


Bat roost dynamics

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Talk outline

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Background and questions

- Why bats?
- Questions

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Roost dynamics

- Analyses
- Species results

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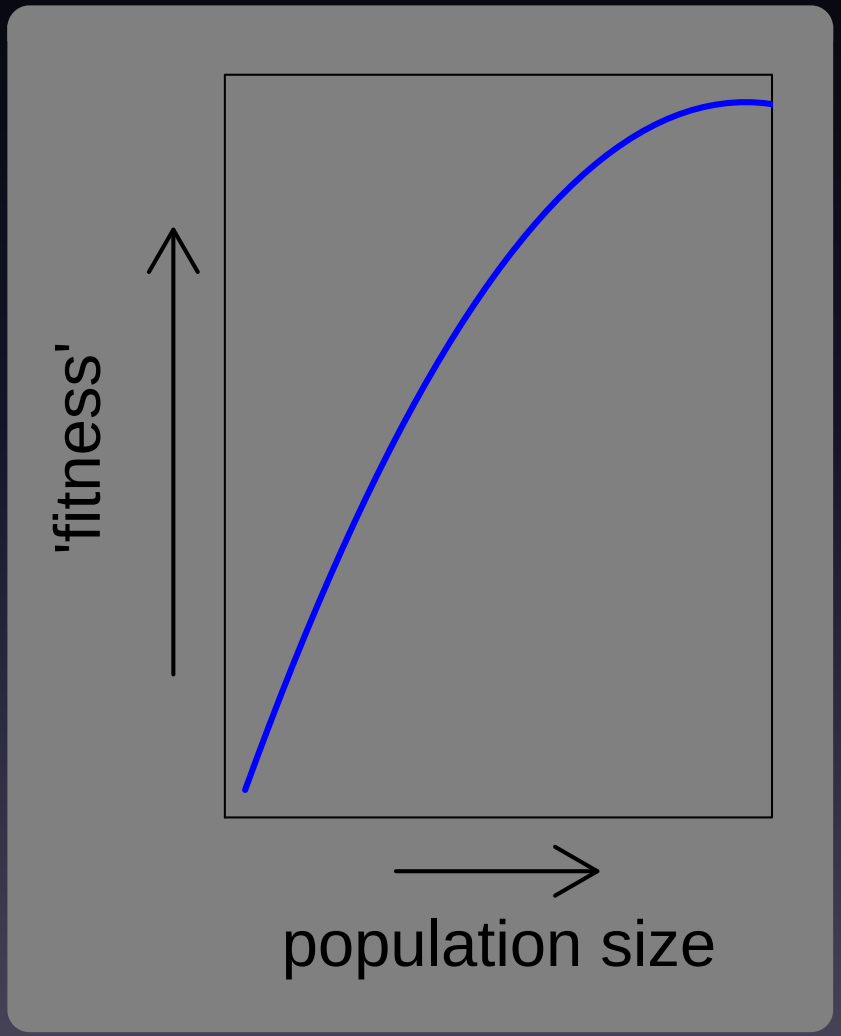
Bats may exhibit Allee effects

What is an Allee effect?

An Allee effect is...



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An Allee effect is...

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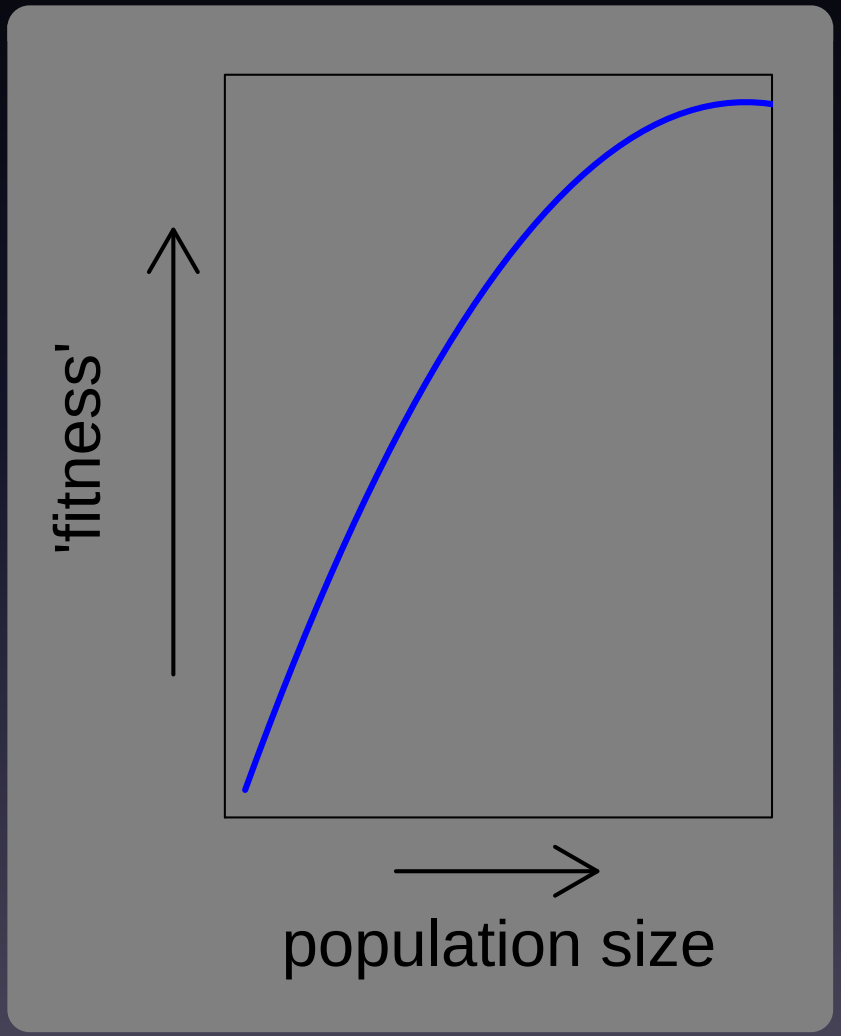

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An Allee effect is...

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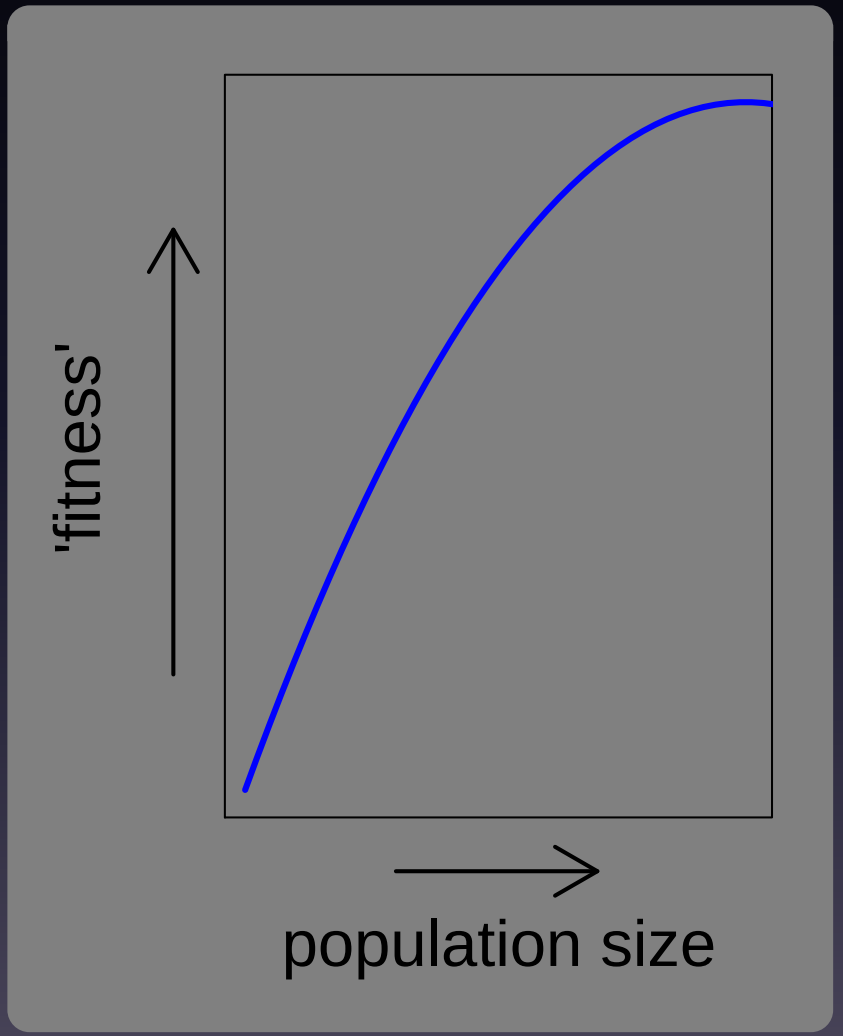
- 'fitness' either individual (e.g. survival) or group (population growth rate)



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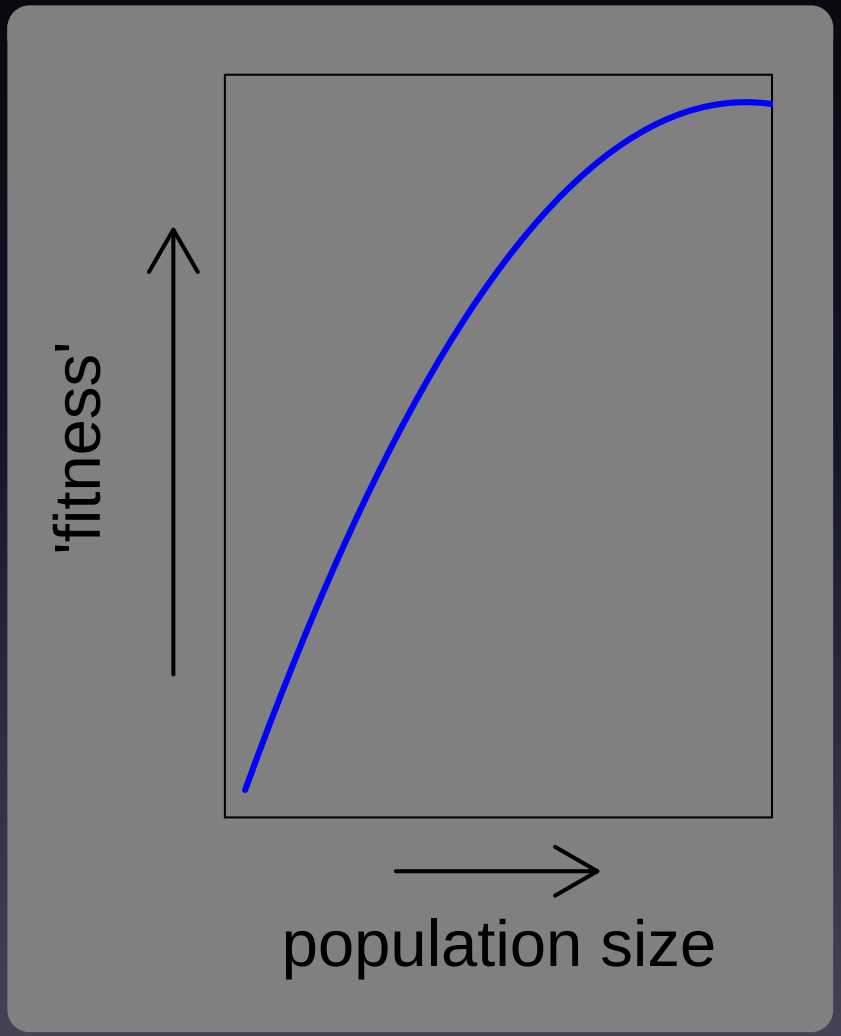

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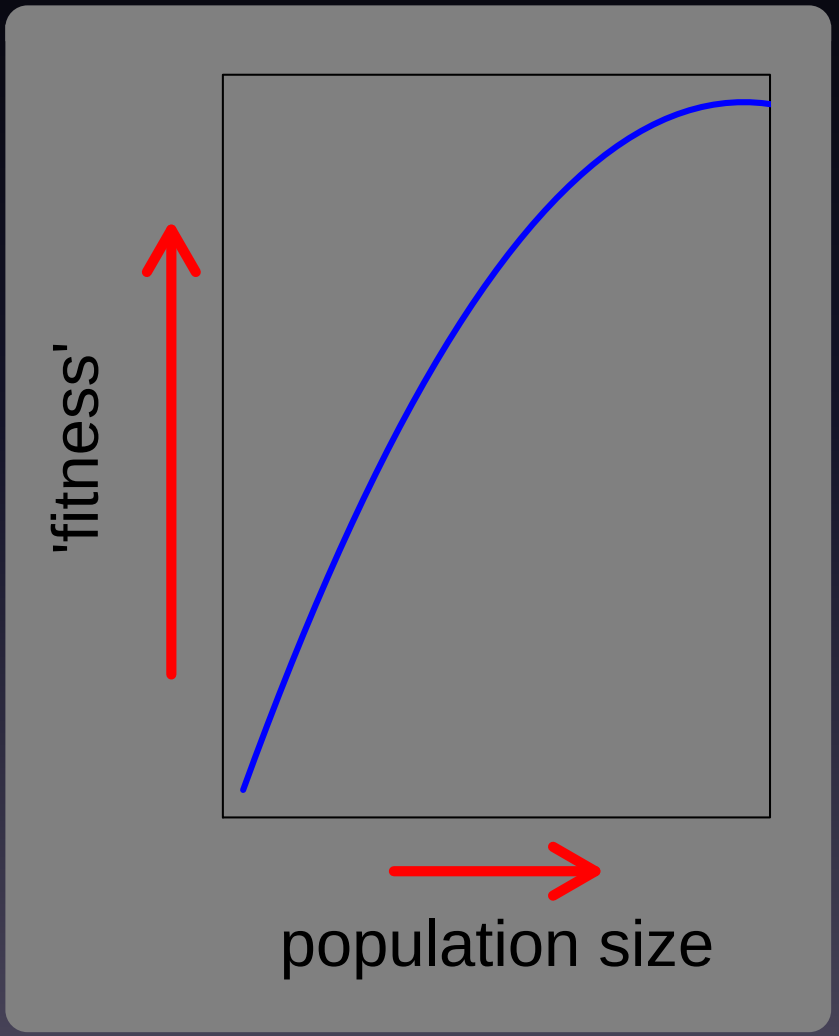

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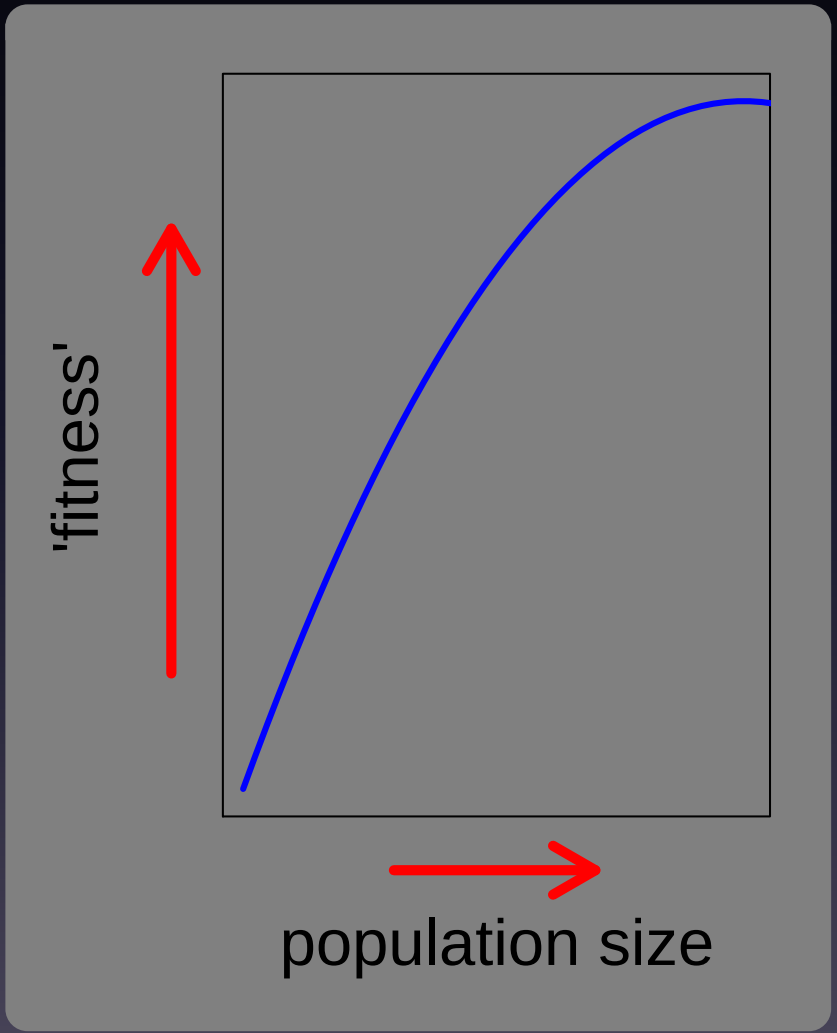

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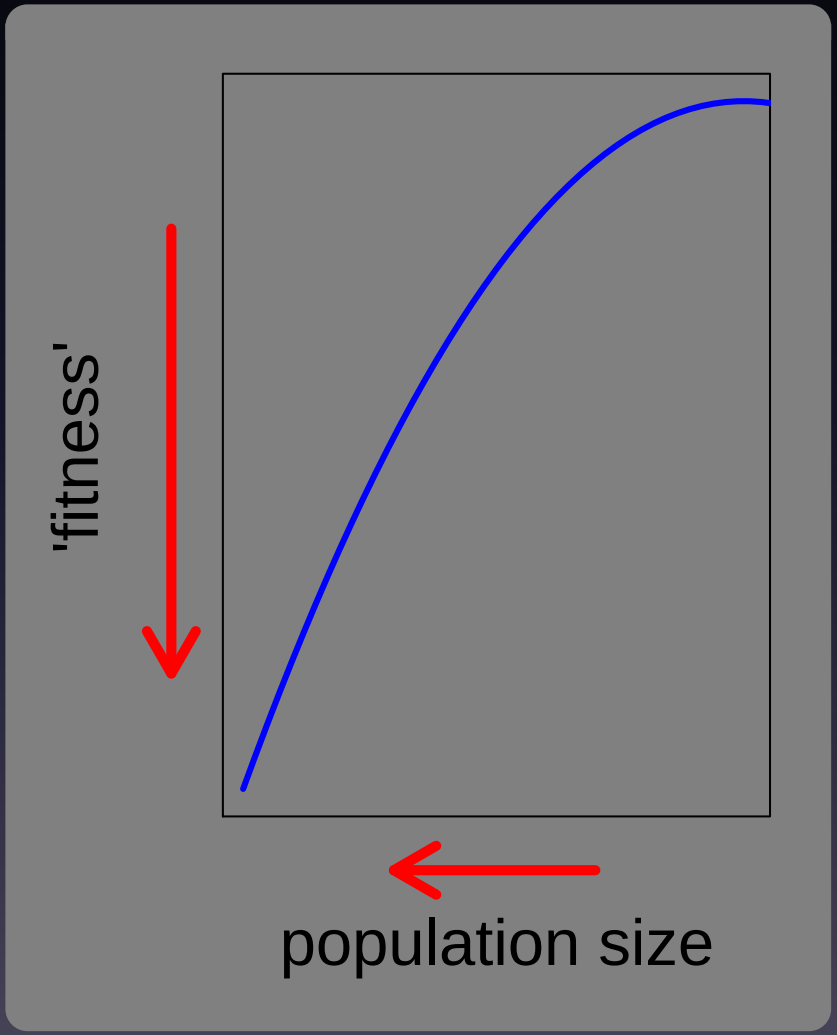

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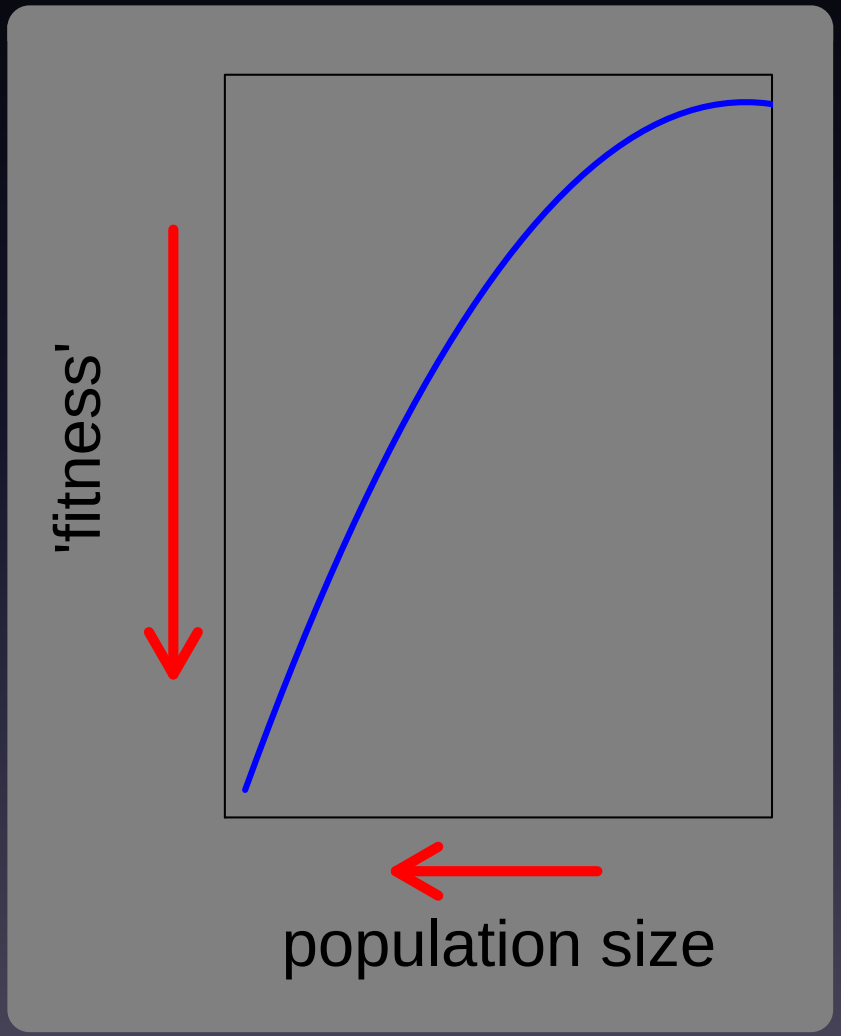
Allee effects may drive declining populations to extinction



Why bats?

UK National Bat Monitoring Programme (NBMP)

Collaborators

Bat Conservation Trust

JOINT NATURE CONSERVATION COMMITTEE

Cyngor Cefn Gwlad Cymru
Countryside Council for Wales

The Robert Stebbings Consultancy Limited

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- NBMP uses 3 core methods; I analyse ‘Maternity roost counts’

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Why bats?

Maternity roost counts

- Maternity roosts are places where bats gather to breed

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- Usually in buildings (e.g. homes) but also trees, etc

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- 8 species are monitored using Maternity roost counts

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2) Do bats exhibit an Allee effect?

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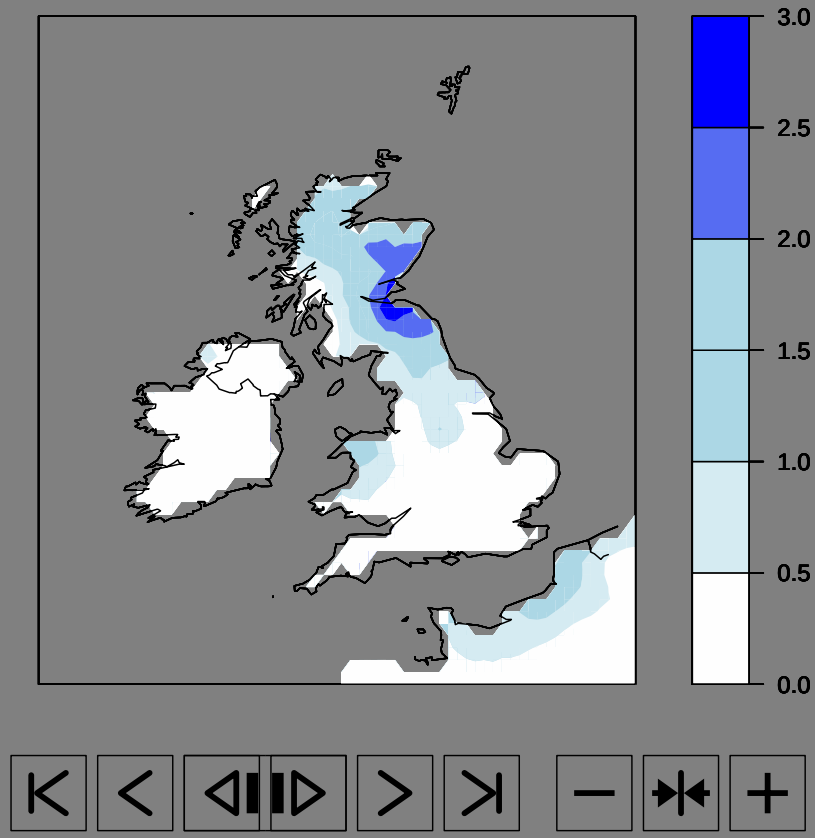
Are bat counts affected by weather?

Weather data

Thanks: ENSEMBLES and ECA&D

UK rainfall this week in 1977



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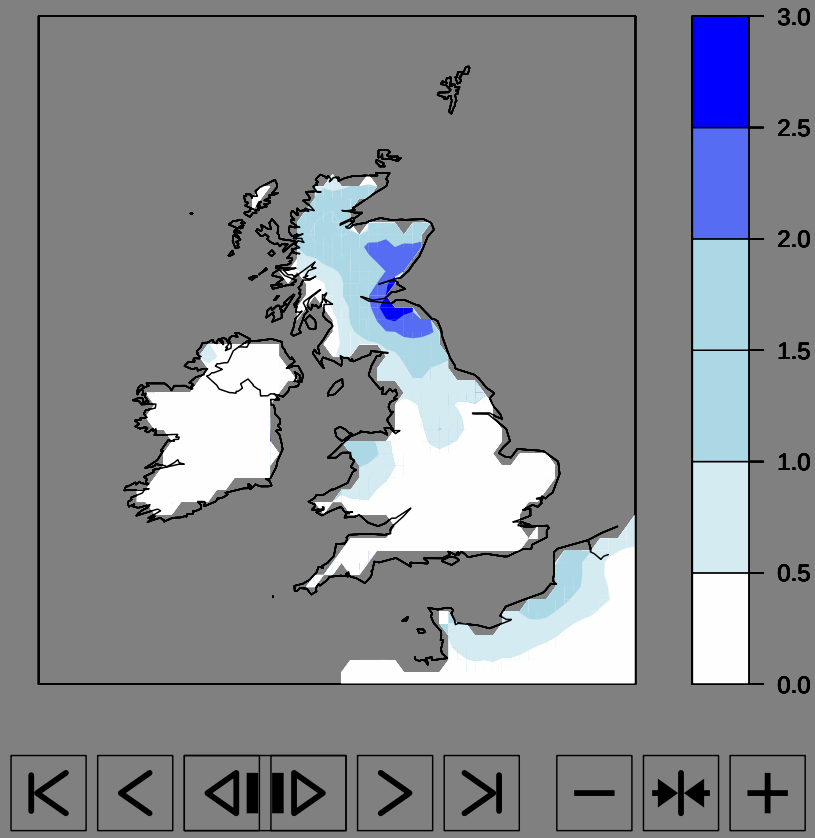

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- Used `ENSEMBLES` gridded weather data for Europe

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- Extracted daily UK temperature & rain using `ncdf` and `spatstat` in `R`

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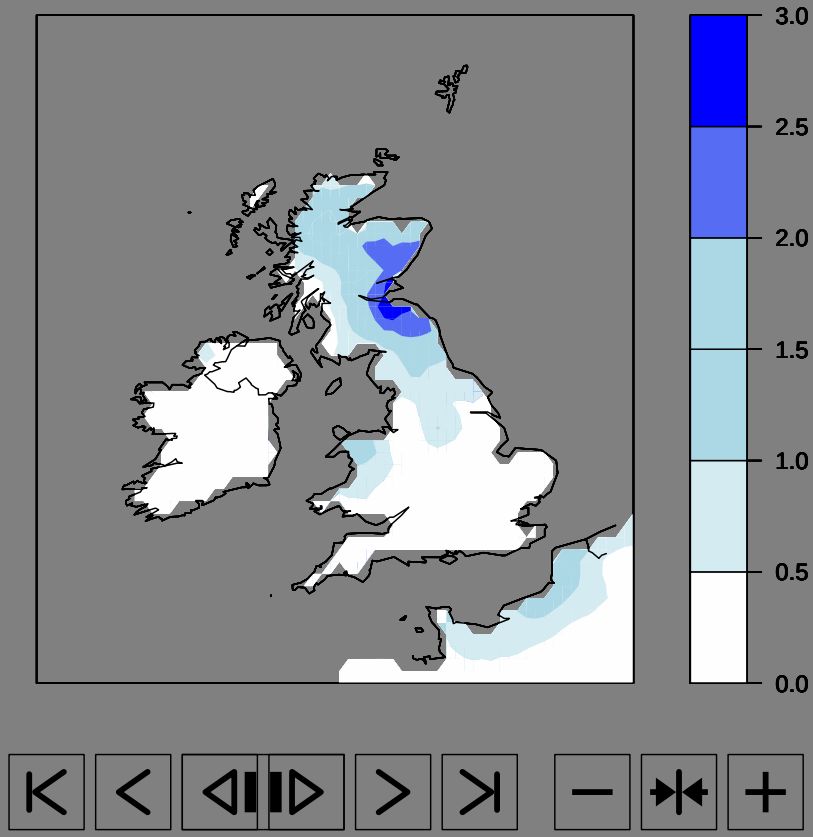

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Smoothing counts for weather variation

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Complexity	Model
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⇓	
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Complexity	Model
Highest	saturated Generalized Additive Model (GAM) with automatic smooth
	⇓
	all combinations of weather covariables
⇓	⇓
	non-linear vs linear terms
	⇓
Lowest	Generalized Linear Model (GLM) with no weather covariables

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Smoothed counts were extracted for the Allee effect analysis

Do bats exhibit an Allee effect?

Allee effect analysis method

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- Fit models representing [i] random walk (RW), [ii] negative density dependence (DD), and [iii] an Allee effect (AE) and measure support

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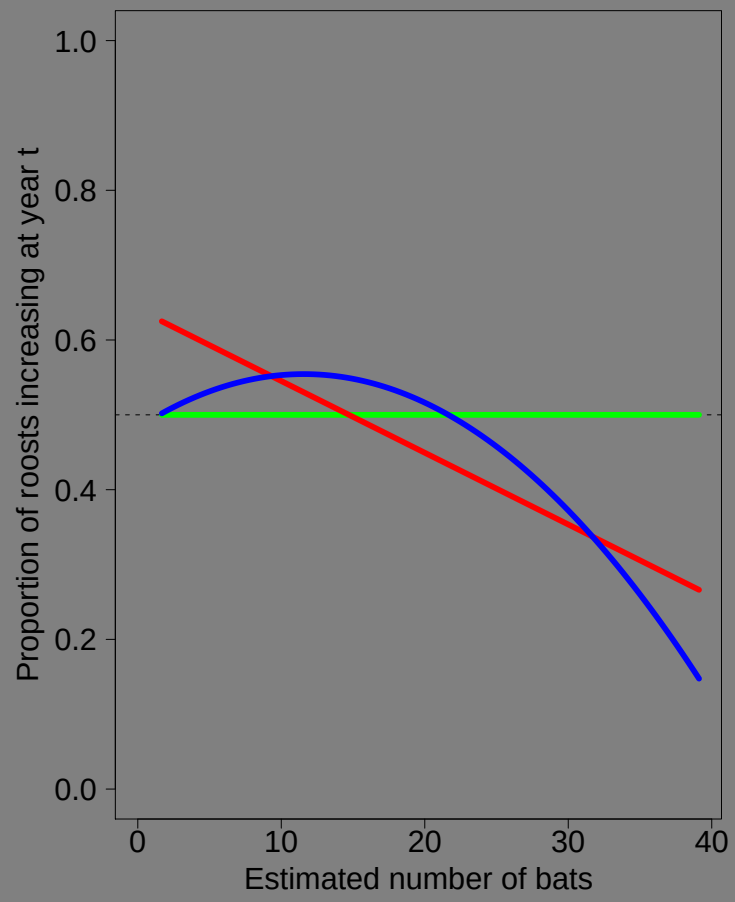
Roost dynamics models



Random walk (RW) Density dependence (DD) Allee effect (AE)

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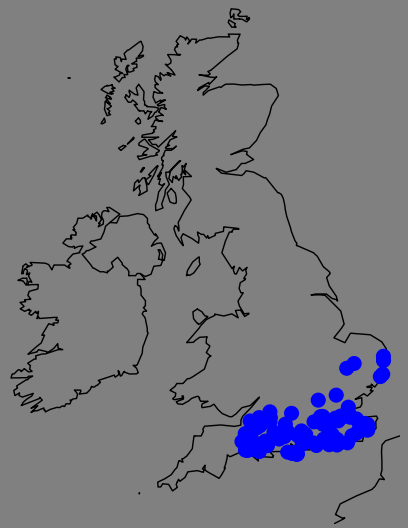
Maternity roost sites



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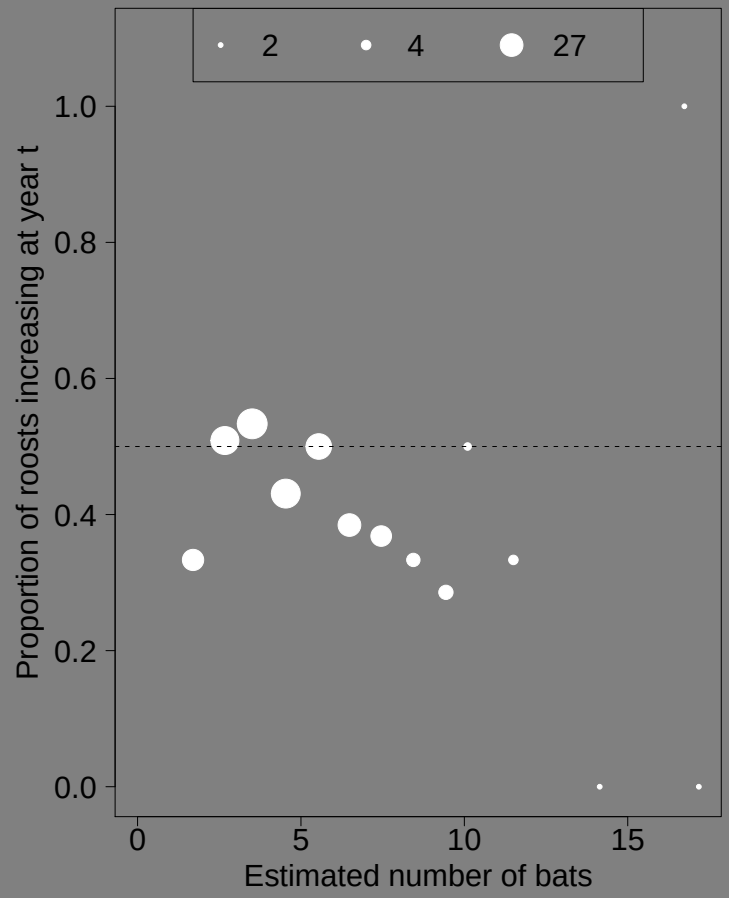

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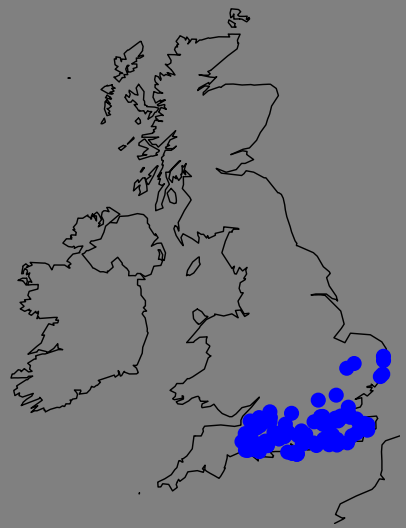

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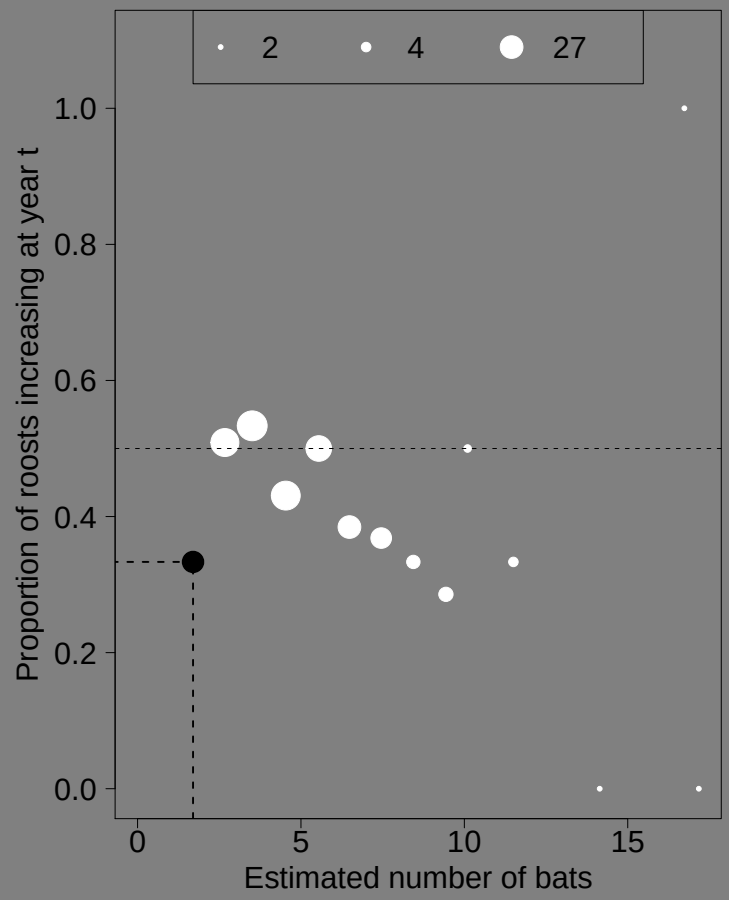

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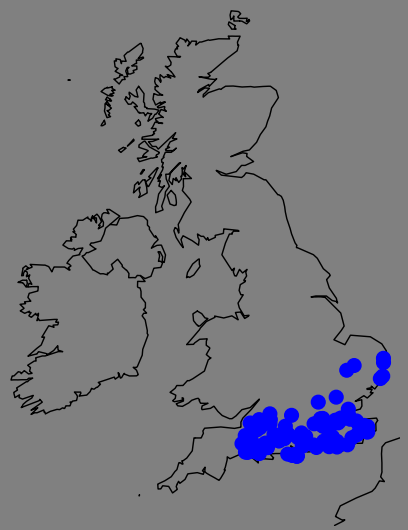

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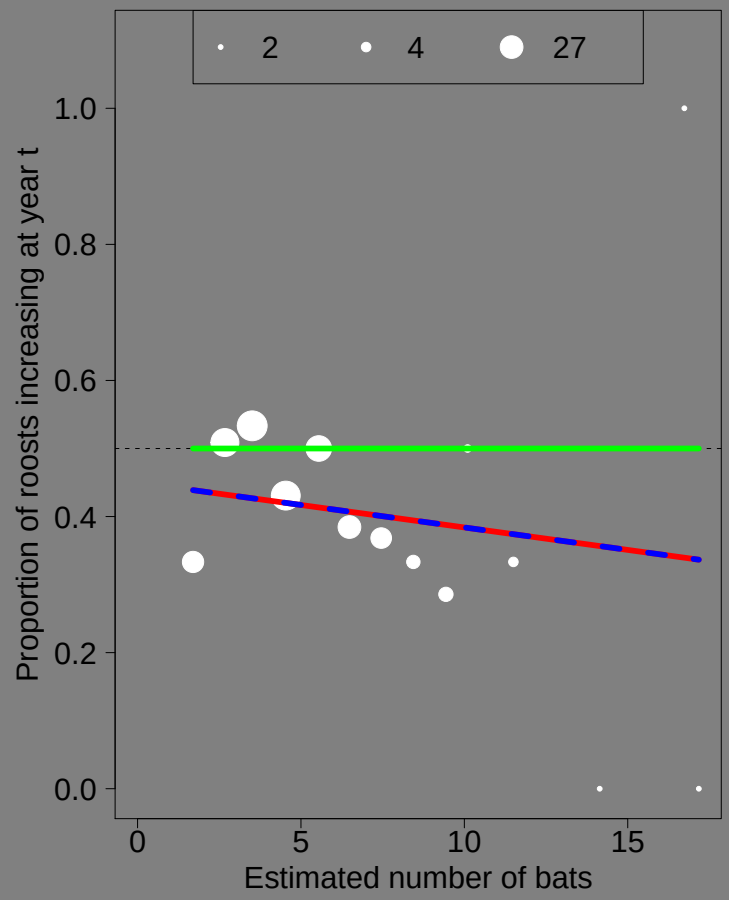

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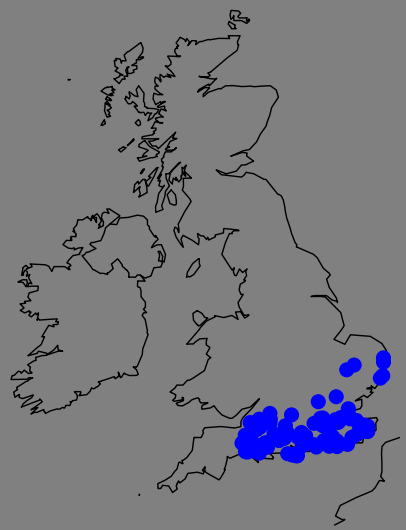

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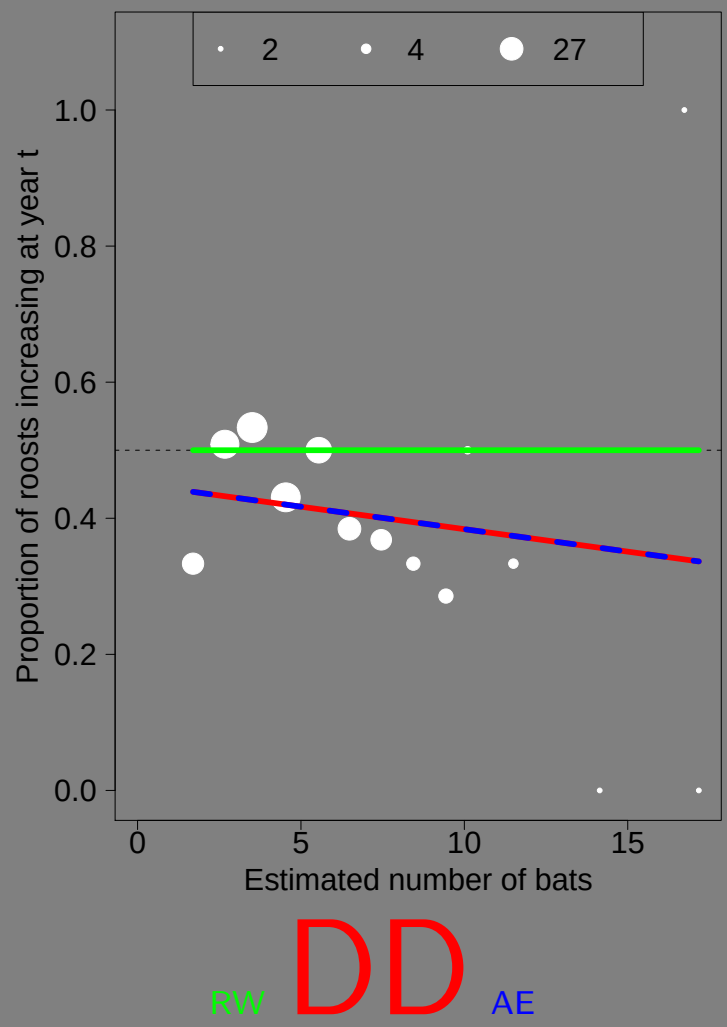
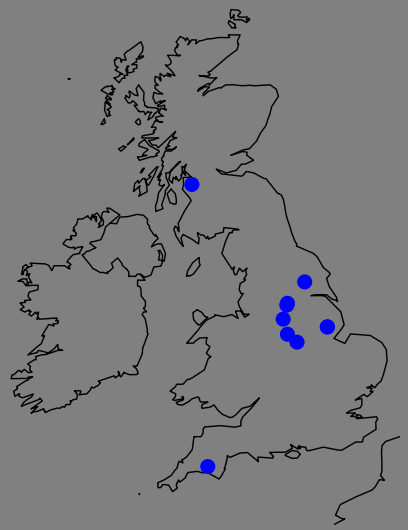


Daubenton's bat (*Myotis daubentonii*)

Maternity roost sites



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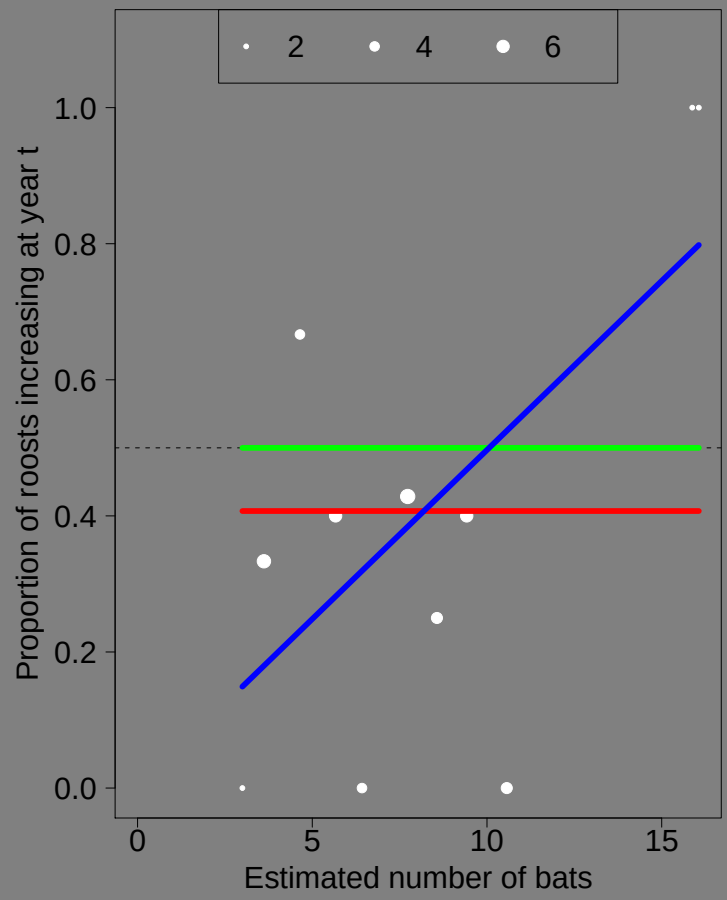

Natterer's bat (*Myotis nattereri*)

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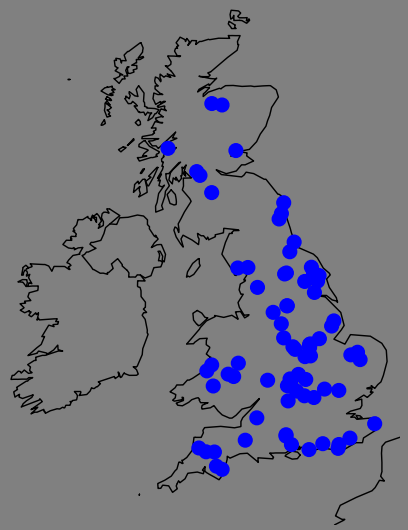

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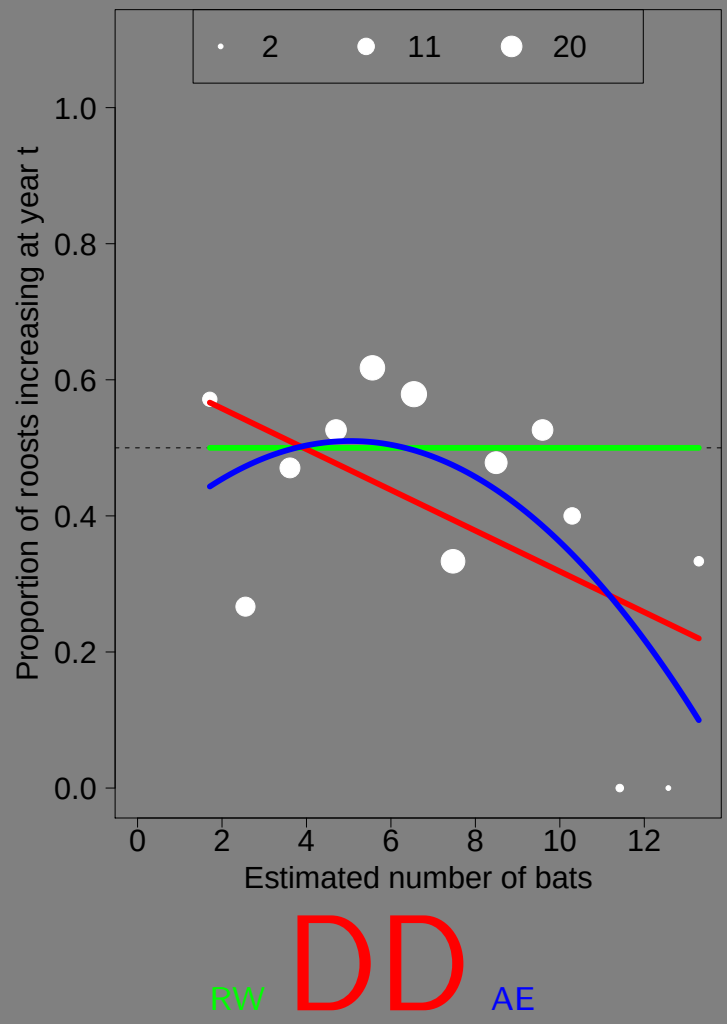

Noctule bat (*Nyctalus noctula*)

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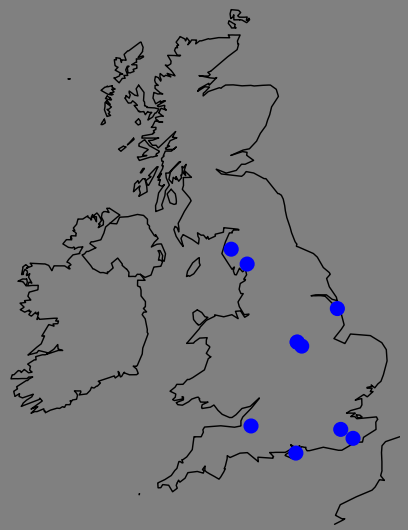

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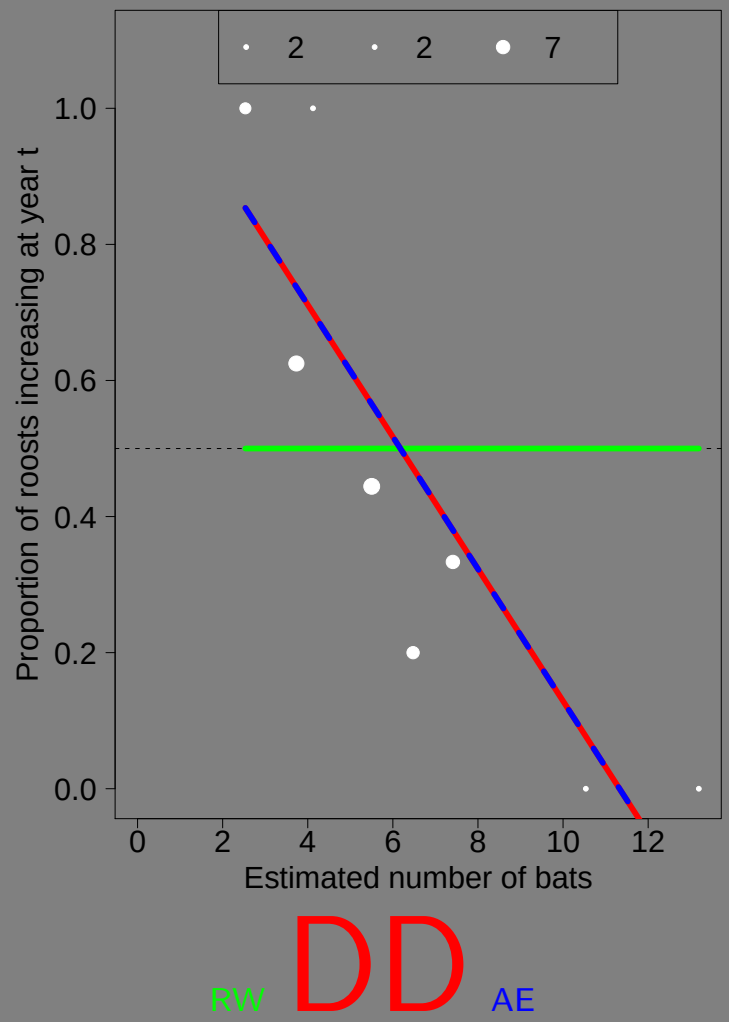

Common pipistrelle (*Pipistrellus pipistrellus*)

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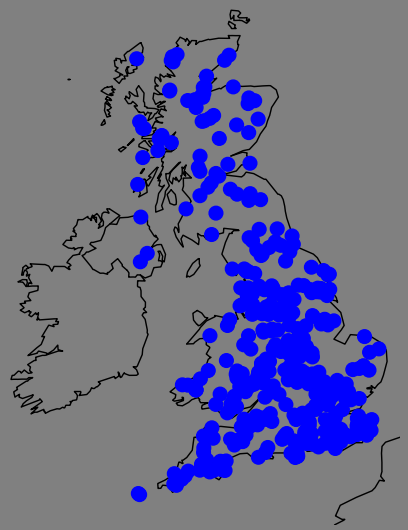

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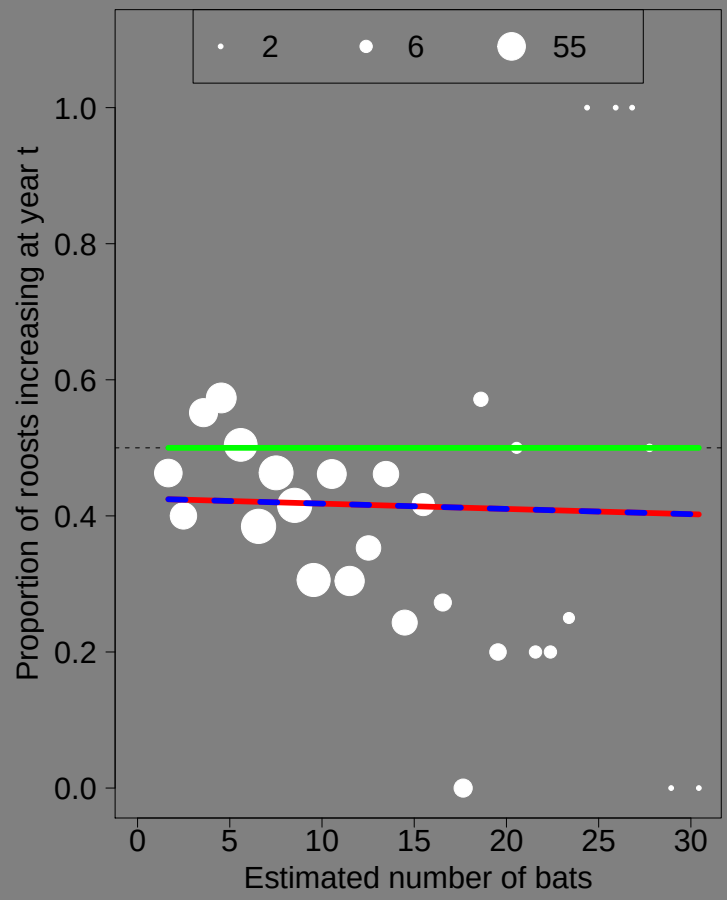

Soprano pipistrelle (*Pipistrellus pygmaeus*)

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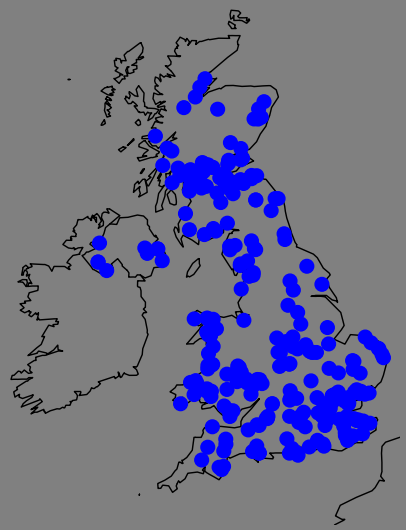

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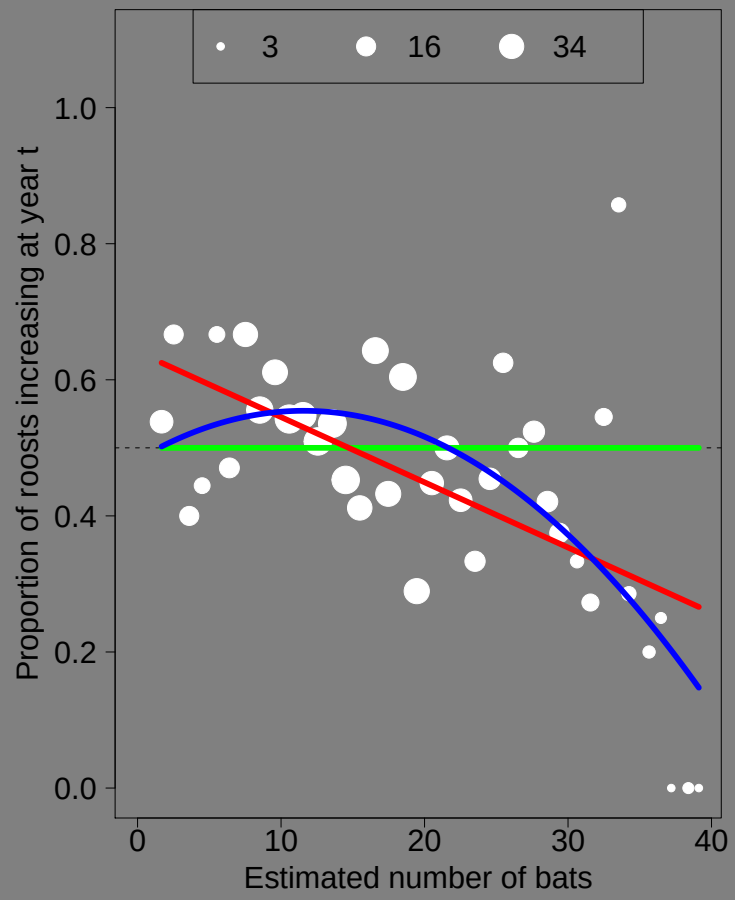

Brown long-eared bat (*Plecotus auritus*)

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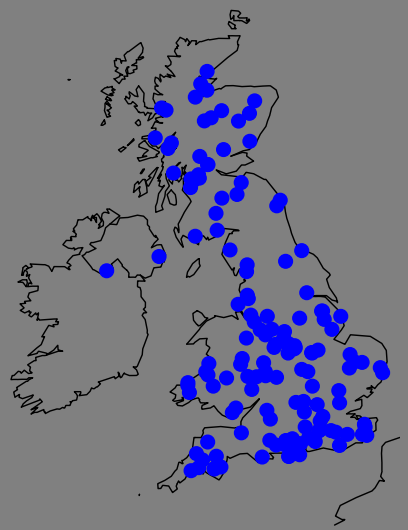

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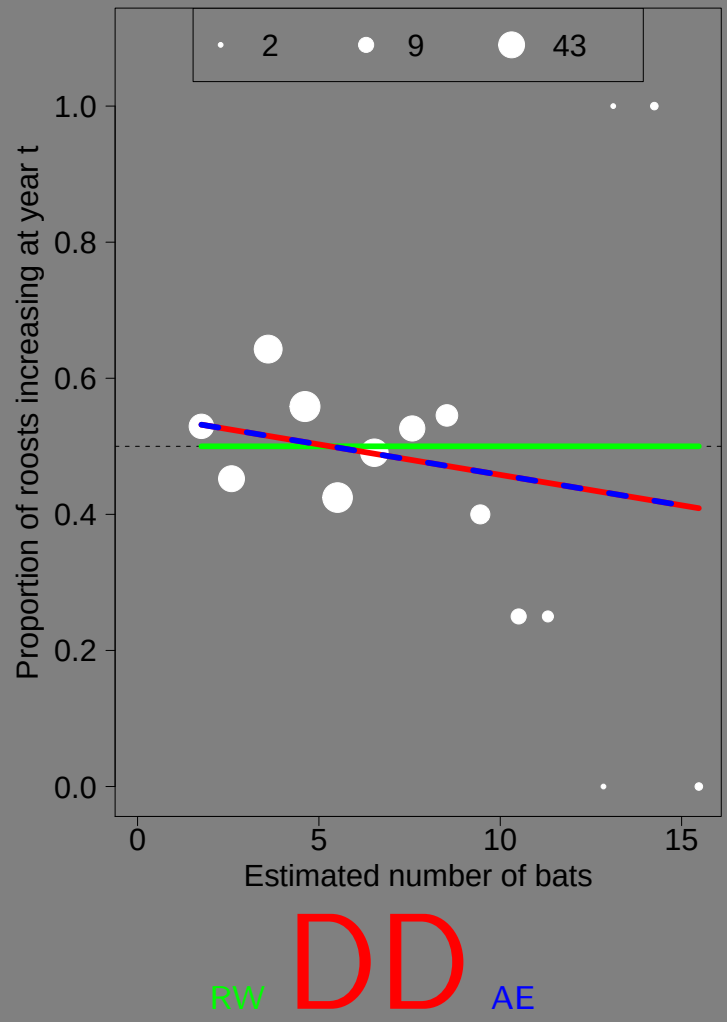

Lesser horseshoe bat (*Rhinolophus hipposideros*)

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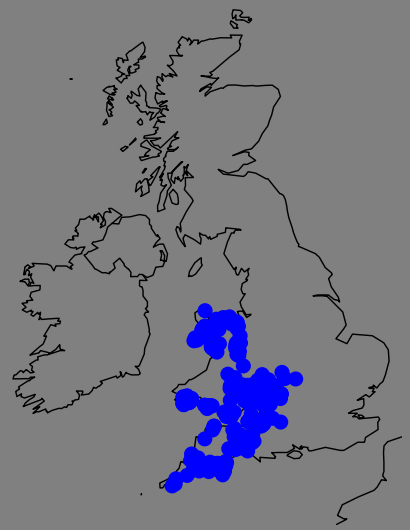

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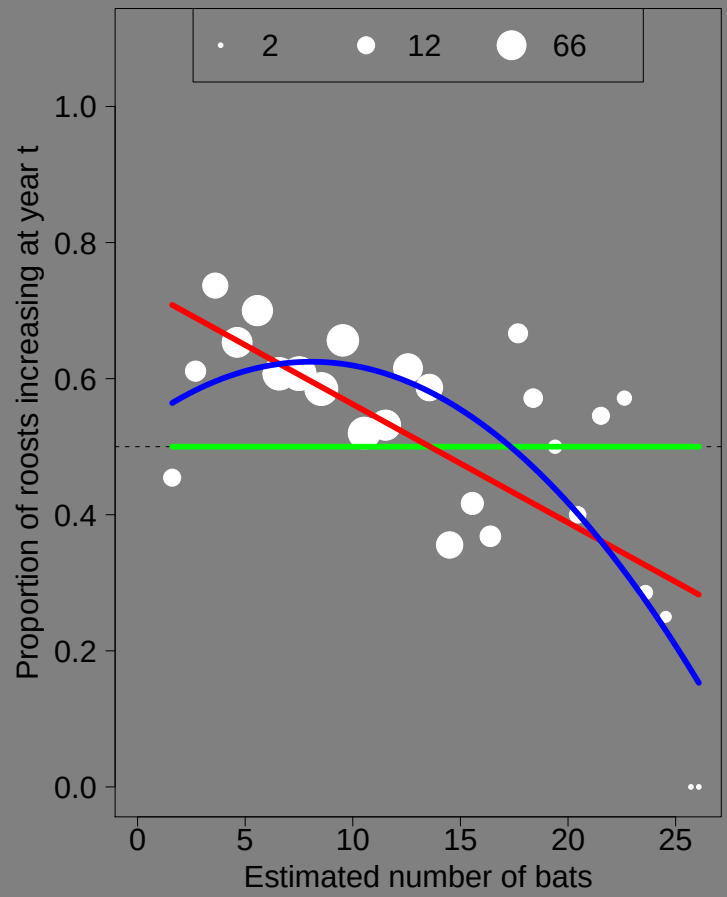

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Management recommendation

Species exhibiting Allee effects should be subject to careful/supplemental monitoring

Questions

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Model AIC_w

Table: Model AICc weights (AIC_w)

Species	**AIC_w**		
	RW	DD	AE
Serotine	0.001	0.882	0.117
Daubenton's	0.096	0.363	0.541
Natterer's	0.000	0.684	0.316
Noctule	0.008	0.983	0.009
Common pipistrelle	0.000	0.795	0.205
Soprano pipistrelle	0.000	0.117	0.883
Long-eared	0.001	0.870	0.129
Lesser horseshoe	0.000	0.053	0.947