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Title: Estimating abundance from counts in large data sets of irregularly-spaced plots using spatial basis functions

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In this manuscript the authors propose a model-based approach for estimating abundance from counts obtained during surveys of areal sample units (plots) whose locations are selected without benefit of randomization. The authors' approach of using a spatial point process as a conceptual model makes perfect sense. They show that the observed counts can be derived from the assumptions of a Poisson process model, and they use Gaussian basis functions to specify spatial dependence among plots as a function of distance between plots. However, I do agree with the authors' assessment that "the whole issue of knot selection needs further research" (p. 18). That said, this does not diminish the value of the authors' current contribution, which I believe to be quite high.

The manuscript is generally well written and well organized. Below I offer several suggestions to improve an already fine paper.

1. p. 1, line 56: D is not defined. Should this be R ?
2. 1st paragraph of Section 1.2: The authors' conceptual framework is very similar to that described by Barber and Gelfand (2007) "Hierarchical spatial modeling for estimation of population size" Environmental and Ecological Statistics 14, 193–205. At a minimum, the authors should cite this article.
3. p. 4, lines 29–31: The condition of unbiasedness is a lot to ask, and I'm not sure the authors have demonstrated that their estimator is unbiased. Why not simply require that the estimator be consistent?
4. p. 5, lines 20–23: Replace dx with $\mathrm{d}\boldsymbol{s}$ to keep notation consistent.
5. p. 5, line 48: Here is first appearance of $\mathrm{Poi}(\mu(A))$. Indicate that this notation is shorthand for Poisson with mean $\mu(A)$.
6. p. 6, line 19: "to make inference on $\lambda(\boldsymbol{s}|\theta)$ from data" sounds awkward. Why not simply say, "to infer $\lambda(\boldsymbol{s}|\theta)$ from data" ? Also, in the same sentence replace "aerial support" with "areal support".
7. p. 7, line 12: Need to indicate that $\rho > 0$ is required by the Gaussian basis function.
8. p. 7, lines 21–22: Here authors promise to discuss later why they treated the parameter $\boldsymbol{\gamma}$ as fixed, not random. I may have missed it, but I could not locate their discussion.
9. p. 7, line 31: Replace "linear" with "log-linear"
10. p. 7, line 44: The simplification from β_0^* with offset to β_0 seems unnecessary. Instead, just change (6).
11. p. 8, lines 29–30: Technically speaking, $Y(B_i)$ and $Y(\boldsymbol{s}_i)$ are not identical. Only $Y(B_i)$ has a Poisson distribution.
12. p. 9, line 51: Replace "Reimann" with "Riemann"
13. p. 11, line 30: Replace "Overdisperion" with "Overdispersion"
14. Section 2.8: I'm not really keen on the authors' approach of trying to account for spatial clustering by simply inflating the variance estimator. I think this is the weakest part of the paper and is not

really necessary. Sure the Poisson process with spatial dependence is not entirely adequate, but wouldn't it make more sense to extend the Poisson model to account for a process that generates extra zeros (e.g., effects of poor-quality habitat)? The variance-inflation approach seems ad hoc to me.

15. p. 14, line 16: The confidence interval for abundance T_t appears to be based on an assumption of normality (but shouldn't 1.654 be 1.645?); however, there is no theoretical basis for this assumption since $\hat{T}(\mathcal{U})$ is a nonlinear function of the model's parameters. If anything, I would have thought that the authors would have used a lognormal distribution and formed the CI by computing lognormal parameters that imply a lognormal mean of $\hat{T}(\mathcal{U})$ and a lognormal variance of $\hat{v}_{k,t}$. If the value of $T(\mathcal{B})$ is small, using a normal distribution could potentially yield a negative value for the lower confidence limit of abundance, which is obviously undesirable.

16. p. 17, line 27: Replace "Figure 1" with "Figure 2"

17. Figure 2: It's difficult to distinguish the spatial pattern with grey scale. I recommend using a color figure.

18. Figure 7: Scale uses dark grey for low abundance and light grey for high abundance, which is exactly opposite that of Figure 2! I think these two figures should use the same ordering of color scale.