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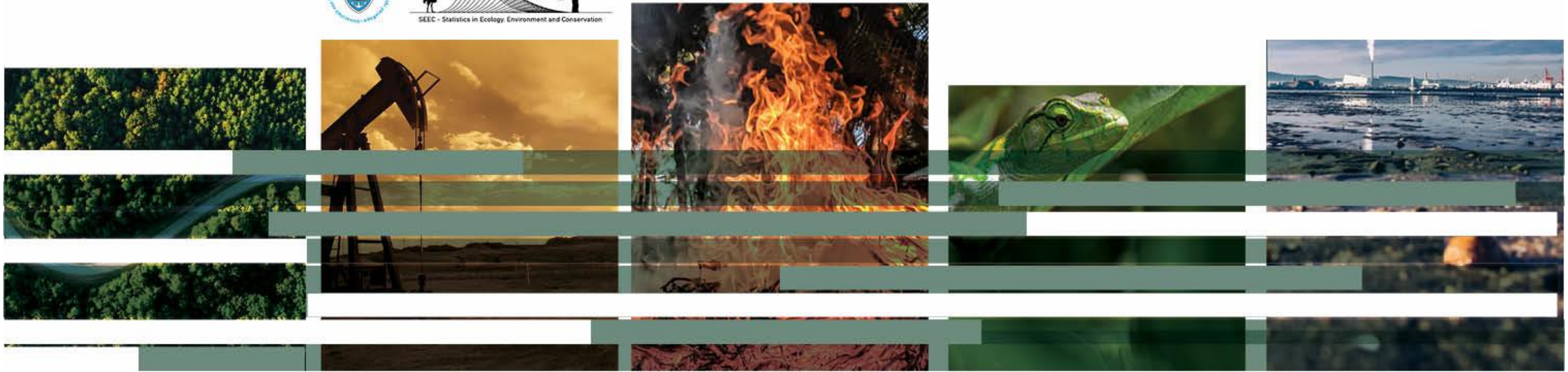

A New Modelling Framework for Roost Count Data

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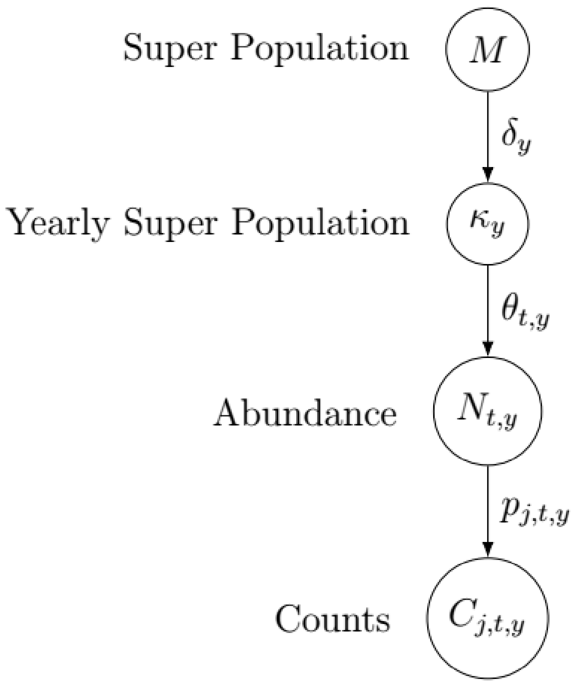
- An increasing number of species are in decline around the globe. Hence, there is a need to study population dynamics to identify species that require protection and to assess management.
- However, for some species such as parrots and bats, monitoring can be difficult due to several factors such as temporary emigration, narrow geographic range and few known populations.
- Roost count surveys, consisting of multiple counts over regular time intervals at a single site, are often the practical and most cost-effective monitoring method.
- Motivated by two roost count survey data sets, we developed a novel modelling framework that can be used to estimate temporal abundance at a site, while accounting for temporary emigration and observation error. We also implement an efficient variable selection algorithm for identifying important predictors of observation error.

Methodology

Sampling follow's Pollock's robust design[1] with $\boldsymbol{T}$ open primary periods (e.g. months) and $\boldsymbol{J}$ closed secondary periods (e.g. days within a month). Often, studies can have multiple levels, e.g. $\boldsymbol{J}$ days within $\boldsymbol{T}$ months across $\boldsymbol{Y}$ years.



$$\text{logit}(p_{j,t,y}) = \eta = \mu + \sum_{s=1}^{D} X_{j,t,y,s}\beta_s + \epsilon_{j,t,y}$$

$$\epsilon_{j,t,y} \sim \text{Normal}(0, \sigma_\epsilon^2)$$

$$\beta_s \sim \text{Bayesian Group Lasso Spike and Slab}^2$$

We model availability ($\theta_{t,y}$):

- Non-Parametrically via Beta Dirichlet Process (DP) Mixture model[3].

- Parametrically via temporal models[4]:

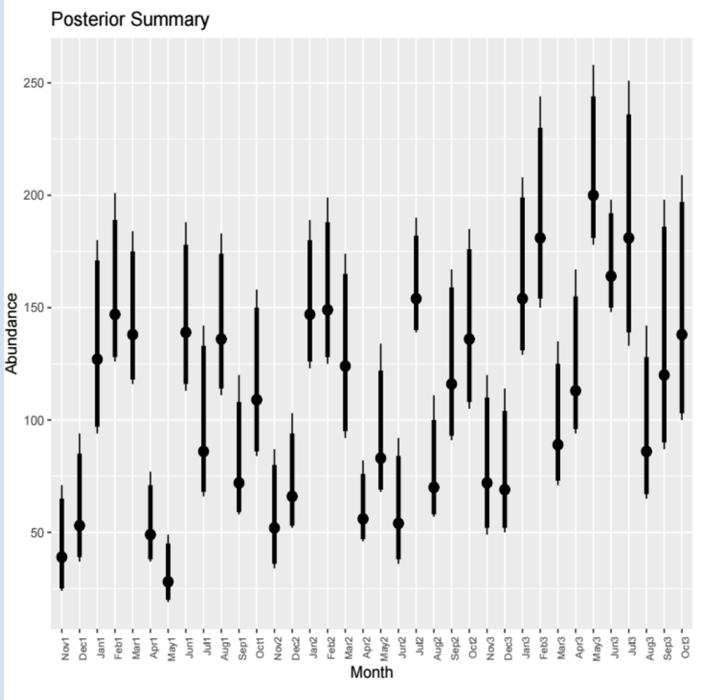
1. Random walk models- random walk order 1,2 models and an across level correlation model.
2. Auto-regressive model order 1.

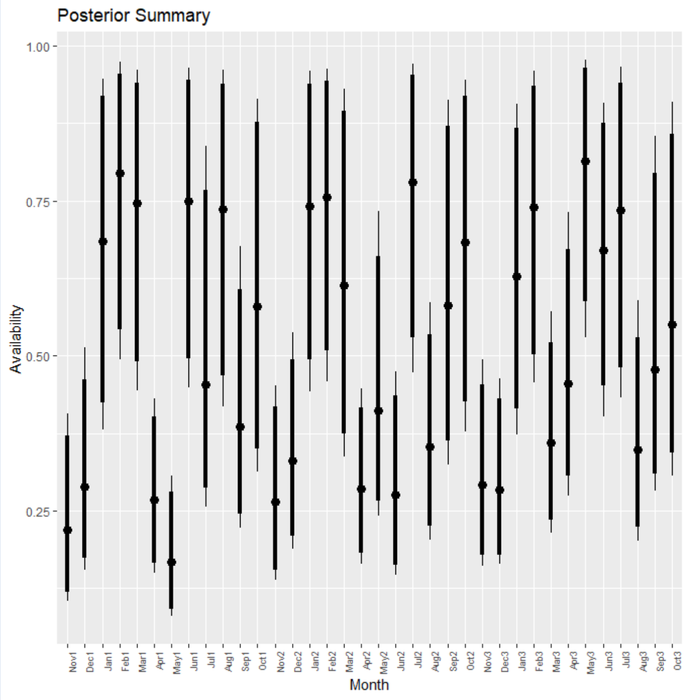
- Finally, we preform model selection via Log Pseudo Marginal likelihood (LPML)[5].

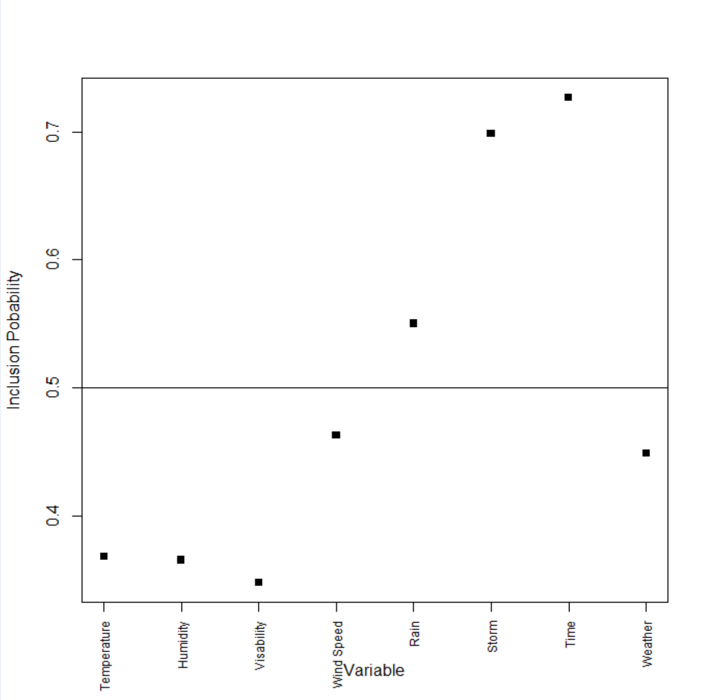
Results

Amazonia Parrots Results from DP model.

- Abundance
- Availability
- Bayesian Variable Selection







	Months											
Year	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
1	L	L	H	H	H	L	L	H	L	H	L	H
2	L	L	H	H	H	L	L	L	H	L	H	H
3	L	L	H	H	L	L	H	H	H	L	L	H

Conclusion

- We presented a unifying modelling framework for roost count survey data that accounts for observation error and temporary emigration, non-parametrically and parametrically.

- This framework provides key estimates of temporal abundance, information on temporary emigration trends and predictors of detection. All of these can serve as fundamental tools in adaptive wildlife monitoring, conservation and management.

Comments/Questions.

References

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