Editors-in-Chief

Functional Ecology

Dear Editor,

Please find attached our manuscript “*THE HIDDEN SIDE OF DIVERSITY: EFFECTS OF IMPERFECT DETECTION ON MULTIPLE DIMENSIONS OF BIODIVERSITY*”, to be considered for publication in *Functional Ecology* as an Original Research article. Both species and individuals are not perfectly detected in the field, but for community studies this issue is neglected in the calculation of diversity measures, assuming the premise that this is not a major issue in the investigation of community diversity patterns. Our study investigates and highlight the effect of imperfect detection in the taxonomic, phylogenetic and functional diversity measures, considering the individual and species count of fruit-feeding butterflies in a vertical gradient. We hypothesize two possible scenarios: 1) the individuals detection probability is constant along the environmental gradient, if this occur the observed patterns of diversity do not change, only having an improvement in the accuracy of diversity metrics; and 2) the individual detection probability is asymmetric along the environmental gradient, if this occur to not accounting for imperfect detection could lead to an erroneously description of the diversity pattern and hence, the inference about processes that generate the observed diversity pattern. In order to evaluate these scenarios, we used a data set of fruit-feeding butterflies sampled at two different forest heights (canopy and understory) in a subtropical Brazilian Forest, and estimated the true abundance employing a Hierarchical Bayesian N-Mixture model. Subsequently, we developed a tool to measure the magnitude and the direction of information loss when imperfect detection is disregarded.

Our main findings are that in abundance-weighted diversity measures, we observed a larger variation in the diversity patterns when imperfect detection was not accounted. Both functional and phylogenetic diversity showed that individuals with distinct traits or phylogenetic position are more susceptive to be missed during sampling, mainly at the canopy sites, in relation to incidence-based measures. We suggest that this variation can be associated with the lower detection probability of individuals at the canopy, that generated an asymmetric detection probability between strata. Thereby, we highlight the importance of imperfect detection to be considered into community diversity measures because not only the pattern can be erroneously described, as well the process that underline the assembly of communities.

We expect that the tool developed and the results found in this study improve the community diversity measures estimation and, consequently, the understanding of processes that mediate the patterns in current assemblages. Also, we believe that our manuscript has potential to be useful for both community ecologists as well by population biologists, since we integrate parameters related to populational dynamics (assessed by multi-species hierarchical models) with tools commonly used to describe patterns in community ecology.

The manuscript had the English language reviewed by a native speaker. We confirm that this manuscript has not been published elsewhere and is not under consideration by another journal. All authors have approved the manuscript and agree with its submission to *Functional Ecology*.

Thank you very much for your attention.

Best regards,

The authors

We assessed the extent to which imperfect detection can influence different measures of diversity. We developed a tool to measure the effect and magnitude and applied this method to fruit-feeding butterflies. The results show a variation in the detection probability for the studied environmental gradient, indicating a probable misinterpretation of the diversity patterns.