

Network structure modulates evolutionary dynamics in resource competition networks

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Introduction

Competition for limited resources plays a key role in species trait evolution.

Competitors are often embedded in **complex networks** of interactions, and differ in the number of resources they use.

The **trait mismatch** between consumer and resource affects consumer fitness.

Connectance describes on average how generalist consumers are in the number of resources they use.

Hypotheses

We expected that species in **high-connectance** networks—and thus in networks with more generalist consumers—would be more negatively affected by competition, experiencing greater **trait shifts** and increased **trait mismatch** with resources compared to species in low-connectance networks.

Methods

1st: Used an evolutionary model

$$Z_i^{t+1} = Z_i^t + \left\{ \sum_{u=1}^R \frac{q_{iu}^t}{K_i^t} (Z_u^t - Z_i^t) + \sum_{u=1}^R \sum_{j=1}^C \frac{q_{iu}^t q_{ju}^t}{k_i^t} (Z_j^t + \epsilon_{iu}^t - Z_i^t) \right\} + (\theta_i - Z_i^t)$$

Relevant Trait

Trait values

i u j

q_{iu} q_{ju}

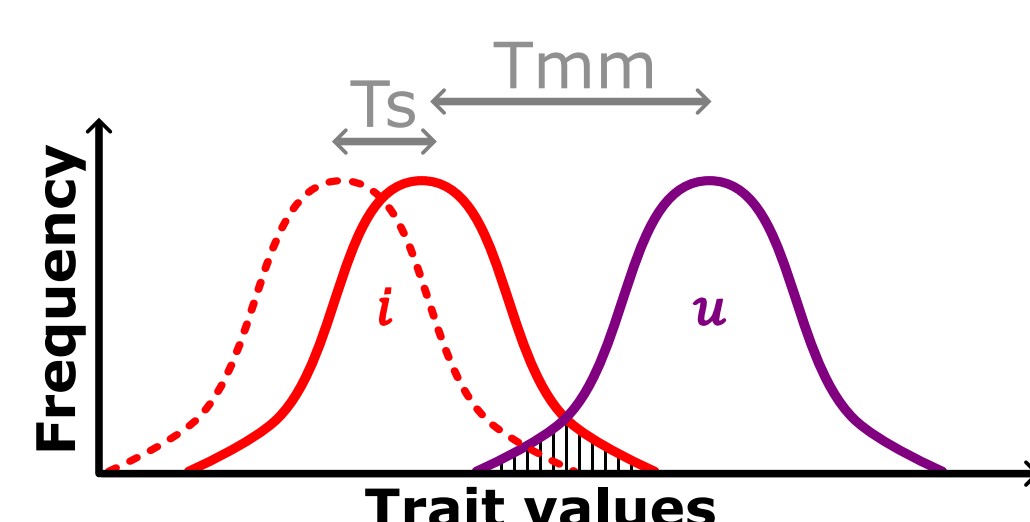
θ_i

1. High resource importance $m_i = 0.8$

2. Varying generalization through connectance $C = \frac{\text{Interactions}}{\text{Competitors} \cdot \text{Resources}}$

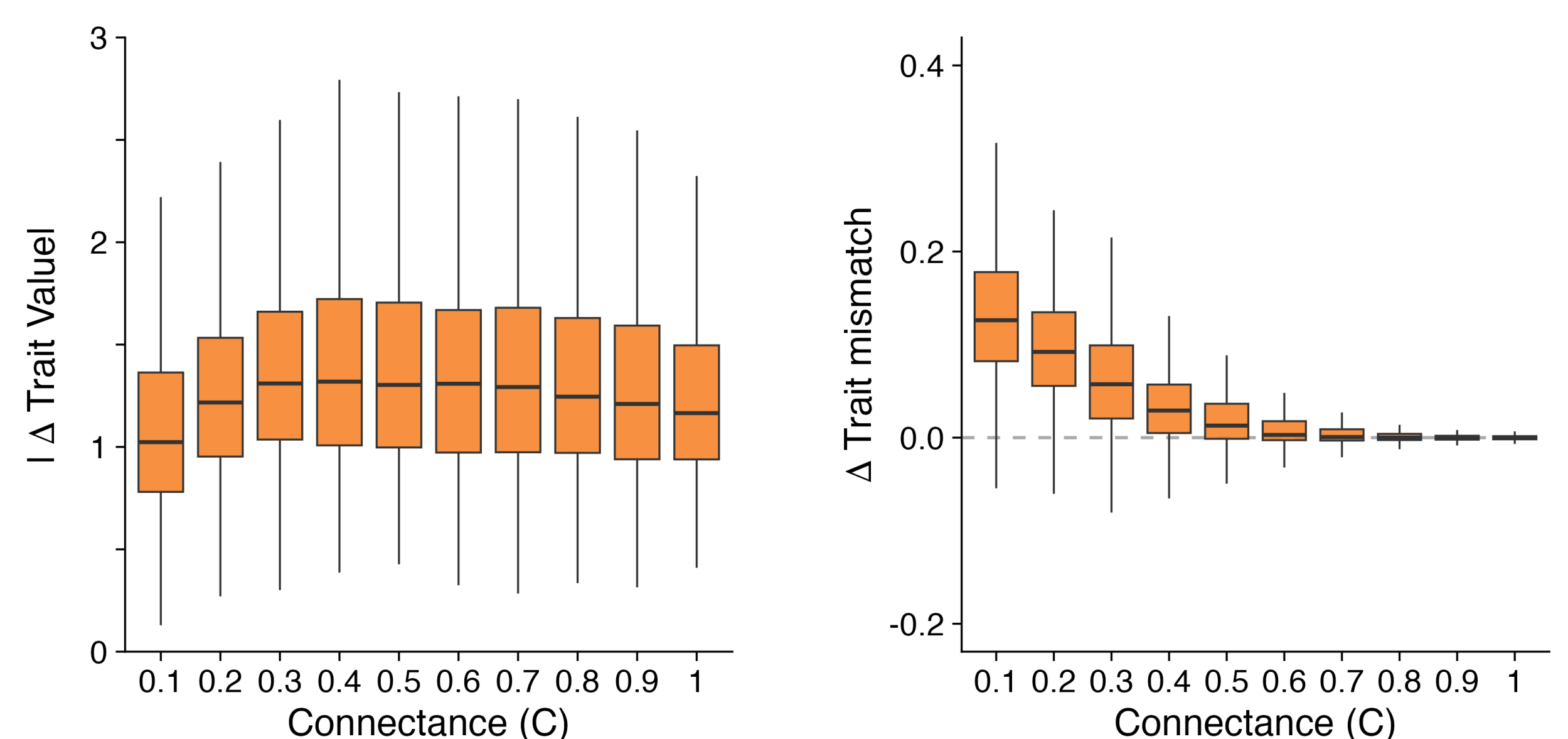
2nd: Compared outcomes across scenarios:

$|\Delta \text{Trait value}|$ & $\Delta \text{Trait mismatch}$
No Competition_{sc} – Competition_{sc}



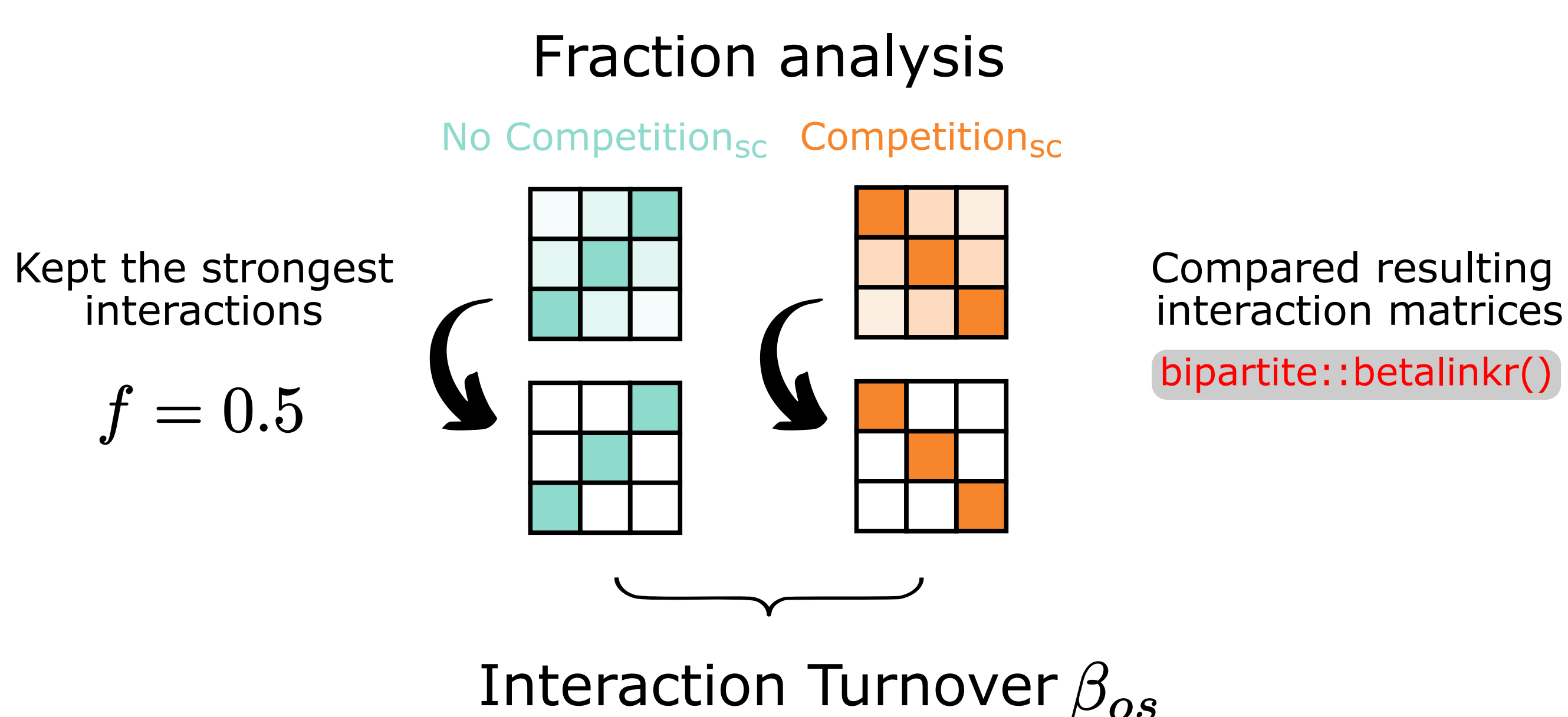
Based upon: Andreazzi et al., 2017

Preliminary Results

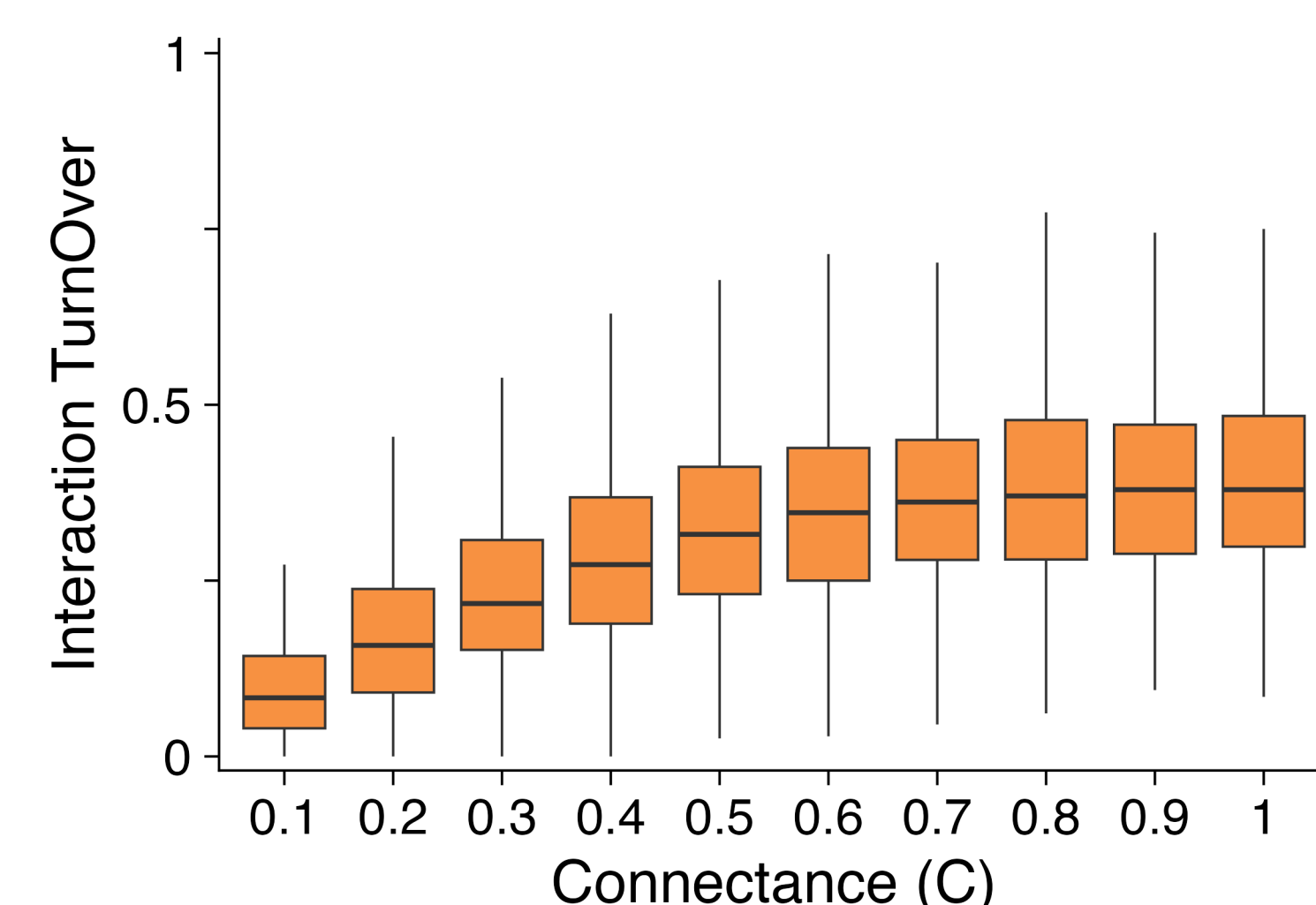


While connectance was associated with a slight increase in trait shift between evolutionary scenarios, low values of connectance were associated with higher values of trait mismatch between consumers and their resources.

Then we explored the identity of the interactions:



Based upon: Poisot et al., 2012; Tinker et al., 2012



Connectance was correlated with increasing resource use shift between scenarios. Species with fewer resources seems to be more vulnerable to competition, as they are limited in what resources to

Next Steps

How do species with different number of resources react within the same network?

How does competition forces trait mismatch in empirical networks with distinct structures?

How do anthropogenic disturbances impact the evolutionary dynamics of native species?

Acknowledgments

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Birds silhouettes were inspired by Anthony Caravaggi.

For more:

