CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Does positional error affect fine-scale species distribution models?

Faculty of Environmental Sciences

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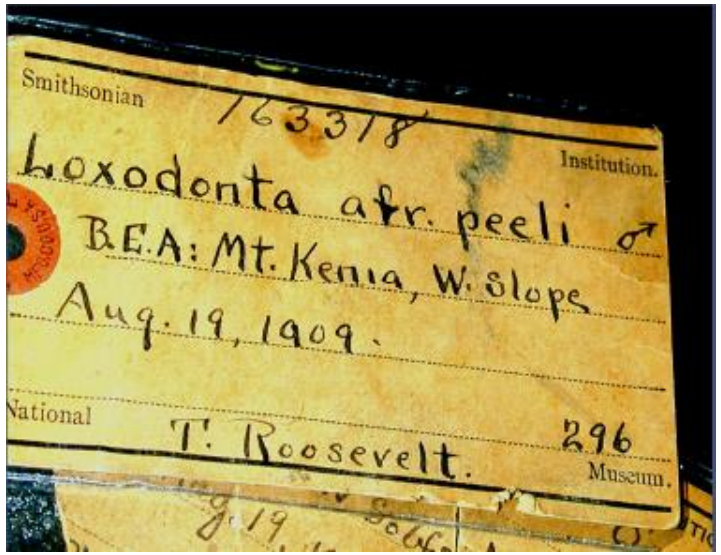
Positional error of species occurrences

OLD DATASETS

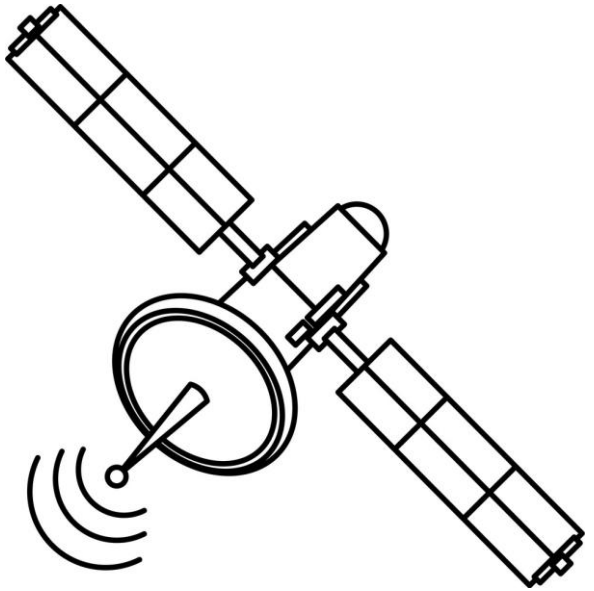


- Georeferenced from textual descriptions
- Positional errors up to hundreds of meters

OBSERVERS

- Occurrences represent the position of observer
- Birds, predators
- Positional errors up to hundreds of meters

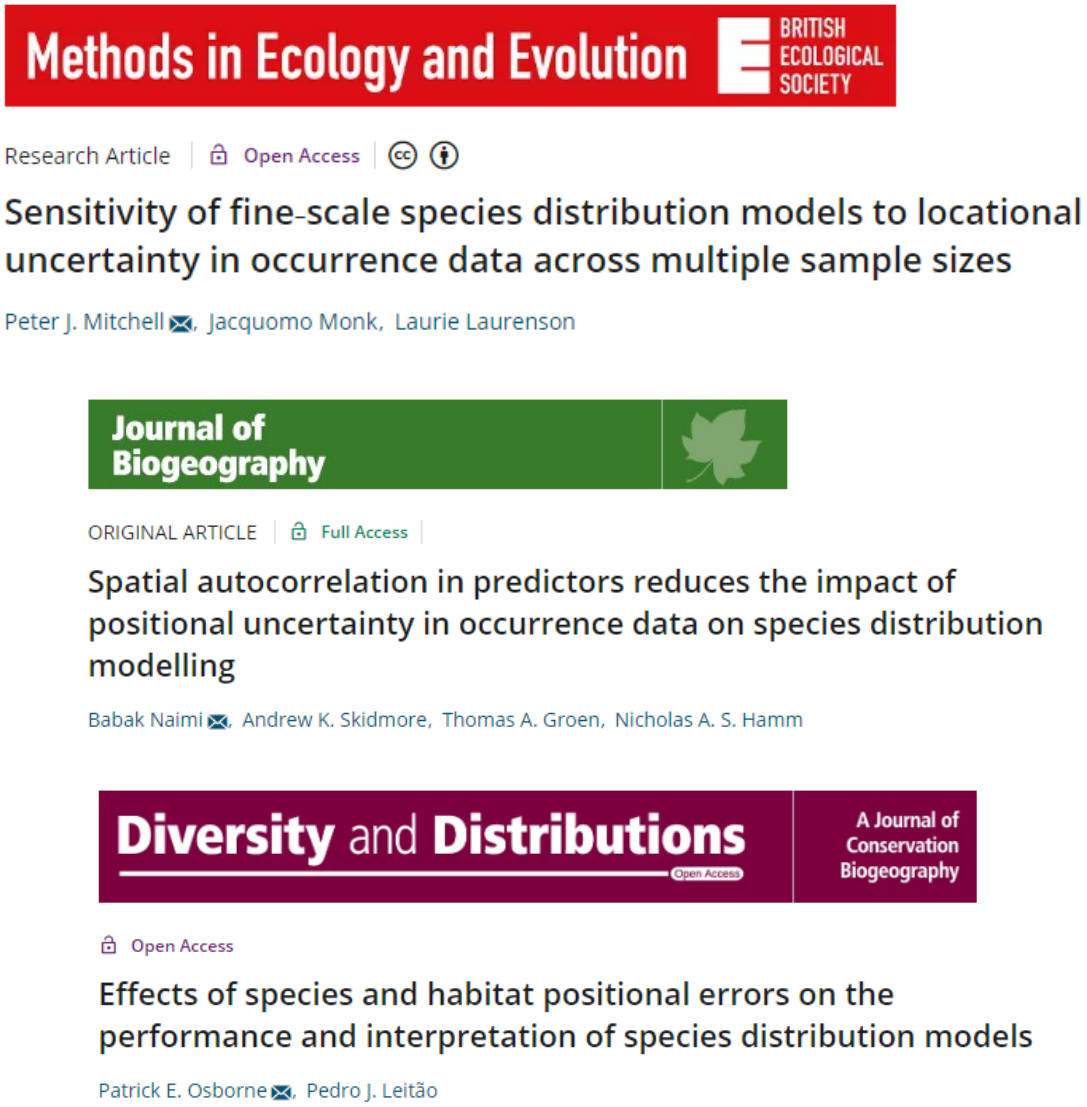
GNSS



- Poor satellite signal reception
- Data processing
- Positional errors up to tens of meters

Prior studies

- There are only a few of them
- Concluded opposing results
- Spatial autocorrelation in predictors plays the role
- Used relatively coarse resolution
  - How are the fine-scale models affected?
- Used real species
- Indices that opposing results are caused by different species niche breadth



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Sensitivity of fine-scale species distribution models to locational uncertainty in occurrence data across multiple sample sizes

Peter J. Mitchell, Jacquomo Monk, Laurie Laurenson

Journal of Biogeography

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Spatial autocorrelation in predictors reduces the impact of positional uncertainty in occurrence data on species distribution modelling

Babak Naimi, Andrew K. Skidmore, Thomas A. Groen, Nicholas A. S. Hamm

Diversity and Distributions | A Journal of Conservation Biogeography

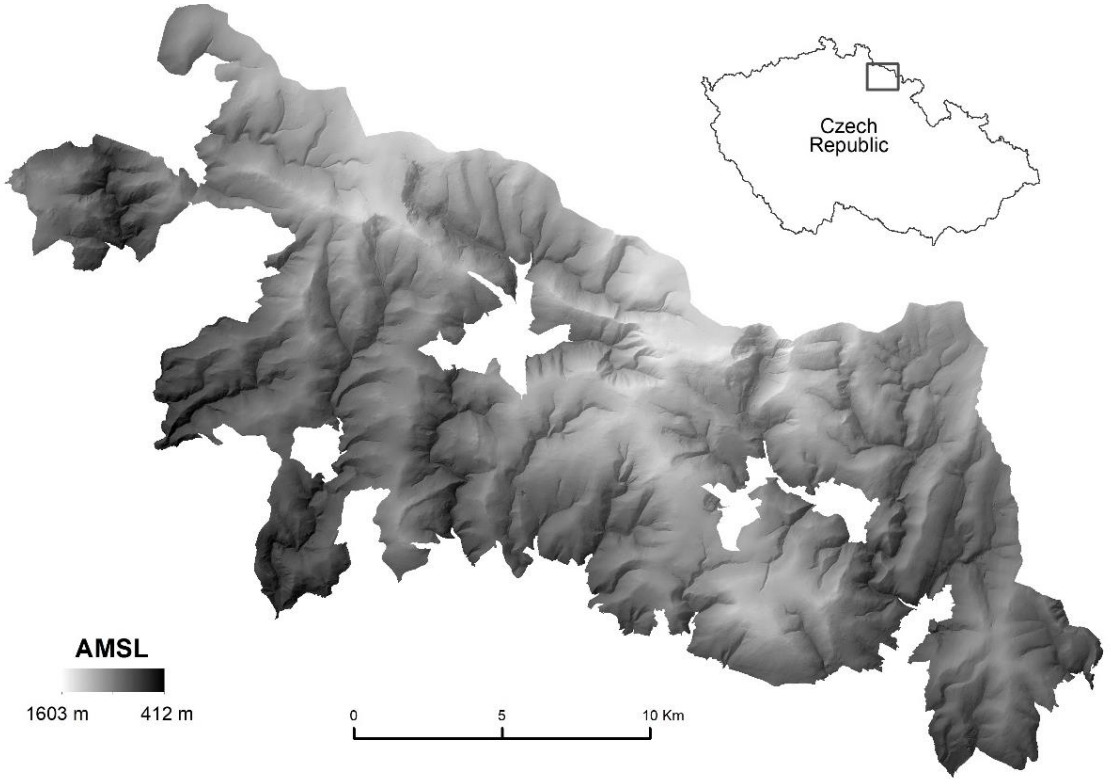
Open Access

Effects of species and habitat positional errors on the performance and interpretation of species distribution models

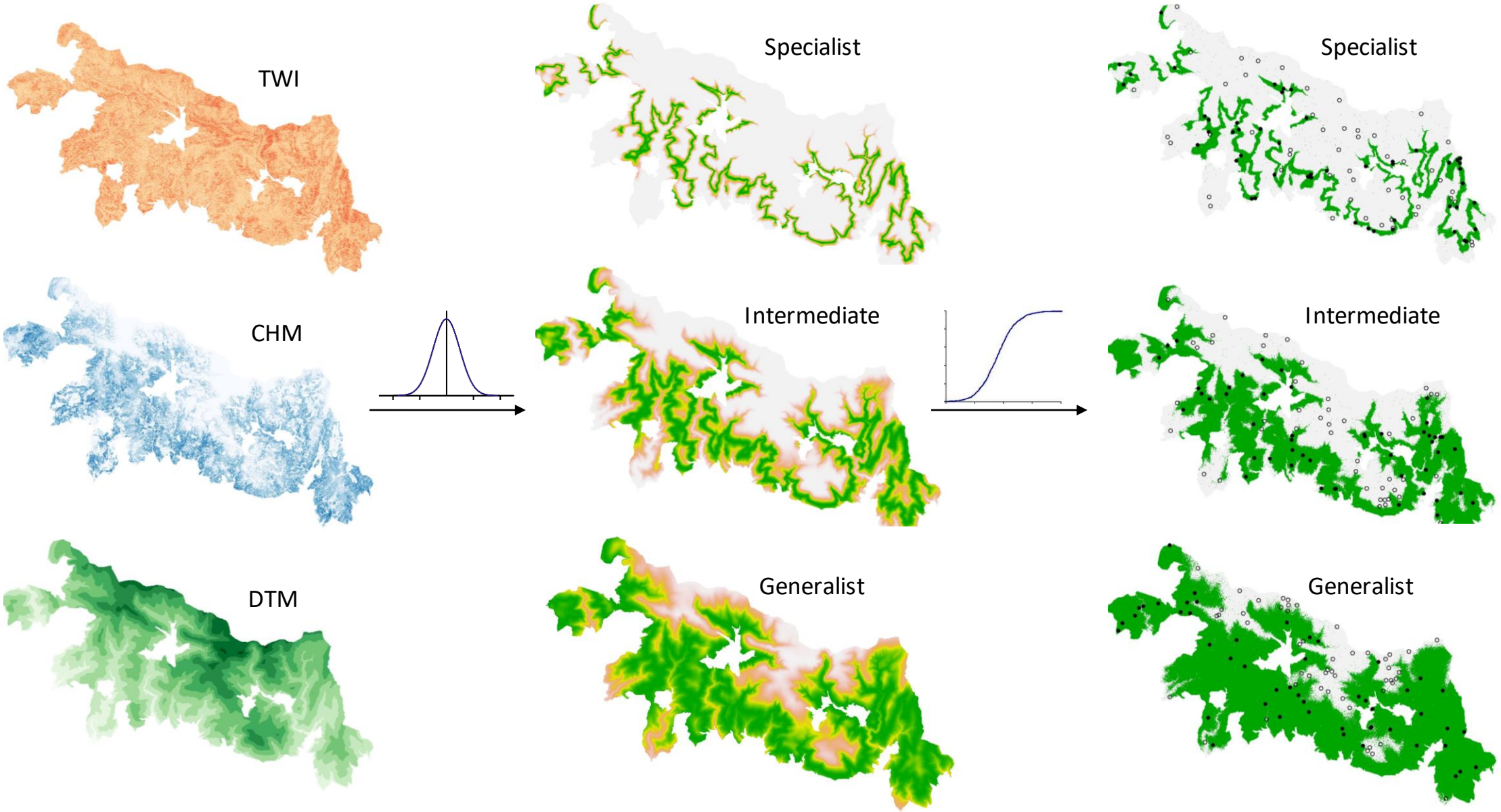
Patrick E. Osborne, Pedro J. Leitão

Our study

- Environmental data derived from LiDAR (resolution 5m)
- Virtual species approach
  - Species with different niche breadth
  - Multiple sample sizes
- Different ranges of positional error
  - from 6 up to 500m
- MaxEnt, GLM
- Model performance X model prediction



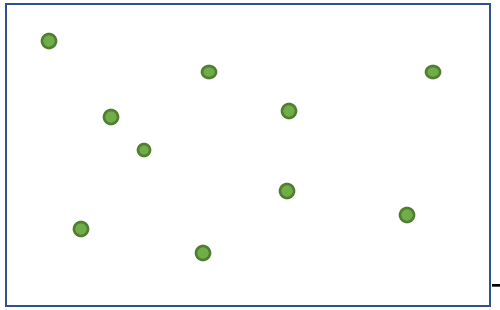
Virtual species approach



Species distribution models

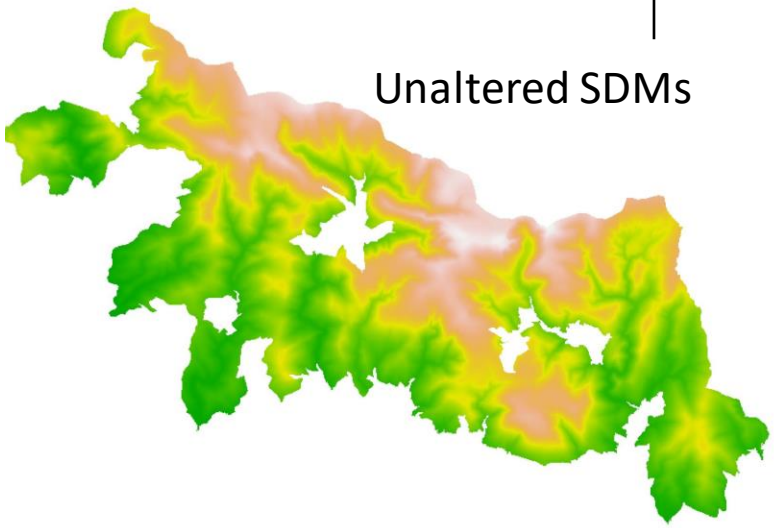
Environmental data

Species occurrences



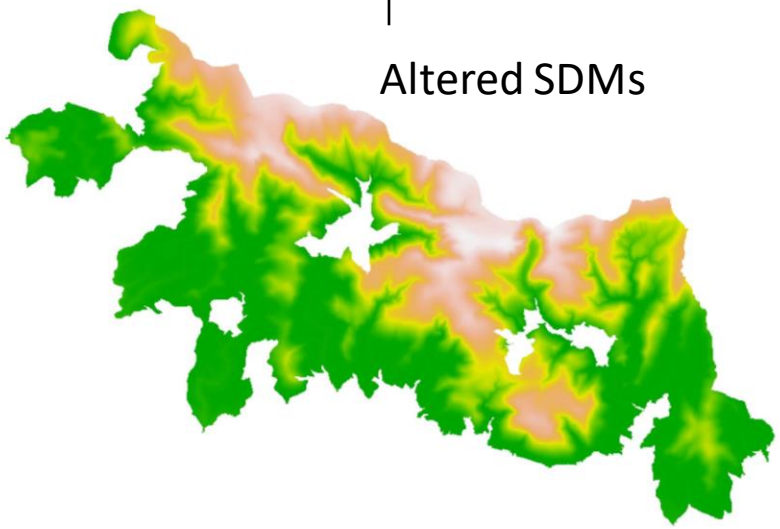
AUC, TSS, Warren I, Spearman correlation

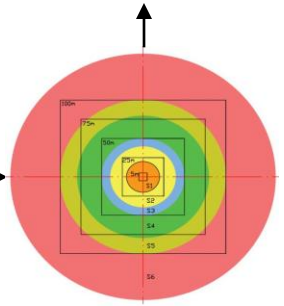
Unaltered SDMs



X

Altered SDMs



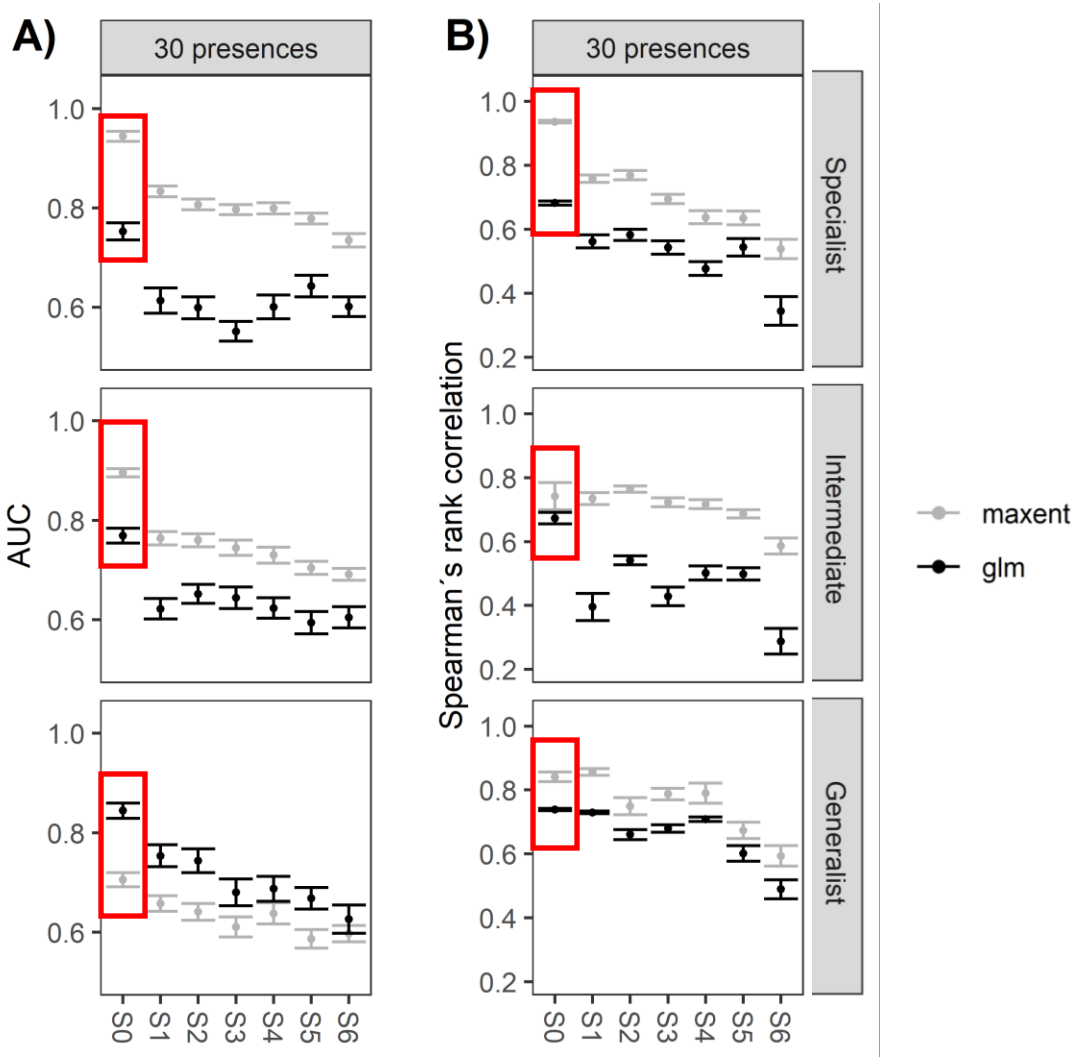


5-10 m
10-15 m
15-20 m
20-50 m
50-100 m
100-500 m

Simulating positional error

Results

- Positional error decrease fine-scale species model performance
- The negative influence vary with species niche breadth
- The degree of decrease differed among adopted validation metrics
- Higher sample size could not compensate the negative effect of positional error



Conclusions

- There is a necessity of quantifying the positional accuracy of species occurrences
- It is critical to evaluate the quality of data with respect to the spatial resolution of the environmental variables
- Improving positional accuracy of species occurrences appears to be more effective than increasing sample size

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The Effect of Positional Error on Fine Scale Species Distribution Models Increases for Specialist Species

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Thank you

Faculty of Environmental Sciences

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Journal of Applied Ecology
BRITISH ECOLOGICAL SOCIETY

Free Access

The influence of spatial errors in species occurrence data used in distribution models

Catherine H Graham, Jane Elith, Robert J Hijmans, Antoine Guisan, A Townsend Peterson, Bette A Loiselle, The Nceas Predicting Species Distributions Working Group

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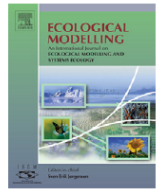

Sensitivity of species-distribution models to error, bias, and model design: An application to resource selection functions for woodland caribou

Chris J. Johnson, Michael P. Gillingham*

Journal of Biogeography

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Methods in Ecology and Evolution 2017, **8**, 12–21 doi: 10.1111/2041-210X.12645

Sensitivity of fine-scale species distribution models to locational uncertainty in occurrence data across multiple sample sizes

Peter J. Mitchell[1,2]*, Jacquomo Monk[1,3] and Laurie Laurenson[1]

ECOGRAPHY
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Where is positional uncertainty a problem for species distribution modelling?

Babak Naimi, Nicholas A. S. Hamm, Thomas A. Groen, Andrew K. Skidmore, Albertus G. Toxopeus

Diversity and Distributions Open Access
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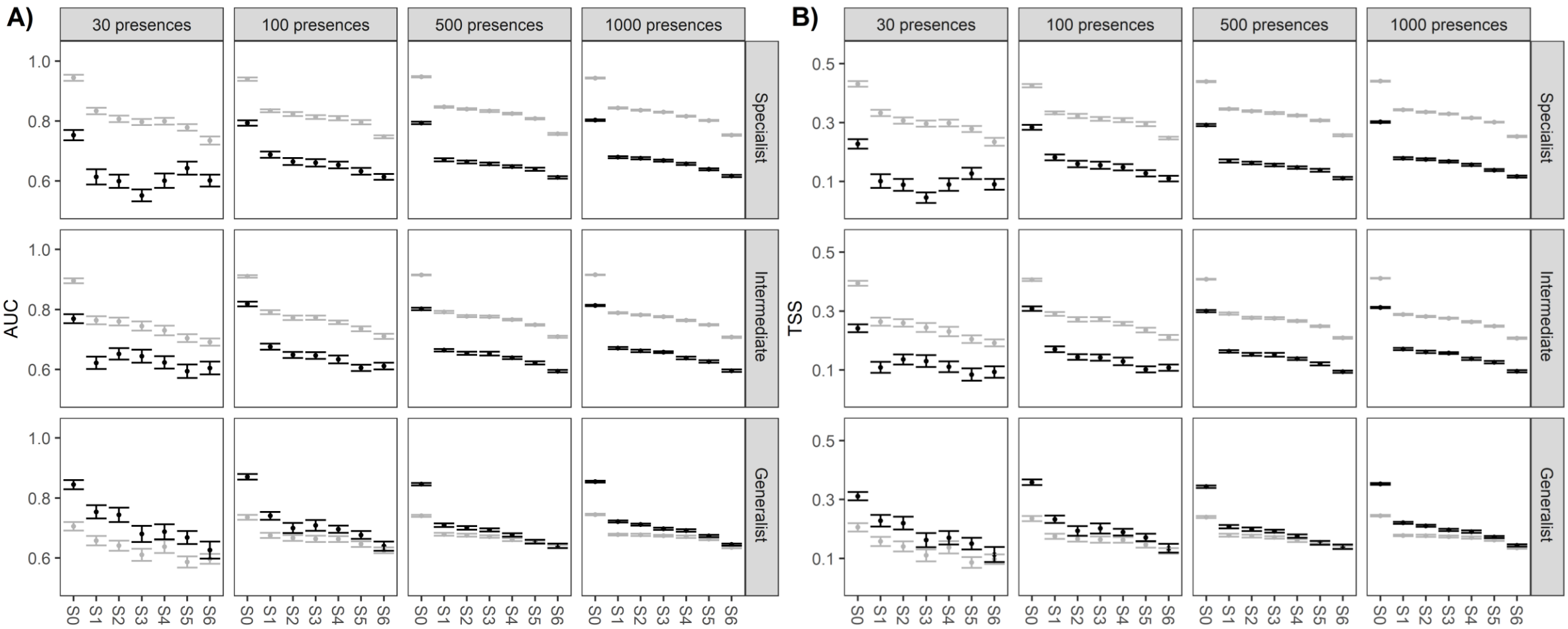
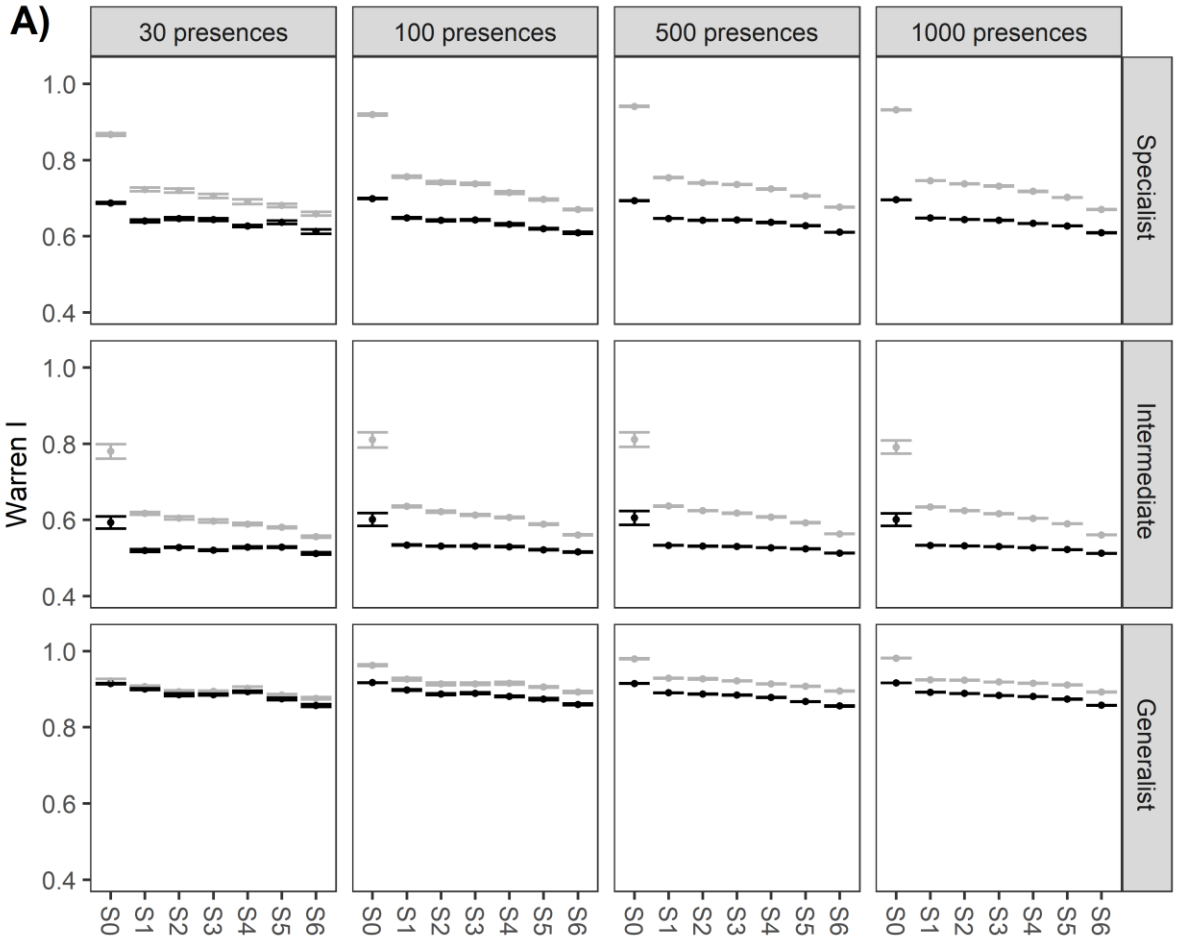
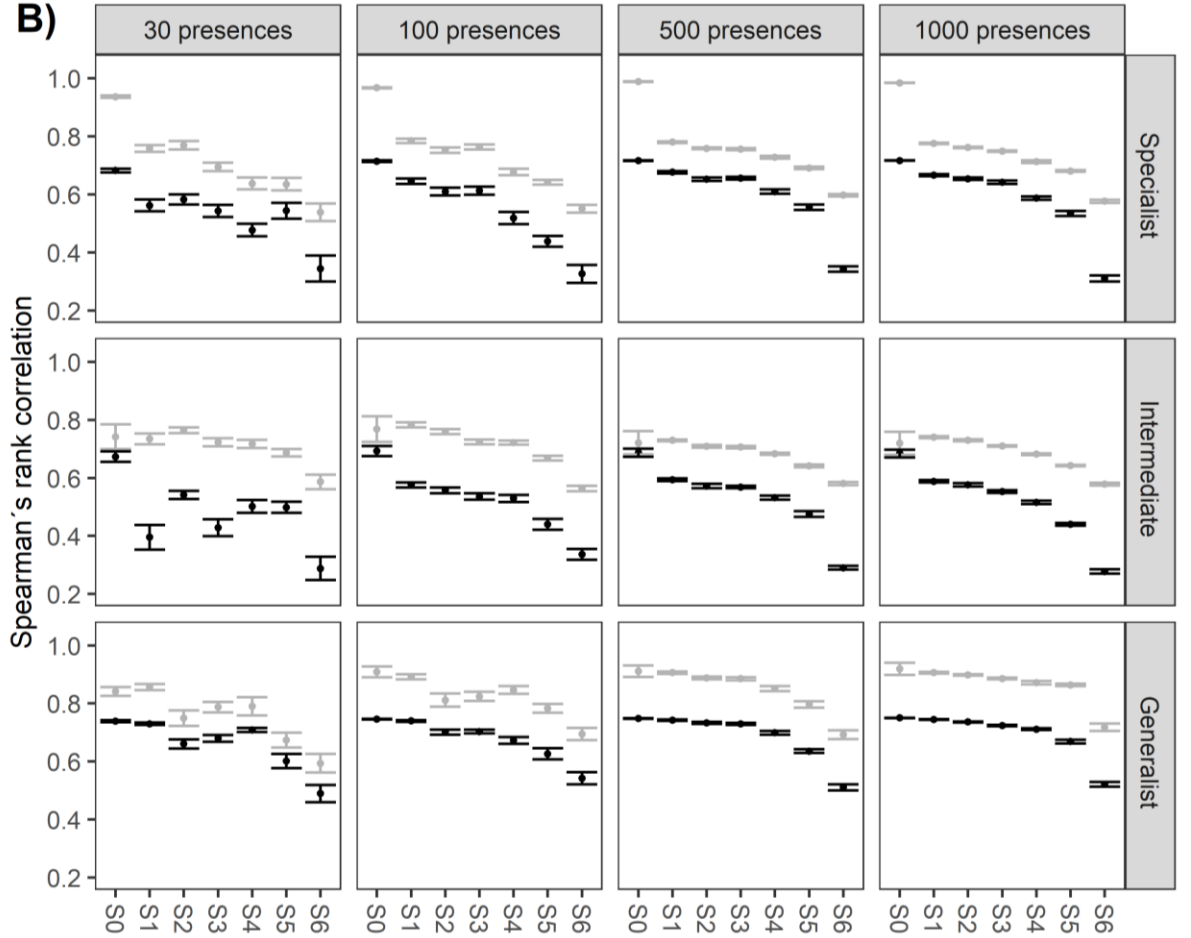
AUC, TSS

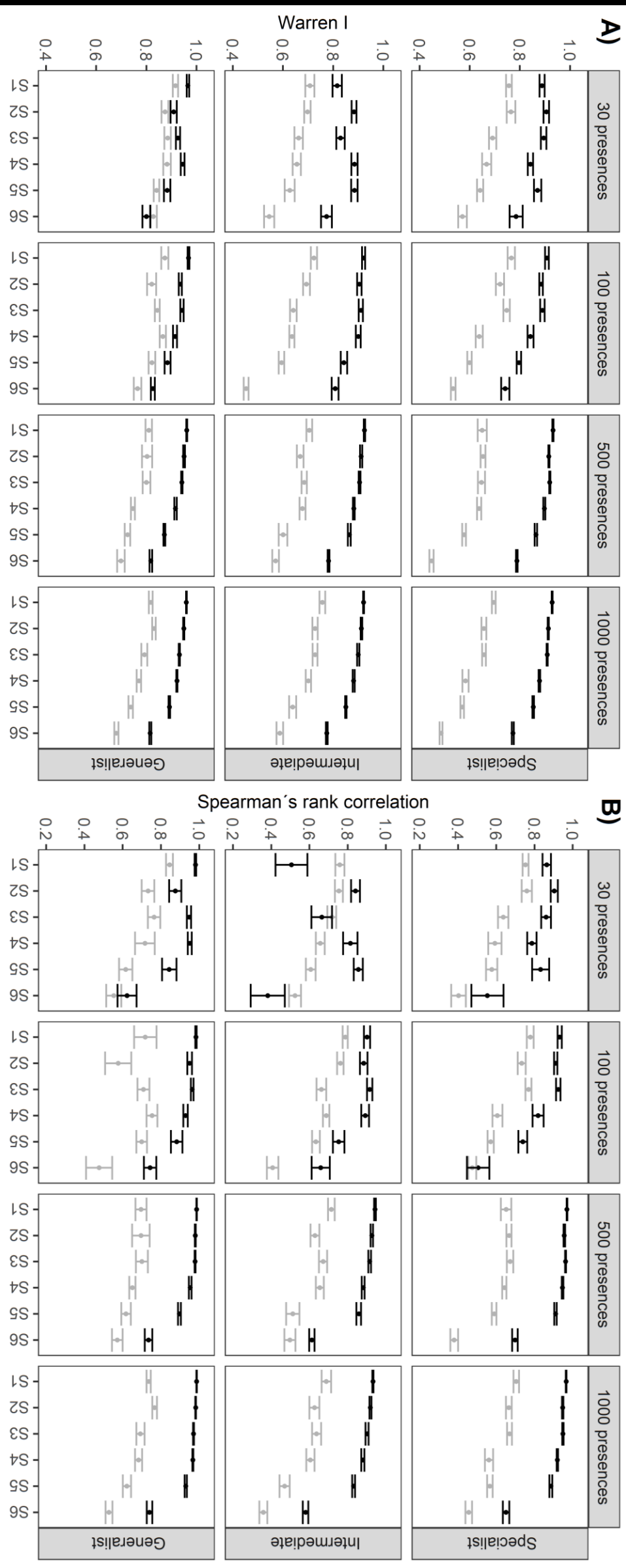

A)
B)
30 presences
100 presences
500 presences
1000 presences
Specialist
Intermediate
Generalist
AUC
TSS
1.0
0.8
0.6
0.5
0.3
0.1
S0
S1
S2
S3
S4
S5
S6

Niche Overlap – Geographical space



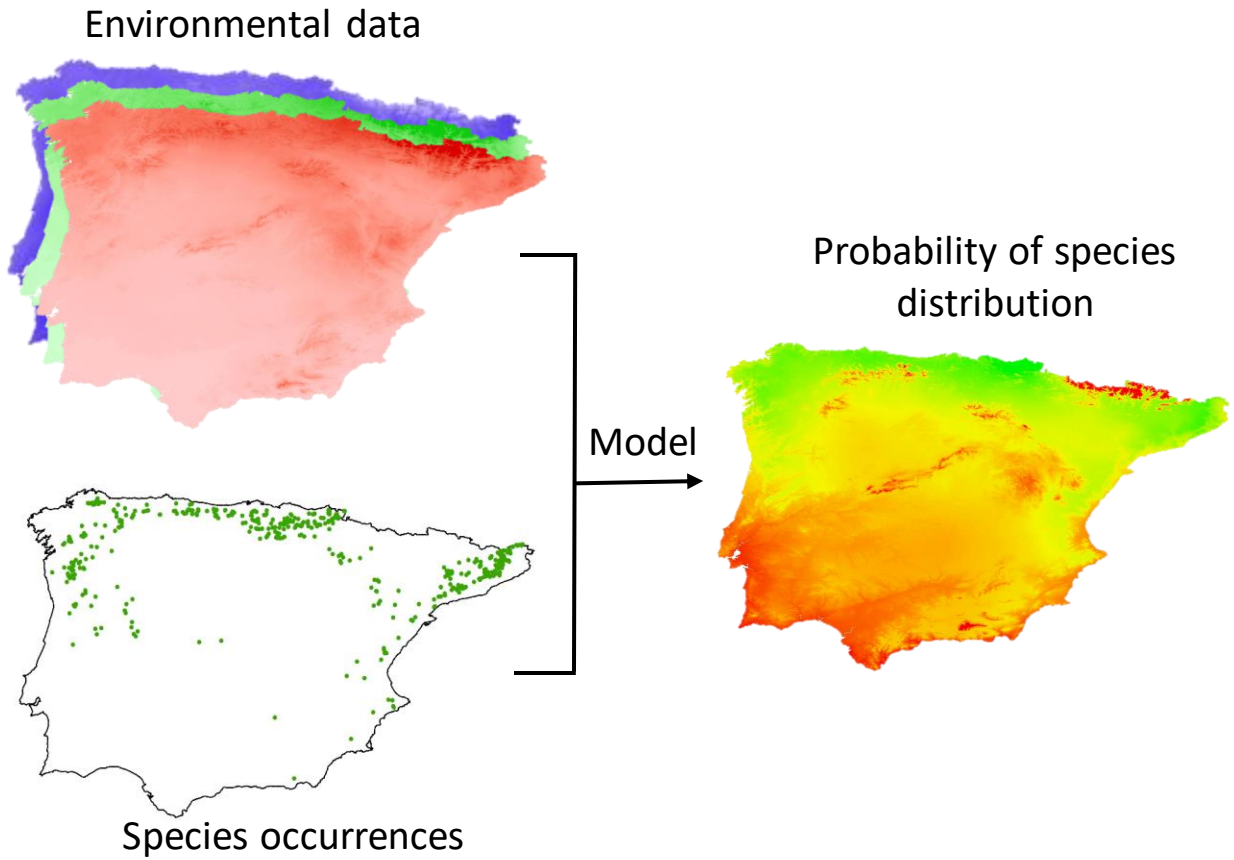


Niche Overlap – Environmental space



Species distribution models (SDMs)

- Define species-environment relationships
- Can be used for example to:
  - Determine the potentially threatened locations by invasive species
  - Study the impact of climate change on biodiversity
- Decreasing development of SDMs in last few decades



Data quality (both for species occurrences and environmental variables) is currently considered a major factor limiting SDM accuracy (Araújo et al. 2019).

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