

## Comments to the authors

The work presented by Patterson et al. raises a relevant issue in ecological studies: the importance of considering detection errors in estimates. In this study, they seek to compare two traditional methods in population density estimation for butterfly monitoring, one that takes imperfect detection into account (distance sampling) and one that does not (Pollard-Yates transects). The results indicate that Pollard-Yates transects are robust methods where species have high detectability despite low sampling area coverage. On the other hand, with the distance sampling method, the authors show that the probability of smaller species being detected decreases as the distance increases. Although the two methods show differences in total population estimates, the pattern is maintained - species with the highest densities in the Pollard-Yates method also have the highest densities in the distance sampling method. Below I list some weaknesses of the study and recommend some improvements within the main topics of the text.

1 - Since one of the study's objectives is to assess whether detection is related to butterfly size, I believe this topic should be better addressed in the introduction and especially presented in the methodology. Table 1 presents the values of wing size, but in the methodology, the authors do not explain whether it was measured by them or taken from the literature. Also, it is not clear if the wing size is used in the detection models or if they use it only to correlate with the detection.

2 - Explore the observed "exceptions" better. For example, why did Little Yellow show lower density values by distance sampling if it has one of the highest detection values? What factors might be causing a greater similarity of estimates for Orange sulfur and Monarch? If Monarch and Viceroy are so similar in characteristics (detection and size), why do their density estimates differ so much between methods? This way, I believe

you give more basis for using methods that do or do not consider imperfect detection, depending on the study's target species or characteristics.

## **Abstract**

There is a bit of a lack of discussion about the main results.

## **Introduction**

Lines 51 – 55: I agree that there is still a lot of neglect in ecological studies about the importance of incorporating imperfect detection, but it should be noted that conservation biology studies are one of the fields in which it is most widely used.

See:

Benoit D, Jackson DA, Ridgway MS. 2018. Assessing the impacts of imperfect detection on estimates of diversity and community structure through multispecies occupancy modeling. *Ecology and Evolution* 8:4676–4684. DOI: 10.1002/ece3.4023.

Jarzyna MA, Jetz W. 2016. Detecting the Multiple Facets of Biodiversity. *Trends in Ecology & Evolution* 31:527–538. DOI: 10.1016/j.tree.2016.04.002.

Lines 72 – 73: I suggest posting a short explanation of what the distance sampling method is. For example: "Distance sampling, which is a powerful technique for estimating the abundance of biological populations, allows us to test this assumption by assigning a distance (or distance compartment) to each detected individual because it allows us to estimate population density without having to assume that all individuals within the surveyed area are counted." (Buckland, S.T., Anderson, D.R., Burnham, K.P. and Laake, J.L. (2005). Distance Sampling. In Encyclopedia of Biostatistics (eds P. Armitage and T. Colton). <https://doi.org/10.1002/0470011815.b2a16019>)

Lines 102 – 106: It is important to present before the objectives something about the relationship between size and detection. It is expected that larger organisms will have higher detection probabilities than smaller organisms. See:

Iknayan KJ, Tingley MW, Furnas BJ, Beissinger SR. 2014. Detecting diversity: Emerging methods to estimate species diversity. *Trends in Ecology and Evolution* 29:97–106. DOI: 10.1016/j.tree.2013.10.012.

## **Material and Methods**

### *Data analysis*

Lines 165 – 168: I suggest removing that sentence because it does not explain the method used, only how the program works.

Lines 170 – 172: Wasn't the density of the Pollard-Yates transects calculated by species?

Lines 172 – 174: Was it not possible to calculate, or were the measurements inaccurate? Because if you have calculated a mean, you can at least calculate a standard deviation.

Line 177: I suggest the following sentence enhancement: "For each species, we adjust the four models endorsed by Buckland..."

## **Discussion**

Lines 236 – 237: Put "Chamaecrista fasciculata" in italics.

I hope my comments will help improve the article, and, to make the review process more transparent, I am signing this review.

Best regards,

Aline Richter