

# Community size affects the signals of selection and ecological drift on biodiversity by Tadeu Siqueira et al.

Siqueira et al. investigate the relationship between beta-diversity and community size (total number of individuals) for aquatic insect communities of two regions: Brazil and Finland (note that the data set is described in Heino et al. 2018). The main findings are:

1. a negative correlation between beta diversity metrics and community size for Brazilian communities but not for Finnish ones;
2. incidence-based beta deviation (i.e. a score based on the difference between observed beta diversity and the expectation under a null model) is negatively correlated to community size only in Brazil but abundance-based beta deviation (Bray Curtis index) is positively related to community size in both regions.

Based on these results, the authors conclude that the smaller the community size the bigger the role played by ecological drift.

I found the manuscript overall clear, the authors have used high scientific standards and they provide data and code to reproduce their analysis. That being said, I think the analysis performed weakly support the conclusions. I also think the manuscript is missing important pieces of information. For these reasons, I believe that the current version of the manuscript is not suitable for a recommendation by PCI.

## 1 Major comments

### 1.1 Ecological drift

I am not convinced that the analysis support the conclusion that ecological drift is higher in smaller communities. As far as I understand it, the analysis (as described in Chase et al. 2011; Kraft et al. 2011) do not allow the authors to determine the nature of the mechanism behind the deviation observed. I agree that ecological drift is one plausible explanation but there are alternative explanations that are as much convincing as the ecological drift. For instance, the variations in dispersal capacities of species and the connectivity within watersheds could explain well the results obtained. This is discussed in one paragraph page 16, but it could also have been an option to frame the paper. My point is that the authors have shown a relationship between beta deviation and community size, this is an interesting result but they cannot conclude that it is due to ecological drift. It *may* be ecological drift, it may also be dispersal or it may be because of the topology of the whole ecological network, or a mixture of these mechanism. My opinion is that the authors should acknowledge this and should not neglect alternative hypotheses.

## **1.2 Information missing / major lack of clarity**

### **1.2.1 Information about the aquatic insect communities**

I understand that there is a published study that describes the data set (Heino et al. 2018). That said, from a reader perspective I think a little bit of information about the communities is required. It could be something like figure S5 in Heino et al. (2018) that would give a sense of the spatial turn over of the communities. So far there are only two figures, so I think there is room for two or three more.

### **1.2.2 Community size and stream width**

Page 7, I read:

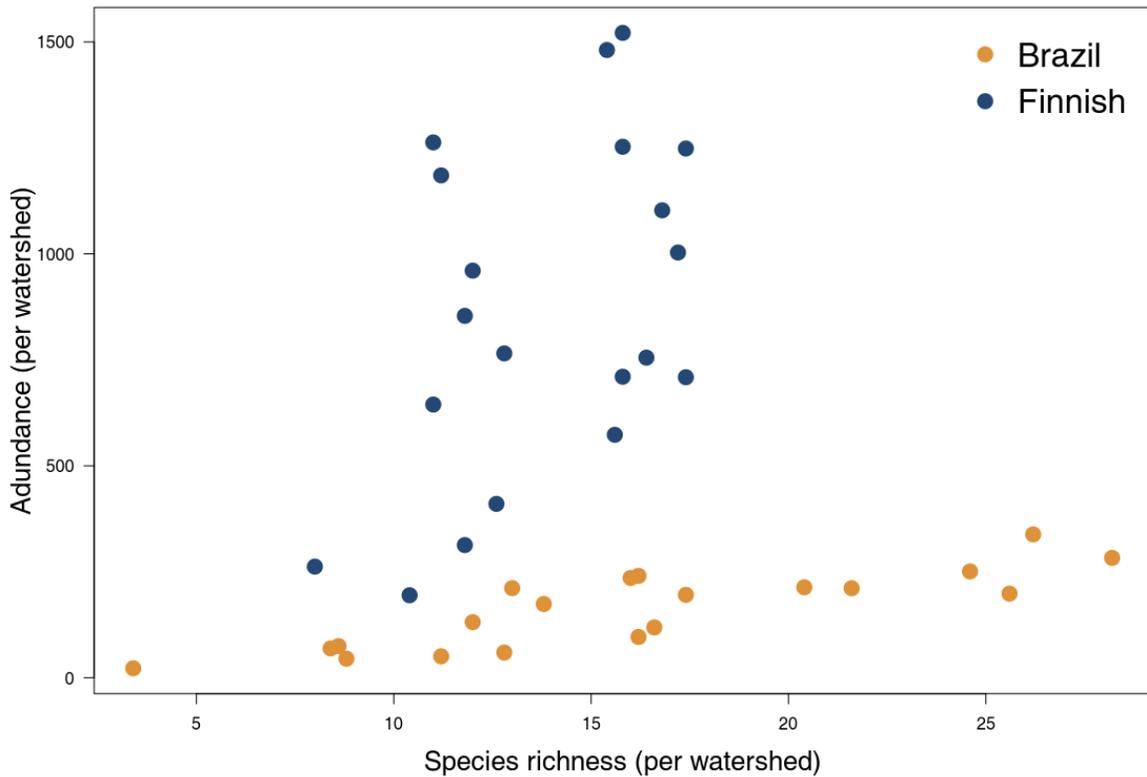
*"Because streams within and among regions differ in width and this could be viewed as measure of habitat size, we multiplied local community size by stream width, averaged it within watersheds, and defined it as an alternative measure of community size."*

I do not understand why the community size was multiplied by stream width. I think that in order to correct this potential bias, one should divide rather than multiply. But more importantly, I do not understand the need for recasting the definition of community size. It would be better to use community size as defined in Vellend (2010), perform the analysis and then check if there is in fact an effect of stream width.

### **1.2.3 Simple correlations**

I would recommend to add simple correlations in the manuscript:

1. I recommend to investigate the role of average species richness per watershed. This is important given that beta-diversity metrics actually depends on the number of species.
2. I was surprise to see that there is a strong relationship between the number of species per watershed and the local community size in Brazil but not in Finland (see Figure 1). Can this explain part of the results? I think this relationship should be included in the manuscript and discussed.
3. The authors showed that there is no effect of site heterogeneity on the beta deviation but I think they should rather investigate whether there is a role of heterogeneity on the raw values of beta diversity.



### 1.2.4 Algorithms

Regarding the null model introduced in Chase et al. (2011), the authors wrote:

*“(i) we defined the species pool as all species occurring in each region;”*

But according to Chase et al. (2011)

*“At the same time, it is not advisable to use a regional species pool that is so large (e.g., all of the species of a particular group across biogeographic zones) that all communities would have exceptionally low  $\beta_{RC}$  values.”*

How do the authors check that they are not using a pool of species that is too large?

Also, I do not fully understand the procedure described in Kraft et al. (2011). Do the authors pool all species or all individuals? Do the abundance of a specific species have an influence on the probability of drawing it (like in a neutral procedure)?

## 2 Other Comments

- p.2:

*“However, although beta diversity and community size were strongly related in both regions, the type of relationship varied according to the type of dissimilarity coefficient.”*

I think this is slightly confusing because the authors are actually referring to results for the beta deviation.

- p.4

*“Thus, to properly analyze the relationship between beta diversity and community size, we need estimates of beta diversity that account for differences both in species richness and species relative abundance. A solution is to use a null model to produce expected values, contrast observed and expected values and use the difference between them as estimates of beta diversity.”*

I am confused by the sentence as it sounds like beta deviations are better metrics of beta diversity whereas there a metric that compare observation (classical indices of beta diversity) to a null models. I guess my confusion is due to the wording of these sentences.

- p.8:

*“We tested whether beta deviation was related with community size by using ordinary-least-squares regression models.”*

Why are you using “ordinary-least-squares regression models” instead of "linear model? (I know that here they are equivalent but you are actually using `lm` in your code not `nls`)

- Figures: I think it would make sense to pool observations for Brazil and Finland on the same plots (like in figure 1 I've created). Hence the reader would easily see the full gradient of community size. Also I think it would be better to add horizontal and vertical errors bars to give a sense of the variance along both axis for each watershed.
- Data and code:

I very much value the efforts that have been put into making the analysis reproducible, that is great. I have a few suggestions:

- In the R scripts, the authors should provide the description of all function arguments. Currently, it is hard to follow the steps just because of this;
- the link to the FigShare repository [https://zenodo.figshare.com/articles/Community\\_size\\_affects\\_the\\_signals\\_of\\_niche\\_selection](https://zenodo.figshare.com/articles/Community_size_affects_the_signals_of_niche_selection) should be added;
- I would add a brief description of the files in *Metadata\_SacleBio.odt*;
- also, there is one typo (“assinged”) in *catanos\_betadev.R* and 2 (“community” and “treatments”) in *Script\_beta\_diversity\_deviation\_Bra\_Finn.R*.

## References

Chase, Jonathan M., Nathan J. B. Kraft, Kevin G. Smith, Mark Vellend, and Brian D Inouye. 2011. “Using Null Models to Disentangle Variation in Community Dissimilarity from Variation in  $\alpha$ -Diversity.” *Ecosphere* 2 (2): art24. <https://doi.org/10.1890/ES10-00117.1>.

Heino, Jani, Adriano S. Melo, Jenny Jyrkänkallio-Mikkola, Danielle Katharine Petsch, Victor Satoru Saito, Kimmo T. Tolonen, Luis Mauricio Bini, et al. 2018. “Subtropical Streams Harbour Higher Genus Richness and

Lower Abundance of Insects Compared to Boreal Streams, but Scale Matters.” *Journal of Biogeography* 45 (9): 1983–93. <https://doi.org/10.1111/jbi.13400>.

Kraft, N. J. B., L. S. Comita, J. M. Chase, N. J. Sanders, N. G. Swenson, T. O. Crist, J. C. Stegen, et al. 2011. “Disentangling the Drivers of Diversity Along Latitudinal and Elevational Gradients.” *Science* 333 (6050): 1755–8. <https://doi.org/10.1126/science.1208584>.

Vellend, Mark. 2010. “Conceptual Synthesis in Community Ecology.” *The Quarterly Review of Biology* 85 (2): 183–206. <https://doi.org/10.1086/652373>.