Review of: "The Role of Metabolic Strategies in Determining Microbial Community Diversity along Temperature Gradients"

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Potential competing interests: No potential competing interests to declare.

The study claims to determine the role of metabolic strategies**along temperature gradients**; however, the authors did not model temperature gradients, but a set of fixed temperatures. Gradients imply change as one moves physically or advances in time. A set of ordered but fixed systems may show the effect of temperature but will ignore that of change. Consider either refocusing the article to “the effect of temperature on microbial community diversity” or modifying the models to capture gradients more accurately.

Apart from that, here are some minor considerations that may improve the article:

1. Consider rephrasing the abstract to improve clarity.
2. The Results section should be more concise. Consider moving relevant text from section 2.1 to Methods and from section 2.2 to Introduction.
3. The adverb “relatively” is used excessively in section 2.3 and towards the end of the Discussion. In many instances, it modifies the adjectives “lower” and “higher,” which are intrinsically relative, so the adverb can just be removed. In the discussion, you mention “species with relatively the highest CUE value.” “Highest” is an absolute term (a superlative). Consider rephrasing it to something like: “the species with the highest CUE value of a community.”
4. Separate the different points treated in the discussion into subsections and list out the conclusions.
5. Define the acronym “TCP” the first time it appears in the main text (it is defined in section 4).
6. Section 3, paragraph 4: the word “unrealistic” is used in reference to a GLV model. If it is in quotation marks because it was deemed so by previous authors, make that clear in the text. If it is a personal remark, consider removing the adjective.
7. Section 3, paragraph 5: OTR instead of OTU?
8. In figure 4, the 97th quantile of the EMP data is highlighted. I assume this refers to the highest 3% of species richness at each temperature point, but it is not obvious to me. Also, why the 97th?
9. In the introduction, it is mentioned that previous attempts to address this show conflicting results. Please compare the obtained results to those of the mentioned studies and discuss where they stand in the conflict.
10. The article concludes that “community assembly along temperature gradients is driven by the species’ life-history strategies, particularly metabolic traits and CUE.” However, the article does not study any other possible driving forces (e.g., resource density) besides metabolic traits and CUE, so there is no estimation of their relative importance in the

final composition of the community.

11. Each temperature point was simulated 670 times with a population of 100 species with randomized metabolic traits. Is the pool of species randomized in each replicate, or are there 670 different pools, each one simulated once per temperature point?
12. Considering only uptake and loss rates, there are a total of 125,000 temperature-dependent metabolic traits. Does each trait have its own TPC?
13. Do the metabolic traits take continuous or discrete values?
14. If each metabolic trait could take 8 distinct values, there are at least a million different possible species. 67,000 species per temperature point seems a bit low to me. I would suggest at least 1,250 replicates to reduce the effects of chance and preferably closer to 10,000.