Hierarchical spatial modelling for applied population and community ecology

Jeffrey W. Doser, Marc Kéry, Gesa von Hirschheydt

24-27 June 2024

Spatial multi-species hierarchical distance sampling models

Jeffrey W. Doser

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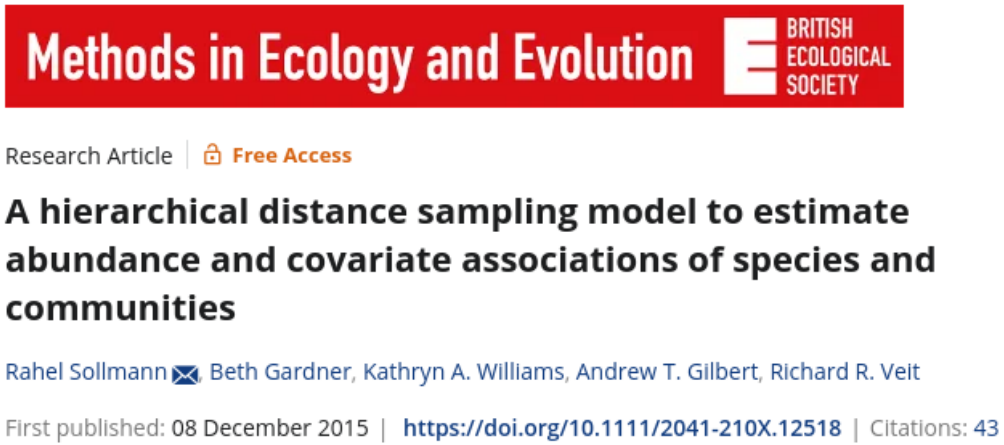
Multi-species HDS models

- Many forms of transect surveys or point count surveys collect data on multiple species.
- Just like we have seen with occupancy models, GLMMs, and N-mixture models, we can extend single-species HDS models to a multi-species framework



Multi-species distance sampling data

i = 1, 2, …, I species

j = 1, 2, …, J sites

k = 1, 2, …, K distance bands

Species 1

Site	0-25m	25-50m
1	0	1
2	1	0
3	1	0
4	0	1

Species 2

Site	0-25m	25-50m	5
1	3	2	
2	4	0	2
3	0	0	0
4	0	3	1

	0
	0
1	0
0	0

Species 3

Site	0-25m	25-50m	50-100m	100-150m
1	3	1	0	0
2	1	1	0	0
3	0	1	2	0
4	2	0	0	1

Three types of multi-species HDS models in `spAbundance`

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    - Species are modelled hierarchically (as random effects)
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Work in groups to write out the equations for one of these model types using what we have learned so far. We will fill in the next three slides as a class.

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Latent factor multi-species HDS models (`lfMsDS`)

Spatial factor multi-species HDS models (`sfMsDS`)

Exercise: estimating forest bird density in the northeastern US

`14-multi-species-hds-harv-forest.R`