

Interactive comment on “High denitrification and anaerobic ammonium oxidation contributes to net nitrogen loss in a seagrass ecosystem in the central Red Sea” by Neus Garcias-Bonet et al.

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General comments:

RC1: This manuscript presents the results of a field study comparing nitrogen (N) removal (denitrification, anammox) and fixation rates in a seagrass meadow sediments and adjacent bare sediments. The authors found that N removal exceeded N₂ fixation in vegetated and bare sediments and that sediment OM and water temperature were important drivers of N processing rates. The manuscript is generally well written and provides valuable insight into N-cycling in seagrass beds. The inclusion of previously published N-cycling rates in the discussion provides useful context for the results.

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AC1: We thank the reviewer for this comment.

Specific comments:

RC 2: As mentioned by the other referees, the discussion should mention the limitations of the acetylene reduction method for measuring N₂ fixation.

AC 2: We will include the limitation of the ARA in the reviewed manuscript.

We propose the inclusion of this text in the discussion section: "Despite the common use of the Acetylene Reduction Assay to measure N₂ fixation, it has some methodological limitations that need to be considered. Acetylene is known to induce changes in the microbial community composition in marine sediments, especially in sulfur- and sulfate-reducing bacterial groups (Fulweiler et al 2015). The effect of acetylene is species specific, and, therefore, the N₂ fixation rates reported here might be under- or over- estimated and need to be carefully interpreted."

RC 3: One of the strong points of the study is the in-depth measurements of N-cycling rates. However, because there were so many comparisons, presenting these measurements can be difficult. Results section 3.2 ("Denitrification, anammox and N₂ fixation rates") is dense and difficult to follow. I would suggest breaking this section into subsections, either by experimental variable (i.e. effect of a) vegetation, b) sediment depth, c) OM, d) temperature on denitrification/ anammox) or process rate (i.e. a) denitrification, b) anammox, c) fixation in vegetated vs. unvegetated sediments, at different depths, relationship with OM and temperature). It would be helpful to readers to do a separate results section for plant material N₂ fixation rates as well.

AC 3: We thank the reviewer for this suggestion and in a newer version of the manuscript we will restructure the results section 3.2 including subsections to improve the flow of the text.

RC 4: In some cases there are references to significant interactions with no description of what is occurring (e.g. L347-351) beyond references to the figures, which do not

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indicate statistical differences. Were these interactions ecologically meaningful? If not, it might be better to report these results in a supplemental table to keep the results streamlined.

AC 4: We thank the reviewer for this comment as we realized that our message was not clear enough. In a newer version of the manuscript, we will improve clarity and readability of the result section.

RC 5: Lines 450-450 of the discussion the authors argue that OM quality is an important driver of N₂ fixation but do not present it in the context of their system. Are you arguing that *E. acoroides* in vegetated sediments and algal biomass in unvegetated sediments are providing labile OM sources to N₂ fixers?

AC 5: We thank the reviewer for this comment and we will improve our discussion on the effect of OM on rates. We argued that a possible explanation for the different annual patterns in denitrification/anammox and N fixation, besides the effect of temperature, might be as well a change in the lability of OM along the year as it has been described in other works. We will improve the clarity of the discussion regarding this point.

RC 6: In the introduction (L99-107), consider stating objectives rather than what was measured to help readers better process the results.

AC 6: We will clearly state the objectives of the study following the reviewer's comment.

RC 7: L184: Include the equations in the text.

AC 7: In a newer version of the manuscript, we will include the equations in the methods section following the reviewer's suggestion.

Technical corrections:

RC 8: L76: should be: Salt et al. (2017) L176: How much is a few? Do you have an actual detection limit? L210, 226: should be: "We ran" L322: "were large" -They really weren't large compared to denitrification, and this qualitative description is not

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appropriate for a results section.

AC 8: We thank the reviewer for pointing out these typos and minor mistakes and we will amend the text accordingly.

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