Tackling knowledge gaps about food webs with trait-based models

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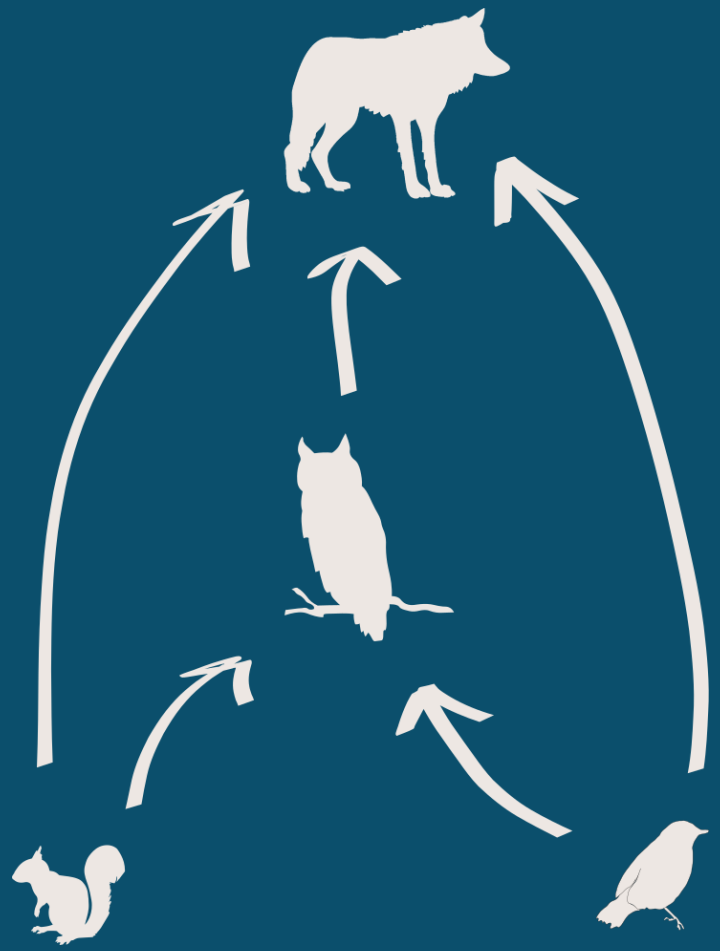
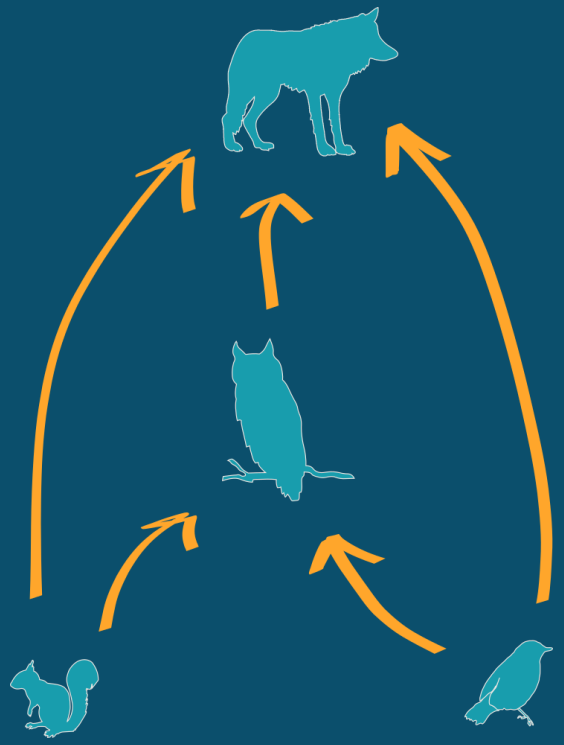
Introduction



Introduction

Theory:
- Community assembly
- Biogeography
- Niche
- Eco-evolutionary dynamics

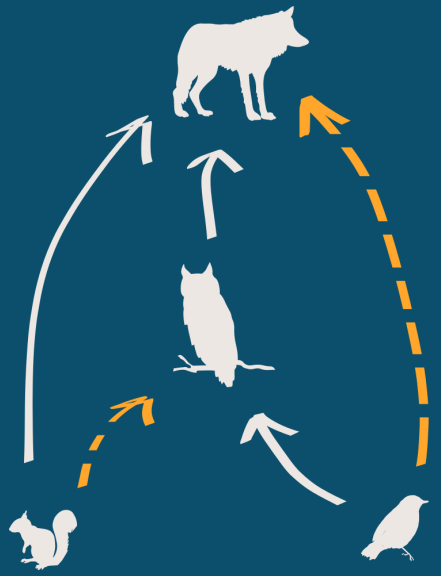


Ecosystem functions:
- Stability
- Nutrient cycling
- Energy flow
- Population regulation

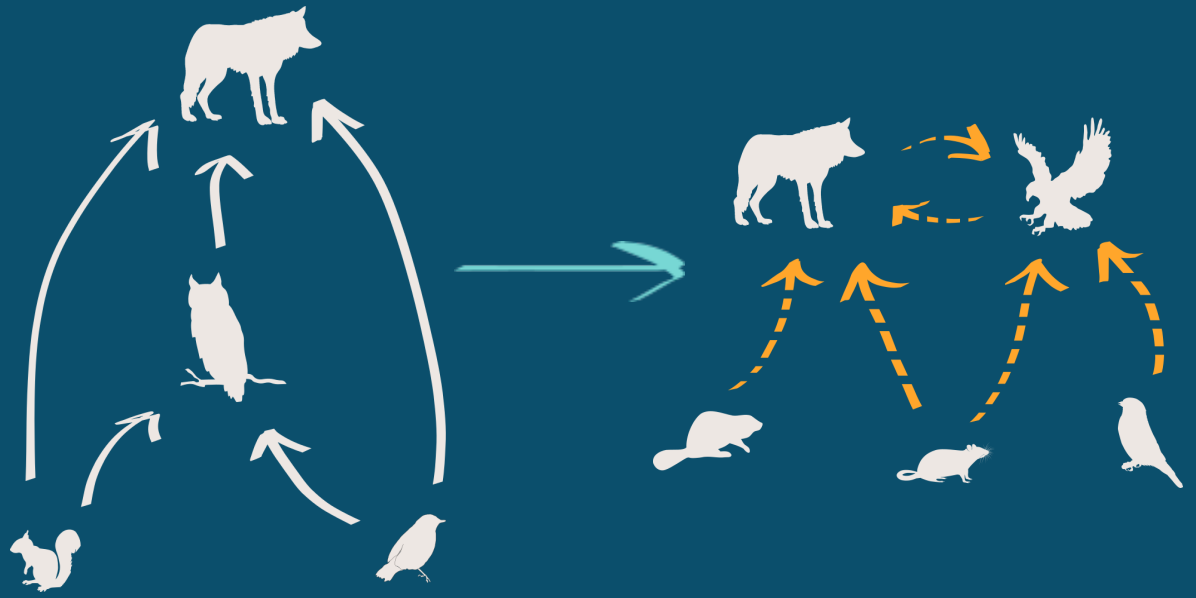
Applications:
- Species role
- Trophic cascades
- Co-extinction

Introduction

Within food web predictions:



Across food web predictions:



Questions

1. How much information are needed to make reliable within food web predictions ?

2. What factors limits across food web predictions?

3. How well can we predict species trophic roles with interaction models?

Methods

Bayesian Generalized Linear Model:

foraging ability of the predator
e.g., foraging strategy

vulnerability of the prey
e.g., body mass

functional match
e.g., activity time

Caron et al., *Ecol. Lett.*, 2022

Q1 Within food web predictions - Methods

Maiorano et al., *Glob. Ecol. Biogeogr.*, 2020

Data

Food web of European tetrapods

~ 1k species

~ 71k pairwise interactions

Variables

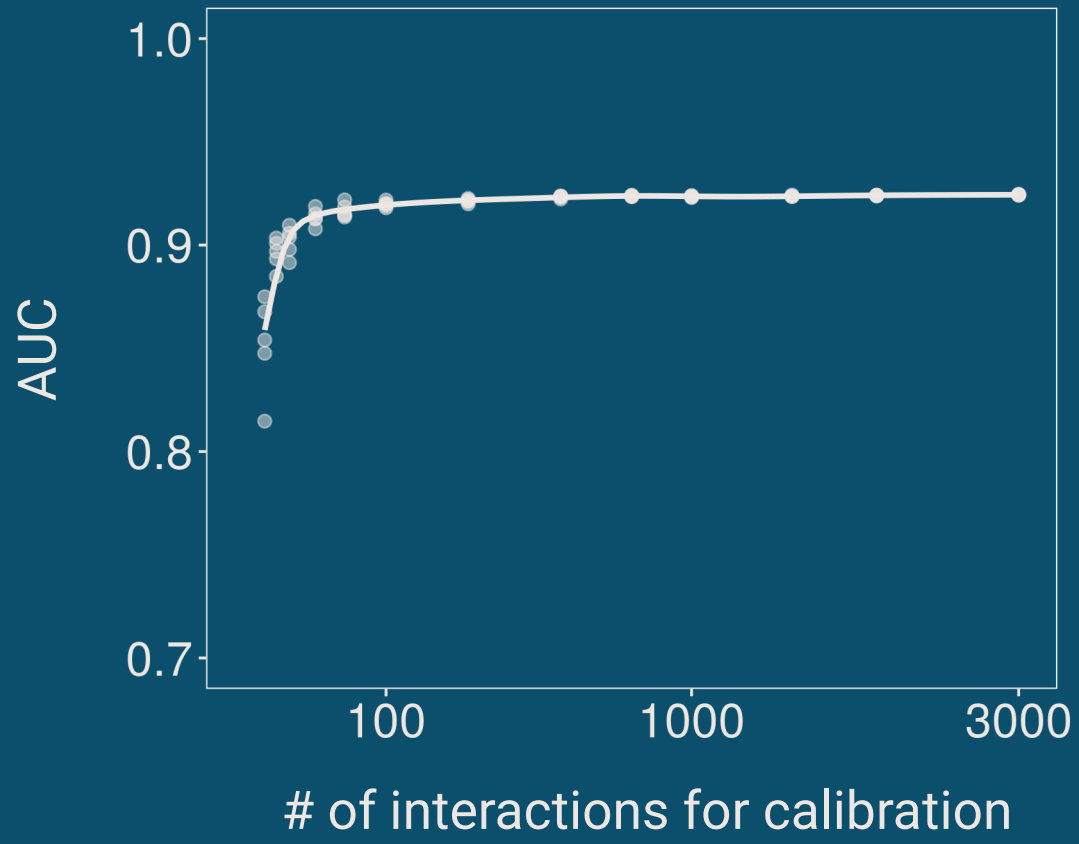
Independent variable:

Size of calibration dataset

Dependent variable:

Model performance

Q1 Within food web predictions - Results

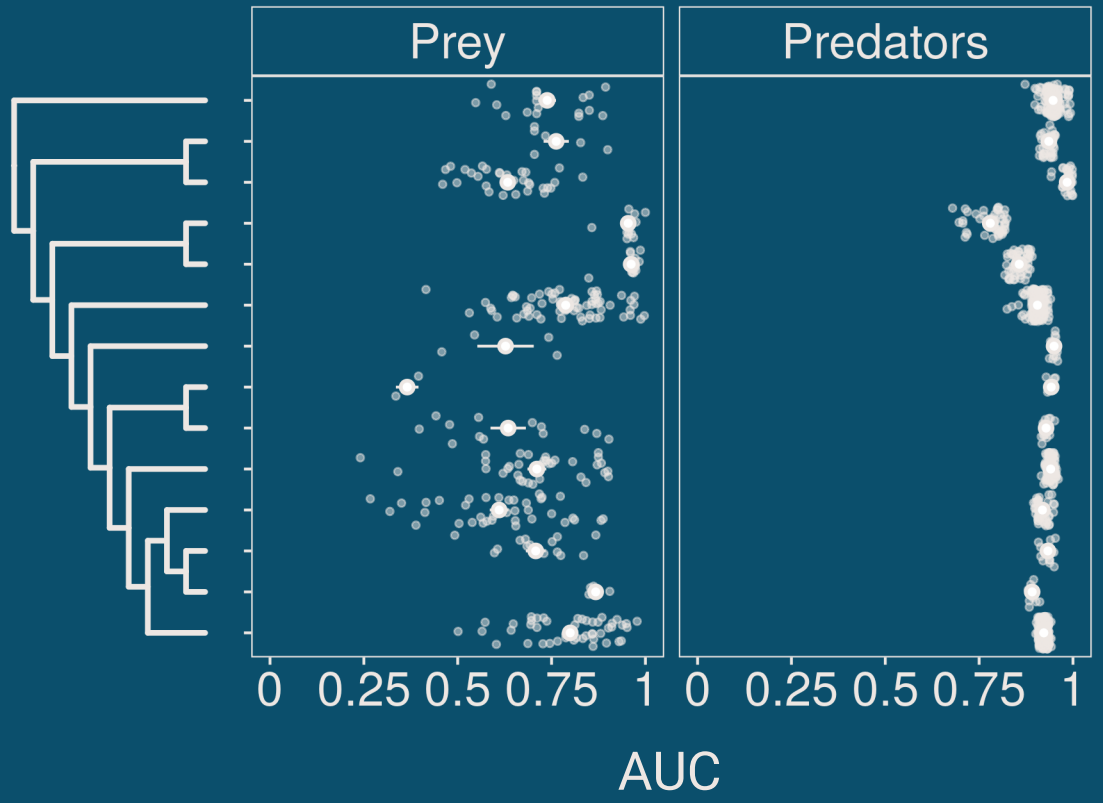


- Performance peaks at a very small training dataset

- A relatively simplistic model predicts most interactions well

Caron et al., *Ecol. Lett.*, 2022

Q1 Within food web predictions - Results

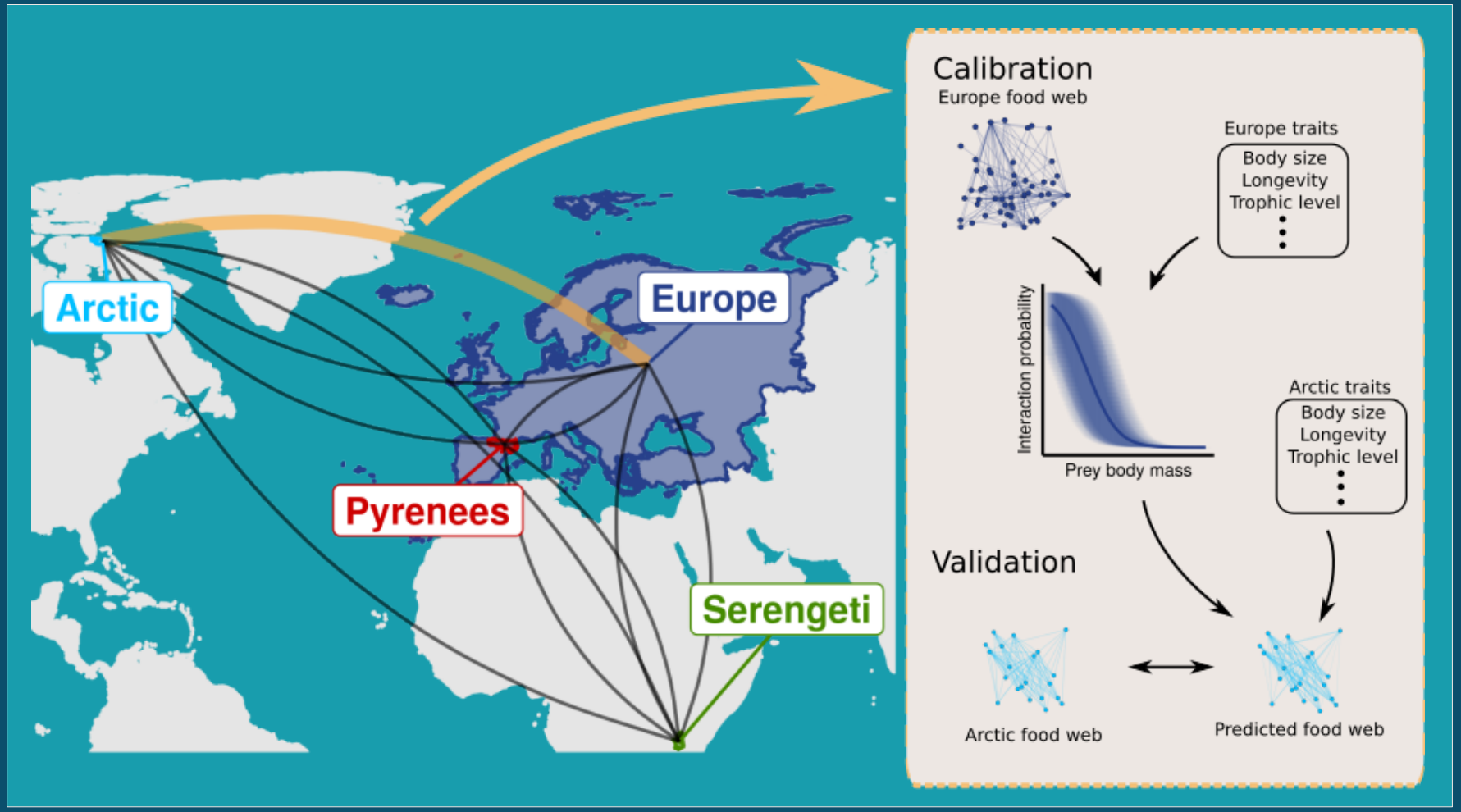


- Prey of some species order are not well predicted

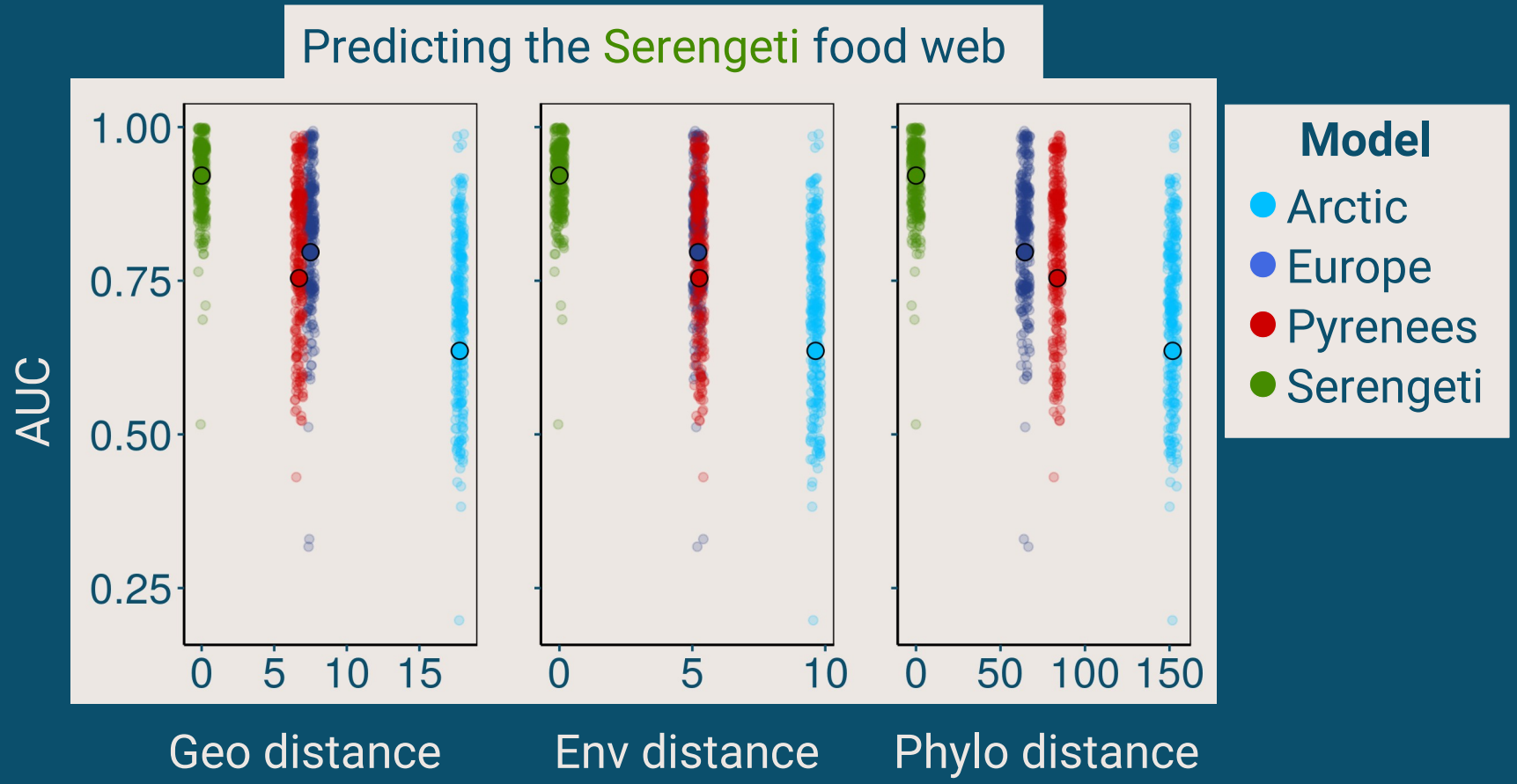
- Predators of most species are well predicted

Caron et al., *Ecol. Lett.*, 2022

Q2 Across food web predictions - Methods

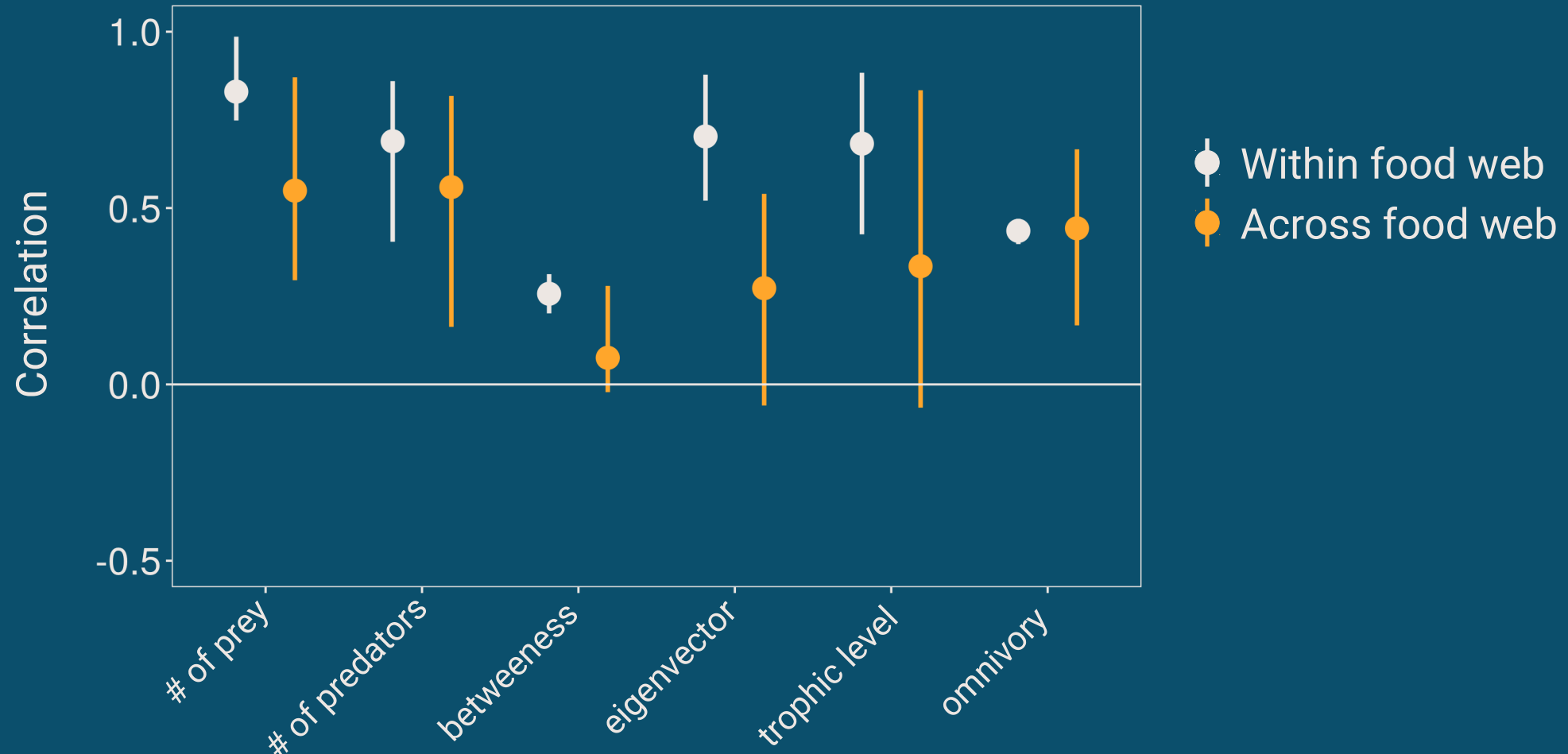


Q2 Across food web predictions - Methods



Q3 Trophic role predictions - Methods

Q3 Trophic role predictions - Results



Summary

1. How much information are needed to make reliable within food web predictions ?

   We recovered a large food web small fraction (<1%) of all interactions.

2. What factors limits across food web predictions?

   We predicted highly contrasting food webs. Environment and shared phylogeny limit transferability.

3. How well can we predict species trophic roles with interaction models?

   We can predict some role reasonably well for within food web predictions. Less so for across food web predictions.

Thank you!

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