19 January 2024

Drs. Aaron Ellison, Natalie Cooper, Nicolas Lecomte, and Huijie Qiao

Editors, *Methods in Ecology and Evolution*

Dear Editors,

Please consider our manuscript “**Thinking beyond the closure assumption: designing surveys for estimating biological truth with occupancy models**” as a Research Article in *Methods in Ecology and Evolution*. Occupancy models have become a standard tool for modeling distributions of imperfectly detected species, but challenges with meeting the assumption that sites are closed to changes in occupancy has been a consistent source of consternation for researchers working with mobile organisms. In this study we suggest it would be prudent to move past discussions over how to meet the closure assumption, and instead focus on designing surveys that accurately estimate true occupancy states of sample sites. We used movement data from wild Wood Thrush (*Hylocichla mustelina*) to build an individual-based model, simulate Wood Thrush populations, and sample them using 162 point count protocols that differed in spatial and temporal sampling scales. We believe our research will be of broad interest to the readership of *Methods in Ecology and Evolution* for the following reasons:

1. **We highlight that for mobile organisms, there is no single, universal definition of ‘occupancy’**. The proportion of sampling sites occupied by the target species varies in time and space, and it is critical for researchers to define what type of ‘occupancy’ is pertinent to their study.
2. **We demonstrate that movement of target individuals interacts with the spatial and temporal aspects of a sampling design to influence the value of occupancy being estimated**. Thus, different protocols provide different estimates of occupancy and occupancy estimates should not be compared among studies using different protocols.
3. **We found that variation in spatial and temporal sampling scales have predictive effects on occupancy**. For example, when surveys and between-survey intervals are short, occupancy estimates approximate instantaneous distributions, whereas when they are long, estimates approximate seasonal distributions. Understanding these patterns is critical for designing sampling schemes to estimate specific biological patterns.
4. **Most importantly, our study provides a framework for evaluating how sampling protocols impact occupancy model estimates and their approximation of truth**. The effectiveness of one’s sampling and modeling methods should be measured by how well the outcome reflects truth, and we argue this is more essential to biological inference than whether the study system meets model assumptions.

For these reasons we believe that *Methods in Ecology and Evolution* is an ideal outlet for this manuscript. We affirm that this is an original, unpublished work and is not being considered for publication elsewhere. Thank you for your time, and we look forward to hearing from you.

Sincerely, and on behalf of my co-authors,

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