of the results from two separate fields of study (biogeochemistry and microbial biology), which is usually challenging. Obviously, two fields are tightly related but it is also true that each field usually employs their own methodologies and way of interpretations. Unfortunately we could hardly find attempts to relate both in coastal region. That's why we suggested the similarities between our study sites and OMZ. Obviously further studies should be done to confirm this but our result clearly shows the possibilities.

We realize that our data is not enough but we are drawing "possible suggestions". We will tone down to make it clear these points. Also we will change the title

"Remineralization activity and sulfur related microbial community changes in response to the development of hypoxia in a shallow estuary"