Review of: "Listening to the Bats of Carajás: Applied Bioacoustics for Species Inventory and Environmental Use in a Mosaic of Forests, Savannas, and Industrial Mining in the Brazilian Amazonia"

Sebastian Botero-Canola[1]

1 Wildlife Ecology and Conservation, University of Florida, United States

Potential competing interests: No potential competing interests to declare.

In the manuscript titled “Listening to the Bats of Carajás: Applied Bioacoustics for Species Inventory and Environmental Use in a Mosaic of Forests, Savannas, and Industrial Mining in the Brazilian Amazonia,” the authors use bioacoustics data to update the list of species occurring in the Carajá region and explore differences in species richness among habitat types of their study area. This region not only harbors the unique canga habitat but is also impacted by mining activities. This is a very relevant study due to its potential conservation implications, but also by the fact that it harnesses arising technologies to survey biodiversity at large scales.

In the introduction, the authors do a good job of highlighting the relevance of this study in the context of the anthropogenic pressures that the bats of this area face, as well as the innovative aspect of using acoustic surveys in the area. The authors also articulate this background well in relation to their objectives. The collection methods are solid, and the results are relevant, with the addition of species to the list as well as providing a reference library of bat calls for the region in the supplementary material.

Nonetheless, I have suggestions regarding the data analysis and interpretation that could improve the quality of this work:

1. I suggest using the term habitat use instead of “environmental use.” The former term is more common in the literature and has a more specific meaning.
2. Please specify in the methods how the survey sites were selected and what determined the number of sites in each habitat type. Also, what is the minimum and average distance among audio recorders?
3. I believe that some revision of the methods could result in a much more robust analysis for the objective of assessing the differences in species richness among habitat types:

- First, I suggest not separating the forest, canga, and cave sites by whether there is a plan for mining or not. Unless there are human activities or impacts currently going on in the areas, there is no reason to expect that at the moment of sampling, the sites that are going to be mined were different from their counterparts. After estimating the richness of your habitat types, you can proceed to identify which of these sites are expected to be mined and what would be the implications. On the other hand, if there are current ecological differences between the sites expected to be mined and those that aren’t, please describe them.

- The authors mentioned the use of the package iNEXT to quantify their sampling completeness, but these results are not presented. In addition, the authors estimate the expected richness of each habitat using the Chao, Jackknife, and bootstrap indices. These indices could be significantly influenced by the sampling size. Given that there are important differences in the sampling effort by habitat type, I suggest using the interpolation/approximation method implemented in the iNEXT package to compare the species richness at the same level of sampling completeness among all sites [1,2,3]. This would probably result in more robust estimates. Furthermore, as the iNEXT estimates provide a confidence range, you can assess the significance of the differences in richness among habitats.
- Similarly, I suggest estimating the species richness at each of your sampling points using the iNEXT approach. This will allow you to compare the species richness by site in a robust way (interpolated or extrapolated to certain sample coverage). Thus, you could report and average comparable numbers of estimated species per site for each habitat type. Similarly, you could perform the GLMM using as the response variable comparable estimates of richness.
- Please clearly separate average richness per site from total richness when presenting and discussing the results.

4. Although species composition is mentioned in a subheading of the results, this is not stated in the objectives. Furthermore, there is no substantial mention of the differences in species composition among the surveyed habitat types in the results section. Performing a non-metric multidimensional scaling (NMDS) using sites with reasonable sample coverage could be a good way to explore differences in species composition among habitats[4].

5. Lastly, there are a couple of issues that I think would be important to include in the discussion:

- It would be very interesting to read what the conservation implications for the canga habitat could be (which is highlighted in the introduction).
- Given that the area covered by the acoustic recorders and the distance among devices are different for habitats, it would be important to discuss potential issues arising from spatial correlation in the data.

6. Minor suggestions and comments are included as comments in the attached PDF.

Good work!

References

1. - https://johnsonhsieh.github.io/iNEXT/inst/doc/Introduction.html
2. - Chao, A., Gotelli, N.J., Hsieh, T.C., Sander, E.L., Ma, K.H., Colwell, R.K. and Ellison, A.M. 2014. Rarefaction and extrapolation with Hill numbers: a framework for sampling and estimation in species diversity studies. Ecological Monographs, 84, 45–67.
3. - Roswell, M., Dushoff, J. and Winfree, R., 2021. A conceptual guide to measuring species diversity.*Oikos*, *130*(3), pp.321-338. https://nsojournals.onlinelibrary.wiley.com/doi/full/10.1111/oik.07202
4. Some examples:

https://jonlefcheck.net/2012/10/24/nmds-tutorial-in-r/

https://rpubs.com/CPEL/NMDS