14 October 2024

Dr. Guillaume Souchay
Recommender
Peer Community In Ecology (*PCI Ecology*)

Dear Dr. Souchay,
My co-authors and I thank you and the referees for helpful feedback on our revised manuscript titled, "Using multiple datasets to account for misalignment between biological and statistical populations for abundance estimation." In the *PCI Ecology* database, this manuscript is identified as #640.

Below, we detail our response to each comment provided by you and the referees. Some of the comments were related to formatting (e.g., subheadings, start of new paragraph). We are unsure how to handle these comments. Does *PCI Ecology* have formatting guidelines or a copy-editing process? Our manuscript is generally formatted to be consistent but not formatted to a specific journal. Please advise on the best approach, and we will make the changes.

We curated our dataset and made it publicly available. We added it to the Literature Cited section and referenced the DOI in the Data and Code Availability Statement.

Again, we thank you and the referees for useful comments on our work and manuscript. We hope our responses outlined here and the revised manuscript sufficiently address your concerns. If you have questions, or problems accessing the data files or code, please let me know. I will be working in a remote part of Zambia from 1 April 2024 to 5 January 2025. While I should have regular email access, I also am expected to have shorts periods without it. If you need something right away, please contact my co-author, Paul Lukacs, at paul.lukacs@umontana.edu. I look forward to hearing from you soon!

Sincerely,

Michelle Kissling

RESPONSES TO COMMENTS

<u>Recommender – Guillaume Souchay</u>
General comments
Thanks for these comments and suggestions. We had quite a few subheadings in the Methods section already, but some of them were not obvious. We highlighted them better in this revision, and we added one.

Specific comments
Line 58: This sentence was deleted in the revised version.

Lines 68–77: We consolidated the first two paragraphs in the last version, which resulted in moving up this paragraph. We think it reads better now. Thanks for the suggestion!

Line 124: We deleted this entire paragraph, following Reviewer 1's suggestion to streamline the text.

Lines 131–144: Done. We like it better with the parameter first and then the definition. Thanks!

Line 170: Done. We changed "model" to "framework." We also made the change in the Abstract.

Line 176: Done.

Lines 214–215: It was related to differences in funding sources. The U.S. Fish and Wildlife Service protocol used estimated perpendicular distance from the line to the group, and the Alaska Department of Fish and Game used the estimated distance and angle from the line to the group. It was a matter of who was leading the field effort in those years, nothing more.

Lines 233–243: We moved the reference to the first sentence of the section on "Telemetry surveys."

Lines 245–264: We retained separate paragraphs here. It was too long for one paragraph, and the themes are different. Our hypotheses regarding the environmental data are described in "Predicting probability of presence" below. We added a sentence to direct the reader.

Lines 278–304: We agree that these two paragraphs are closely related. However, we left it as two paragraphs. One paragraph was very long and difficult to read. As is, the first paragraph describes how we delineated spatial states, and the second paragraph describes all other aspects of estimation.

Line 307: We added the citation of Lukacs et al. 2010 but did not use the "following…." The study described was part of the current study, so it did not seem accurate to describe it as "following."

Lines 482–484: We added the posterior distributions of mean r for the statistical and biological

populations as Appendix 4. The estimates are symmetrical around values slightly less than zero, with mean r of the biological population slightly more negative than that of the statistical population.

Lines 540–543: Point noted, and we agree. We considered doing simulations but decided against it because we aren't actually modeling anything as much as we are accounting for something (i.e., variation in p_p). With that said, we appreciate the value of simulations and agree that it would be worthwhile to do them in the future.

Lines 598–600: Unfortunately, no. We have another publication in press now that tried to identify a proxy for prey availability and failed miserably. Our study area is very remote, but in more accessible areas, trawl and acoustic surveys can be done simultaneously to generate an index of prey availability.

<u>Reviewer 1</u>
We appreciate the reviewer's comments. We streamlined the text as much as possible, notably reducing the Introduction by two paragraphs.

Line 102: Done.

Line 499: Done.

<u>Reviewer 2</u>
*General comment*s
We added a schematic diagram to show the data sources used to estimate abundance of the biological and statistical populations with the components of detection probability (Figure 3). We hope it helps!

We are unsure how to address the reviewer's comment. Will the manuscript be typeset? If not, we can use indentation of a new paragraph instead of a skipped line. When writing, I prefer a skipped line because it helps me separate my thoughts, but I am indifferent to how it looks in a publication.

Code comments
MCMC runs: We added a comment with the full model run attributes in the code.

Model code: We added a section titled, "Key parameters estimated" at the beginning of our JAGS files. In this section, we included all the parameters that are tracked when the model is run and therefore appear in the output. Our code is heavily commented and easy to follow (we think), so we viewed this suggestion as more of a convenience for the reader that wants to re-run our code rather than a necessity.

Absolute paths: We added a Rproject file to the main directory.

Specific comments
Line 18: We added "complete," so it now reads "complete census."

Lines 30–31: We did not add "to estimate biological population abundance" here because we stated it already as the purpose of our model on Line 25.

Line 43: It is not feasible because we cannot collect repeat or replicate samples, not because of the models themselves, so "suitable" is not accurate. We changed it to "possible."

Lines 58–59: We added "complete," so it now reads "complete census."

Lines 68–77: We appreciate the reviewer's comment, but this paragraph is not entirely new! Nonetheless, we combined the first two paragraphs and therefore, this paragraph was moved up.

Line 102: Done, thanks!

Line 116: When referring to models, we replaced "feasible" with "possible," and when referring to replicate and repeat sampling, we retained "feasible."

Lines 245–264: We added a subheading to the second paragraph for "Environmental data." We understand the confusion with the word "below," so we deleted it; we were referring to how p_p was estimated, but it wasn't necessary.

Line 276: We added a sentence for clarification. The UDs of all radio-tagged individuals intersected with the sampled area of the boat surveys in all years. We are not able to track individuals across years.

Line 292: We added "Then" to start the second paragraph, in hopes of having a better transition between paragraphs.

Line 306: Done.

Line 313: We added a citation. We stated earlier that we conducted boat-based line transect surveys for murrelets, and we state later in the same paragraph that we used a half-normal detection function. The word "conventional" simply notes that it is standard, nothing fancy! It is commonly used in the distance sampling literature.

Line 321: Similar to above, we added "Then" to start the paragraph, hopefully linking the two paragraphs together.

Lines 312–330: As the reviewer suggested, it was a pre-analysis that was exploratory and fairly standard for distance sampling data. Given the complexity of our model, we examined the effect of group size to see if we needed to consider it, and the answer was no.

Lines 380–381: Thanks! This comment was helpful. We added two sentences (and deleted one) in the Discussion where suggested. In our IPM, we reduced uncertainty of the trend by 85% by accounting for non-breeding. It was a huge gain!

Lines 383–405: Fair comment. Initially, this analysis was part of an appendix. However, we referred to it regularly in this manuscript and others that are pending publication. So, we decided to move it into the main body as opposed to burying it in an appendix. The presentation order follows the objectives order in the last paragraph of the Introduction. The purpose of the analysis to explore our ability to predict the probability of presence with environmental data; if we were successful, we could account for variation in p_p without the need for telemetry data. Of course, we were not successful, as evidenced by the cross validation. We added some information and reference to equation 2 for clarity, and we added a citation for cross validation. If preferred, we can move this analysis back to an appendix prior to publication.

Lines 407–408: Like we explained above, we ran this analysis separately and it was somewhat exploratory. We were hoping to be able to predict p_p using environmental covariates in the years that we lacked telemetry data. After determining that the covariates were not helpful, we saw no value in running them in the base model. However, we think that the results are worth reporting because they demonstrate that (a) we need to sample murrelets differently, or (b) we need to telemeter them, at least until we develop a better solution.

Lines 425–426: The reviewer makes a good point. We added a sentence to help clarify our approach. We are not trying to hide what we did, which was done only to minimize runtime, but instead we were trying to keep the text simple and straightforward.

Line 446: In response to the reviewer's comment, we changed the term "standard error" to "standard deviation" in our manuscript. However, standard deviation is a measure of the variation in a distribution, and standard error is a specific kind of standard deviation that measures precision of an estimate (sampling variance). By using the term standard error, we were actually being more precise about what we were trying to present. Moreover, the formula for standard error differs by distribution, and the reviewer only presented the formula for a normal distribution. Nonetheless, in the spirit of moving forward, we made the change in terminology, as the reviewer suggested.

Lines 501–502: Done.

Line 510: Done.

Data and code availability statement: Done.