

Interactive comment on “Tracer experiment and model evidence for macrofaunal shaping of microbial nitrogen functions along rocky shores” by Catherine A. Pfister et al.

Anonymous Referee #1

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General Comments The authors present a study in which they evaluated the potential relationship between macrofauna and nitrogen transformation by microbes in rocky intertidal systems. The authors used ^{15}N tracer addition experiments in tide pools, which they treated as natural mesocosms, to test the role of mussels and light on microbial nitrogen processing. Rather than using the traditional method of calculating ammonium, nitrate, and nitrite processing via the source-product model, the authors used a series of ordinary differential equations (ODE) to quantify multiple, simultaneous nitrogen transformations. The authors found that mussels enhanced nearly every nitrogen cycling process measured, and that rates were often further enhanced in the daytime. They also found that their nitrogen cycling rates calculated via ODE were

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always greater than the rates calculated using prior methods, suggesting that the older method would have significantly underestimated actual rates in this study. Importantly, their results highlight the significant role that isotope dilution can play in contributing to error in these calculations, and the ODE model should be used in future studies.

Overall, I think the authors addressed important questions related to isotope tracer methodology as well as ecology and biogeochemistry that will be of interest to many readers of this journal. The paper is very well written, and the ODEs and related calculations are explained so clearly. I am comfortable with the conclusions and support publication of this manuscript with minor edits, as detailed below. This paper was a pleasure to read.

Specific Comments

lines 180-181 It would be helpful to get an idea of how much the value of the multiplier (2:1 for $\text{NH}_4:\text{NO}_3$ uptake) influences the fits. It's useful that 2:1 fit the data best, but does empirical evidence exist for what this rate is in nature? Please clarify.

line 437 replace "no" with "not"

line 476 insert "which" after "transformations"

Fig. 2 I suggest adding labels to each panel, which you can refer to in the results and discussion more explicitly. You have this in figure 3, and I don't think it's too busy. I also think changing the legend from "mussel control" just to "mussels" would be clearer. These are simply stylistic recommendations, but they would have made things a bit clearer for me.

Fig. 5 See comments for Fig. 2. Also, what is the purpose for the blue shading? I suggest just using grey for consistency.

Table 2 In the caption, you need to add a comma after " $p>0.05$ ".

Appendix A1 I suggest using the actual time axis (in hours) rather than the categorical

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axis of T1, T2, T3, etc. This will more accurately represent 15N dynamics. You have done this already in Fig. 3.

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