Dead Can Move?

Sampling effects on the identification of roadkill hotspots

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Introduction

Roads

- Habitat fragmentation
- Changes of behavior and movements
- **Mortality through vehicle collision**

Introduction

Mitigation measures

- over or underpasses
- viaducts
- fences
- animal crossing signs

Expensive

Directed to road segments with high numbers and concentration of road-related mortality

Roadkill hotspots

Introduction

Roadkill hotspots ← Repeated road sampling

Introduction

Sources of bias in Roadkill estimates

Imperfect detection → Failure to detect all carcasses present

Persistence time → Carcasses disappear from the road after some time

Sampling frequency should matter

Introduction

Increasing time interval of surveys

↓

Reduces number of survey days

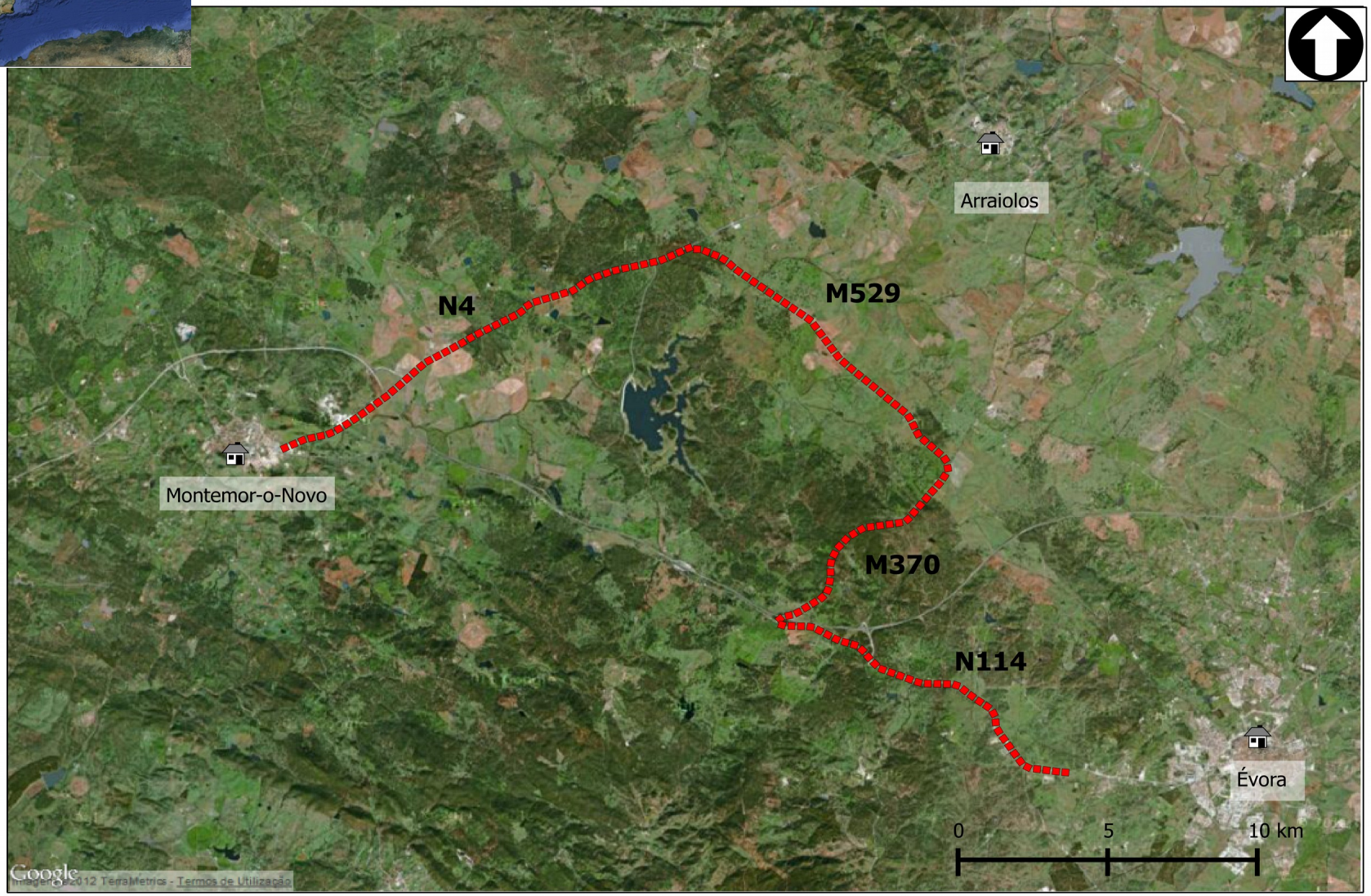
↓

Increase likelihood of false negative and false positive hotspots

Objectives

To estimate how sampling frequency affects the accuracy of hotspots identification for different taxonomic groups

Study area


Arraiolos
N4
M529
Montemor-o-Novo
M370
N114
Évora
0
5
10 km
Google
Imagens ©2012 TerraMetrics - Termos de Utilização

Roadkill surveys

- daily, over 1 year (n=368 days)
- 1 observer driving a vehicle 20 km/h, at sunrise
- each carcass: species identification, GPS position, persistence time and others


Foto: Sílvia Barreiro


Foto: Sílvia Barreiro

Data analysis

- Baseline data set with 4453 carcass observations and persistence times

- **Daily surveys**: “true” spatial pattern of road mortality

- **Surveys with lower frequencies**: new data sets simulating the results of surveys carried out using different sampling schedules were built by rarefaction (1 to 30 days)

- 11 taxonomic groups and global data

Data analysis

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	…
Daily	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
1-day interval	X		X		X		X		X		X		X		X	
2-day interval	X			X			X			X			X			
3-day interval	X				X				X				X			
4-day interval	X					X					X					
5-day interval	X						X						X			
…																

Simulation of survey data sets

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Species 1	X	X	X	X											
Species 2				X											
Species 3					X	X	X	X	X	X	X				
Species 4					X	X									
Species 5									X						
Species 6													X	X	X
…															

Data analysis

- Analysis unit: 75 road segments (500 m) with counts of carcass numbers

- Classification of road segments as hotspot (or not) assuming that the number of road-kills follows a Poisson distribution

- Production of hotspot patterns (0/1) for each simulated survey, for global data and taxonomic groups (n=434 data sets)

Data analysis

- Phi correlation - Agreement evaluation of hotspots pattern between “true” data set (daily surveys) and each simulated sampling frequency

- % false negatives (“true” hotspots missed by the simulated data set) and % false positives (hotspots identified using the simulated data set that did not correspond to “true” hotspots)

Data analysis

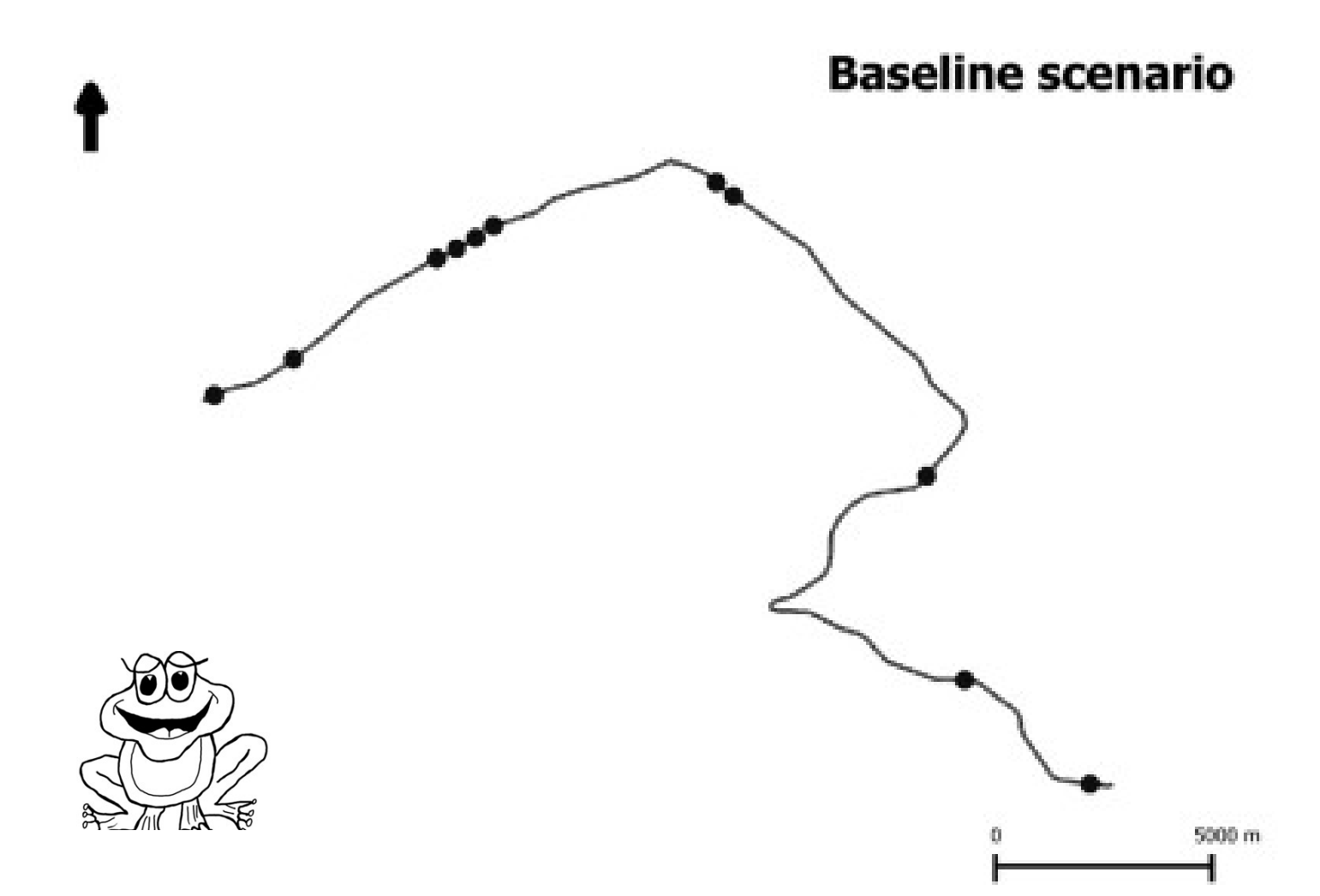
An R package was built to do all the work for us:

"DeadCanMove"

Barbosa, A.M., Marques, J.T., Santos, S.M., Lourenço, A., Medinas, D., Beja, P., Mira, A., 2014. DeadCanMove: Assess how spatial roadkill patterns change with temporal sampling scheme. R package version 0.1. Available at http://deadcanmove.r-forge.r-project.org.

Results

Example with frogs and toads



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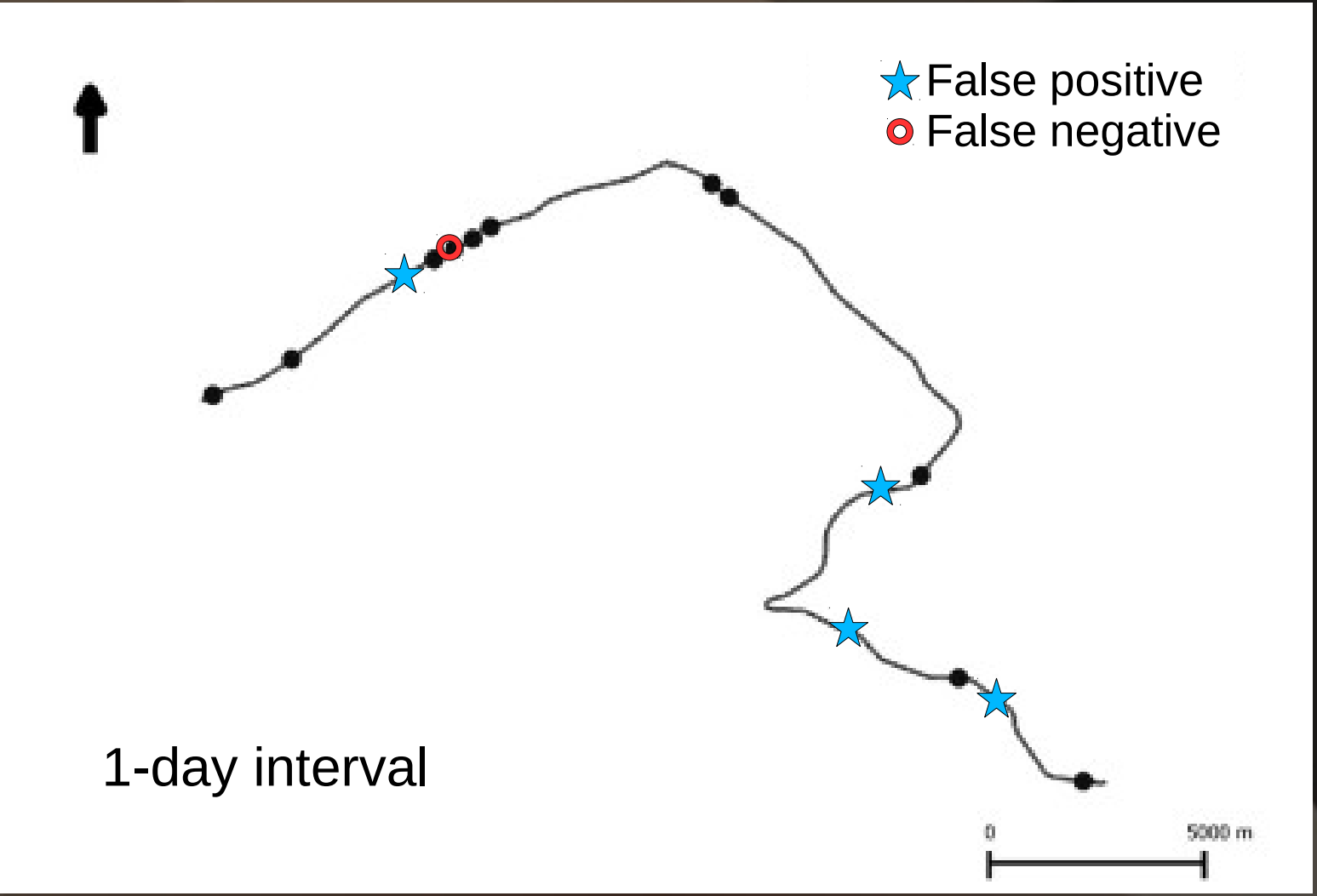

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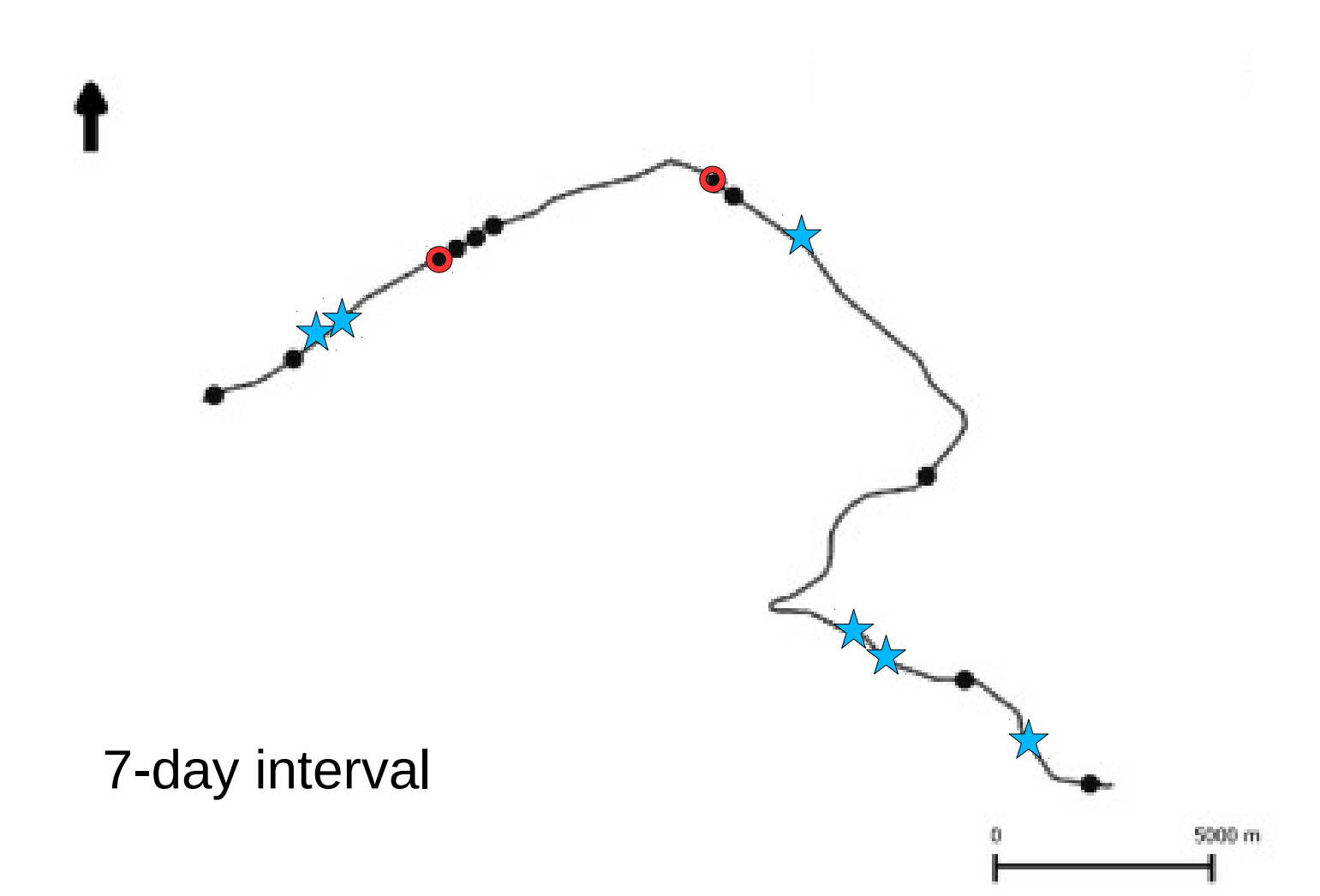

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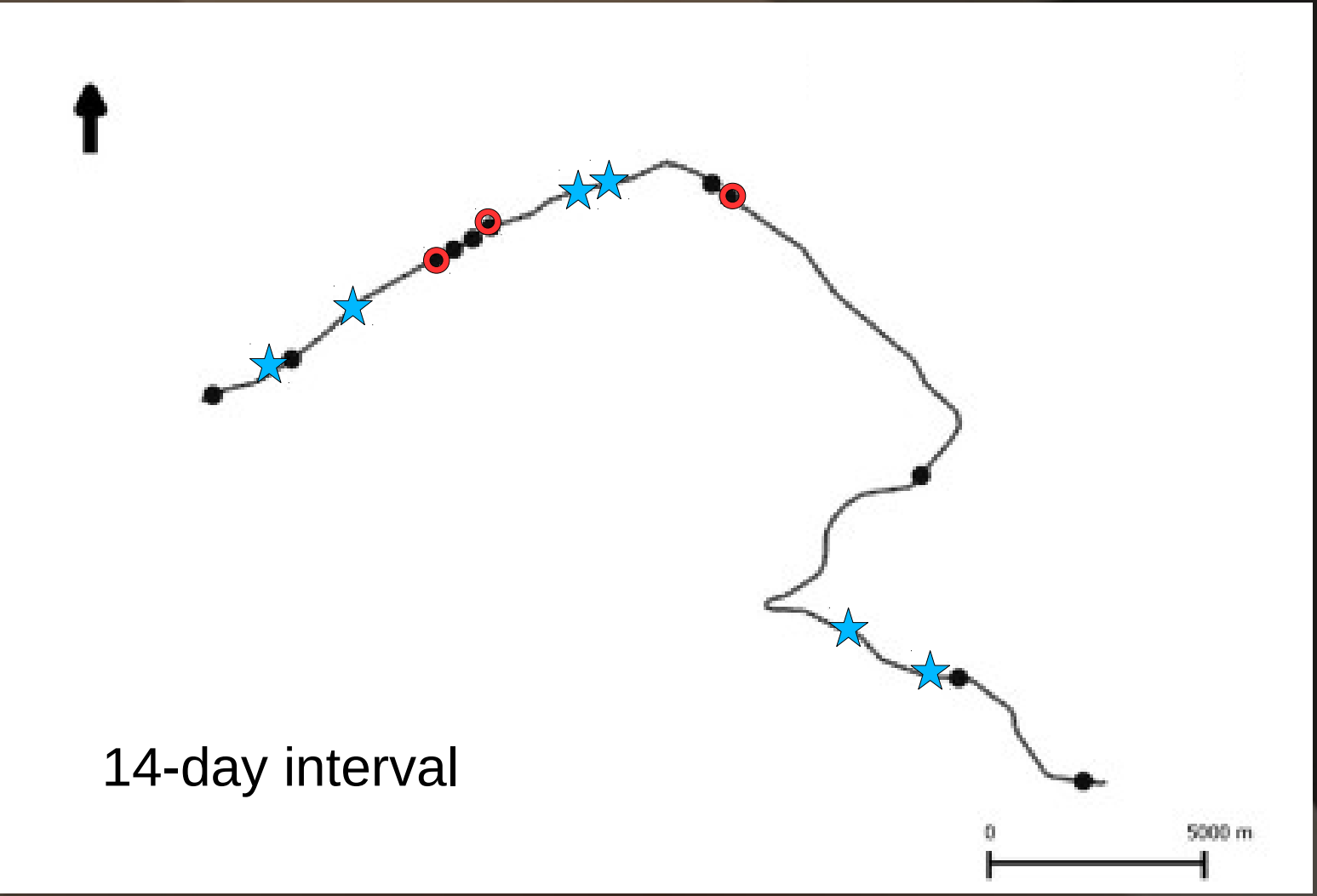

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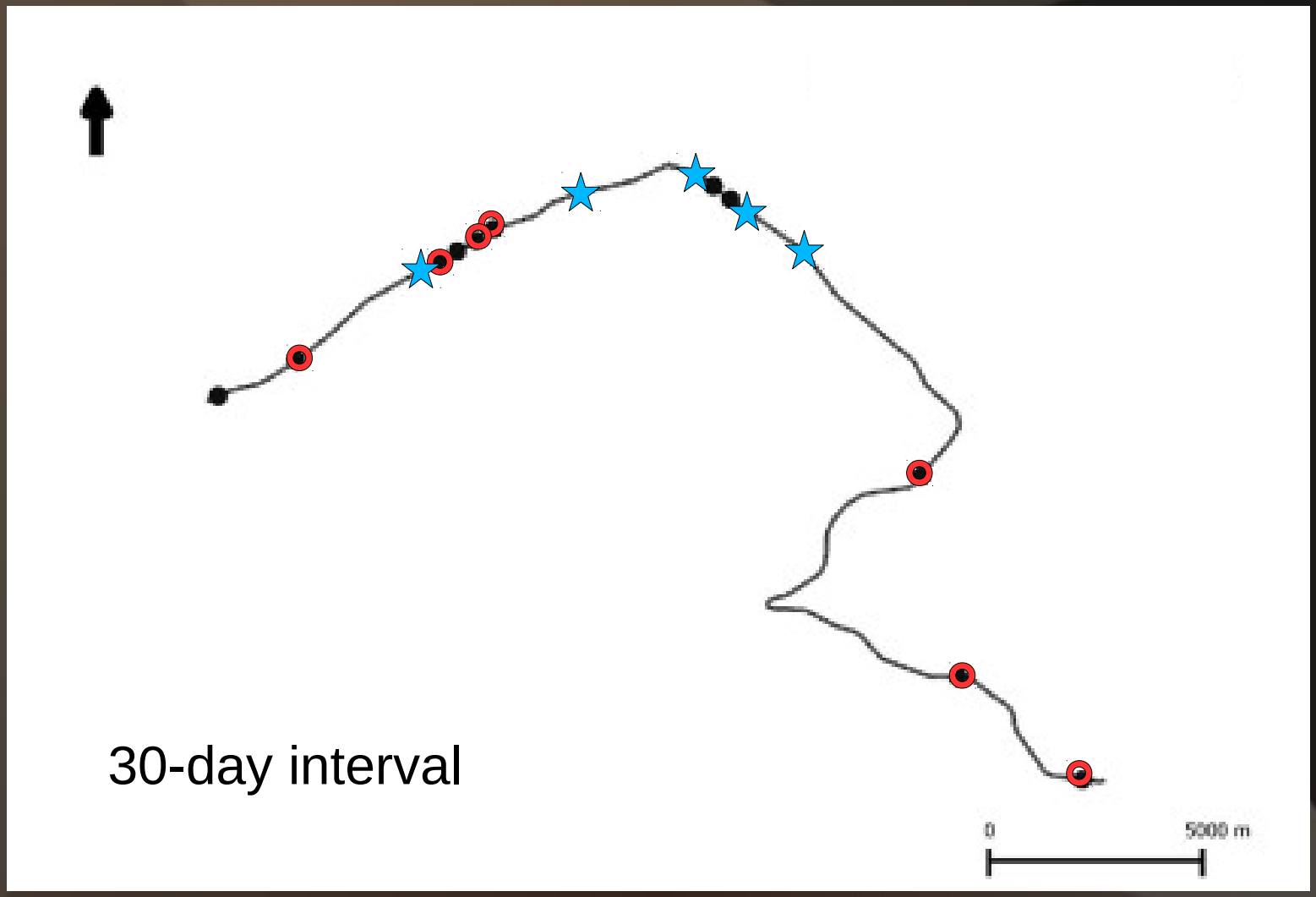
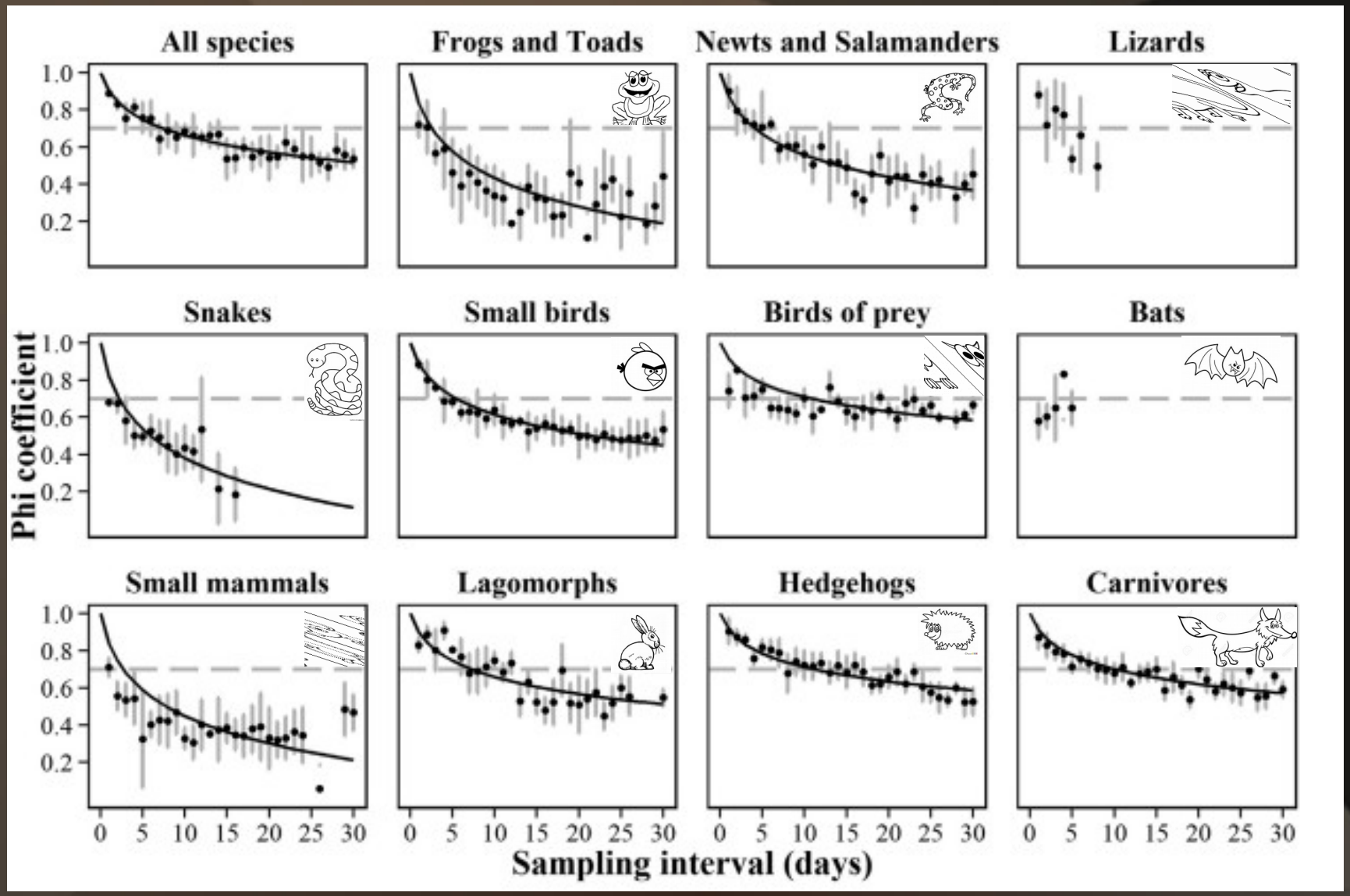


Results

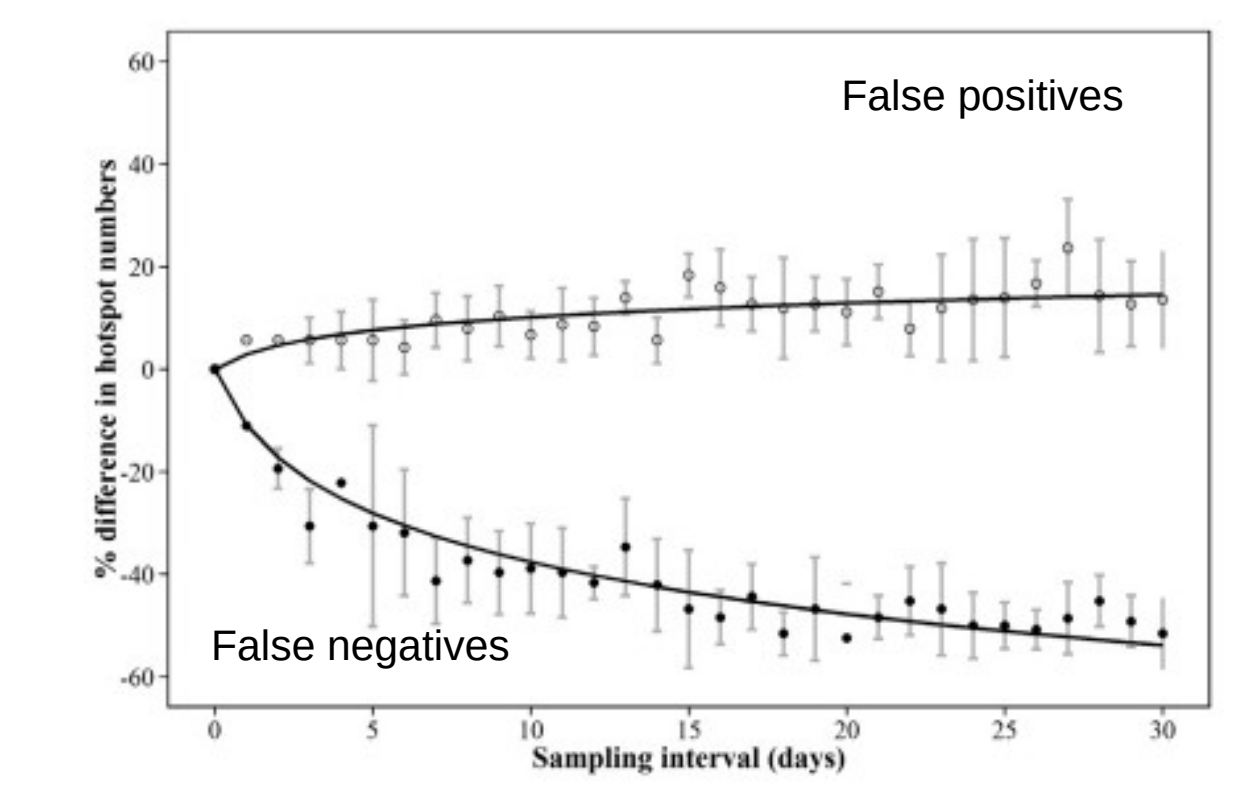
Correlations with daily sampling



Results

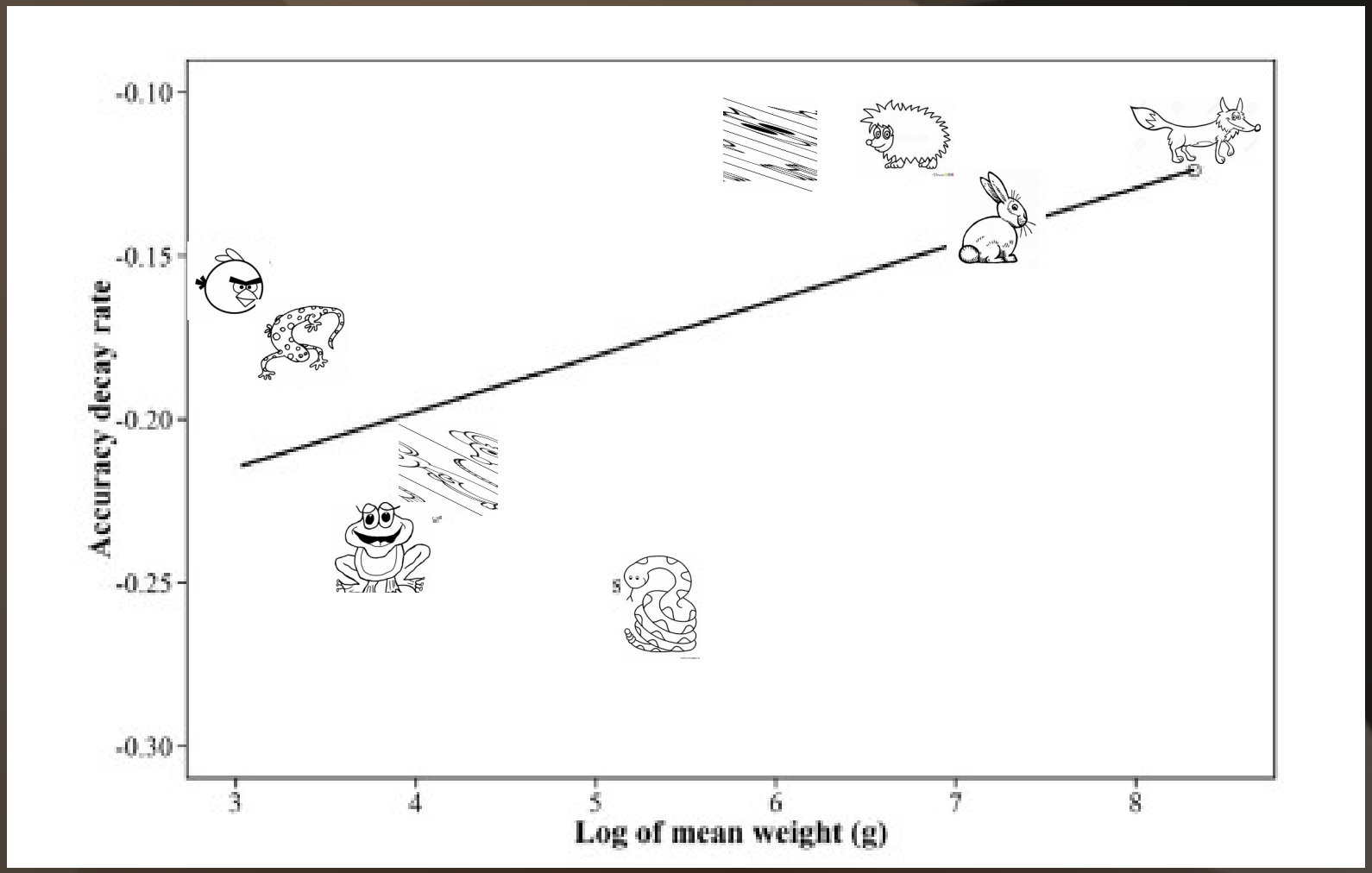
Lower agreement from less intensive sampling surveys result in more false negatives

"true" hotspots missed



Results

Accuracy variation with body size



Conclusions

- Lower sampling frequencies may fail to identify road segments with high roadkill rates and prevent the application of mitigation measures
- When high sampling frequency is not possible, the application of mortality estimators must be considered (e.g. Erickson, Huso, and others)

Conclusions

- Our study highlights the importance of methodological decisions that influence the spatial allocation of costly mitigation measures.

Thank you all!