2024 CHALLENGER SOCIETY CONFERENCE

National Oceanography Centre

A CLOSER LOOK AT PLANKTON: CENTIMETRE-SCALE INTERACTIONS REVEALED IN SITU

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ECOLOGICAL NETWORKS

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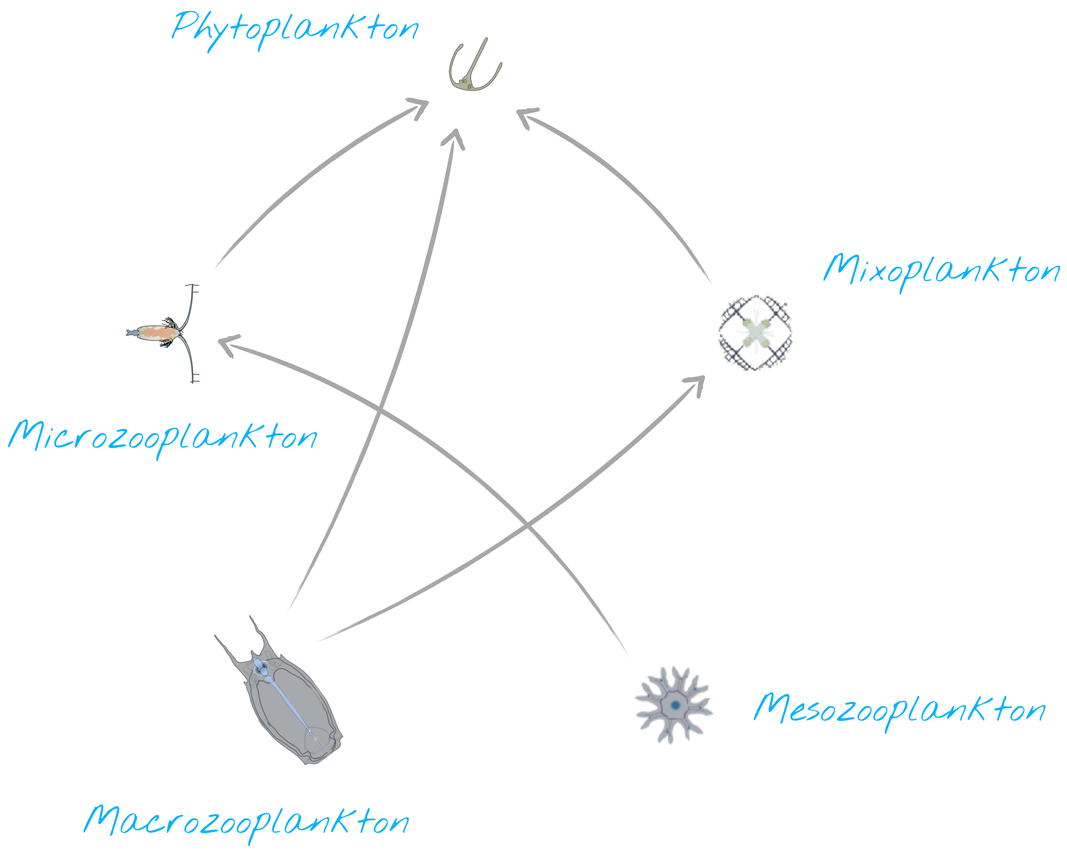
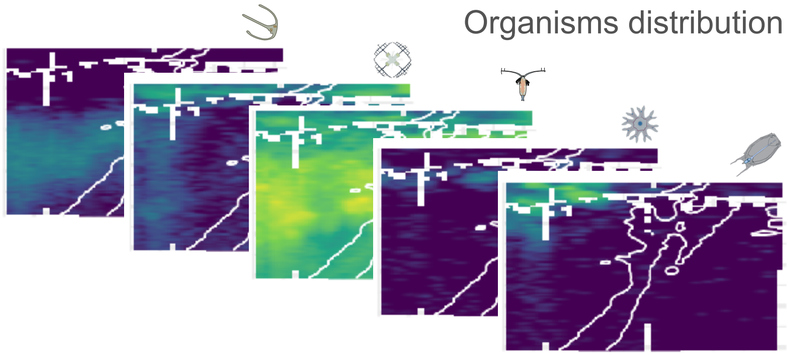
Empirical network

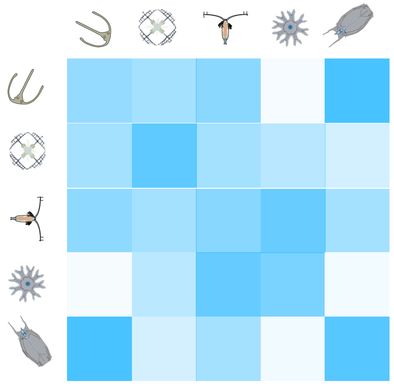


Co-occurrence network

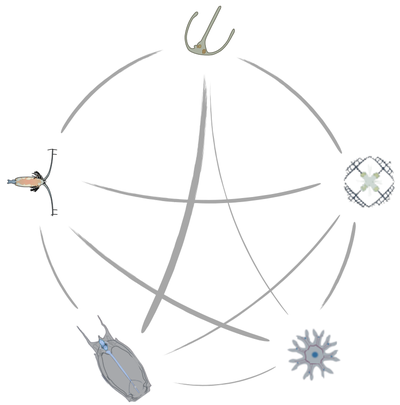
Organisms distribution



Co-occurence matrix



Network



ECOLOGICAL NETWORKS

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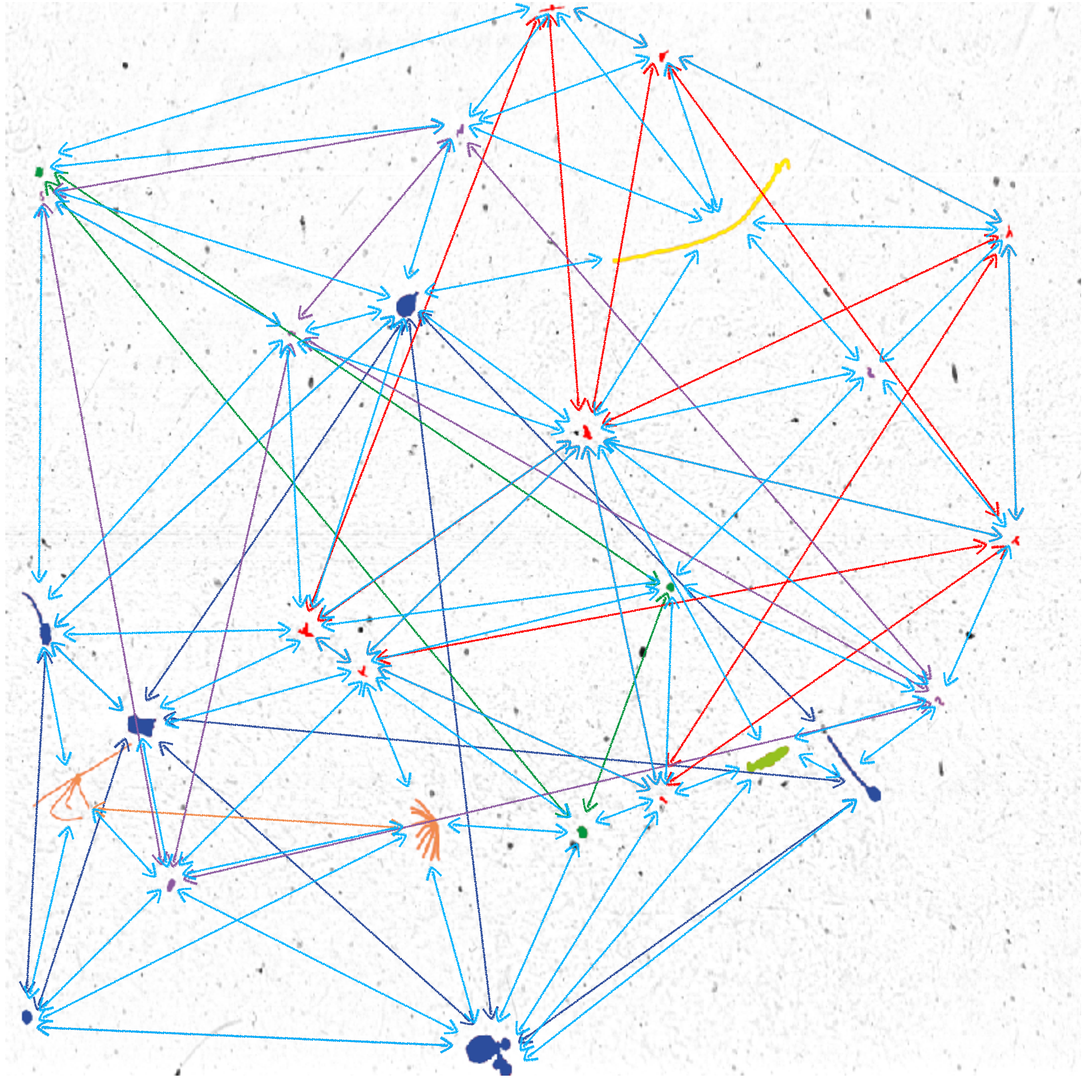

Information from distances → distance-based network?

Distances* between planktonic organisms in situ

- all organisms
- intra-taxonomic
- inter-taxonomic

*distances < 10 cm

ISIIS DATA

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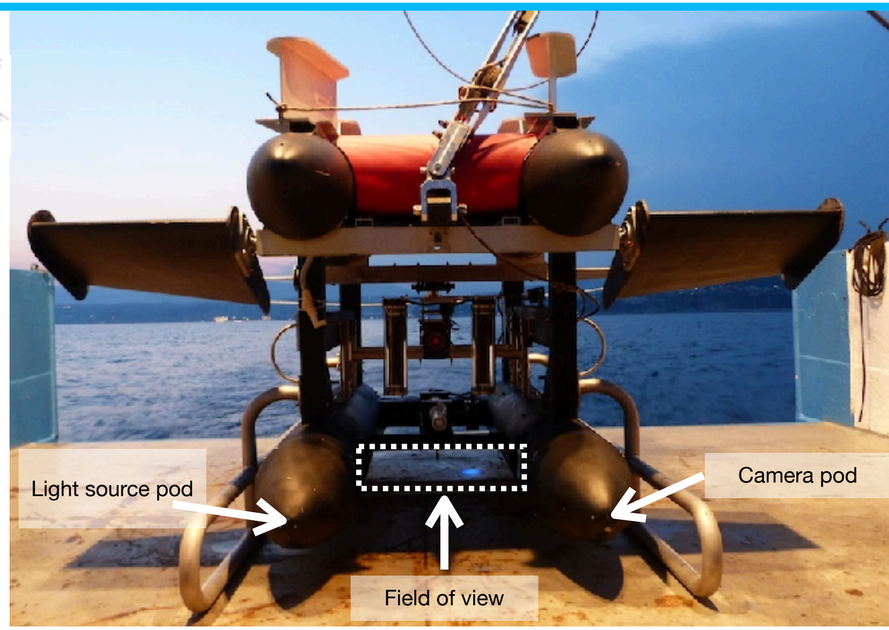
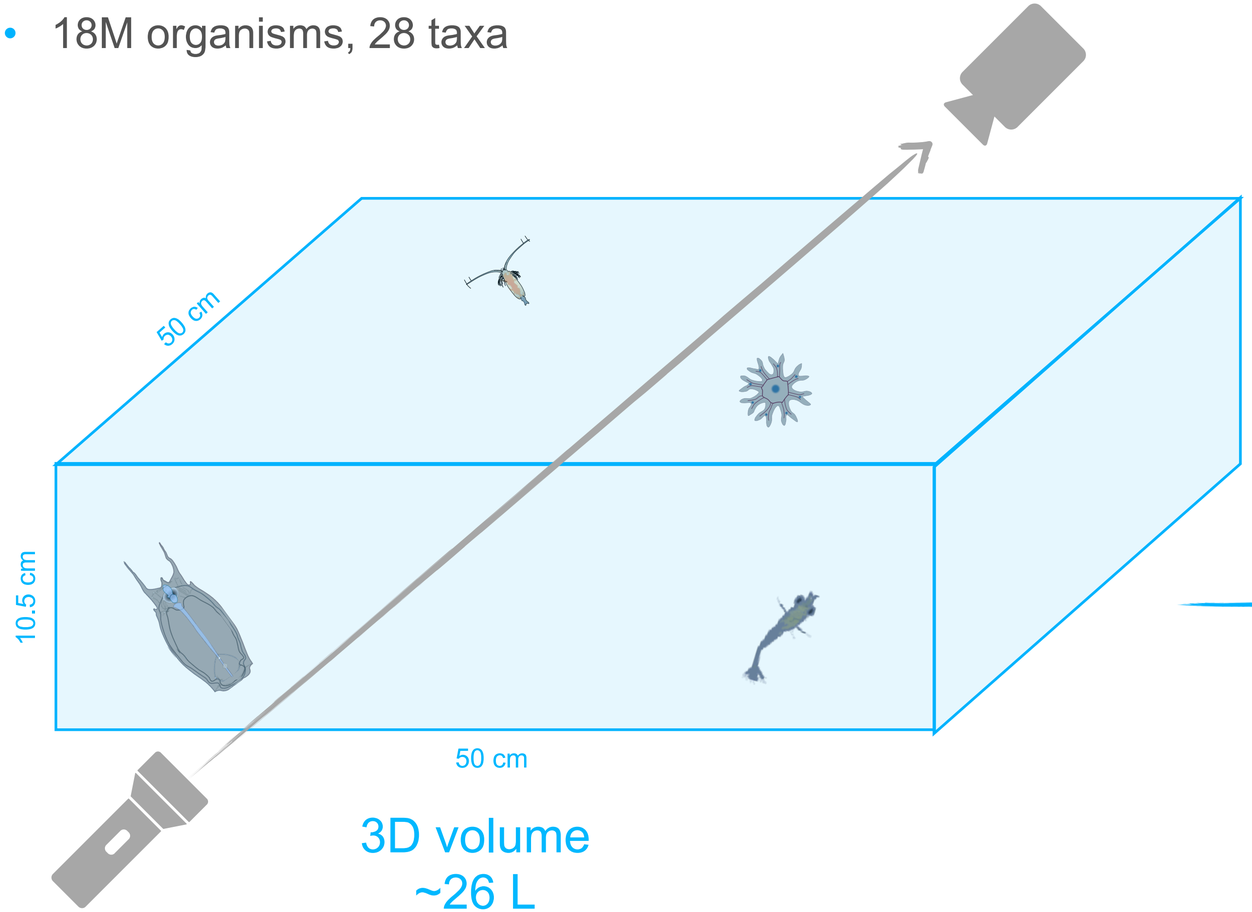
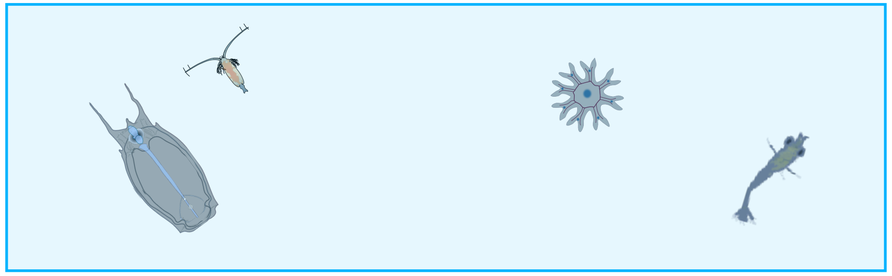
In Situ Ichthyoplankton Imaging System

- 250 µm - 10 cm
- > 100 L s^{-1}, ~ undisturbed organisms
- 18M organisms, 28 taxa





3D volume
~26 L



2D image

PLANKTON DISTANCES VS NULL DISTANCES

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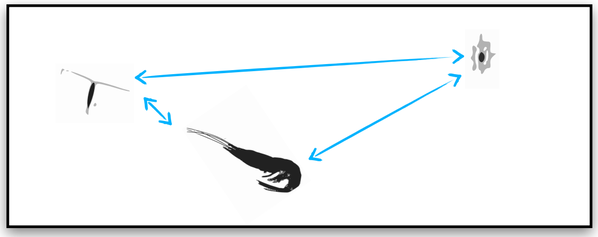
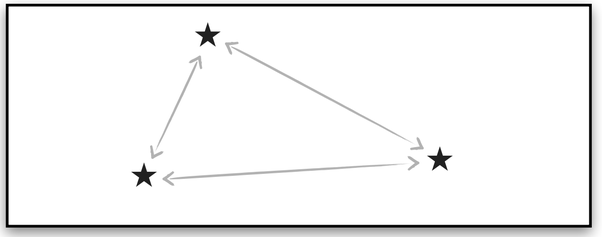
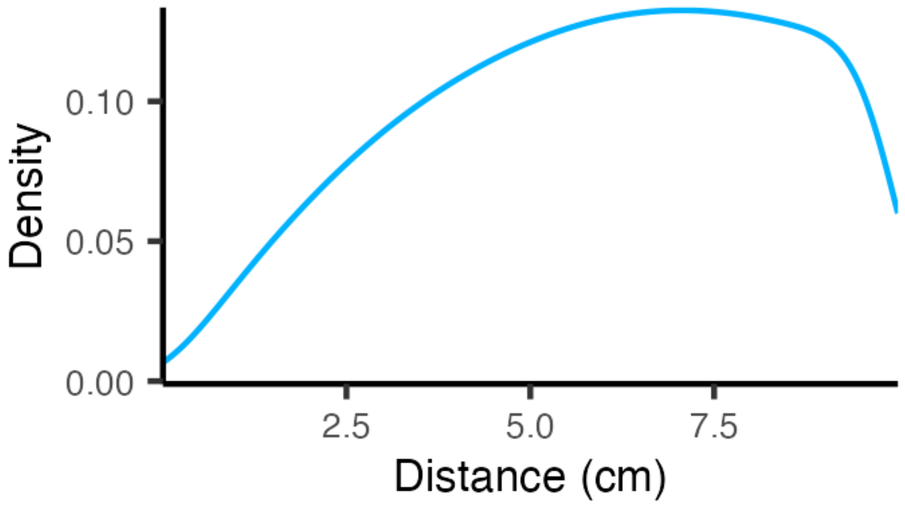
Plankton distances



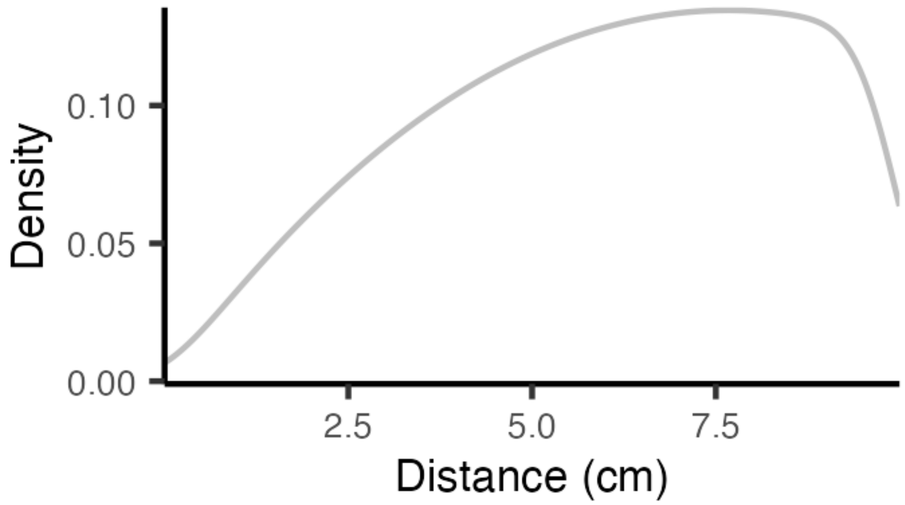
Synthetic but preserving:
- number of images
- number of objects per image
- **number of distances**

Null distances

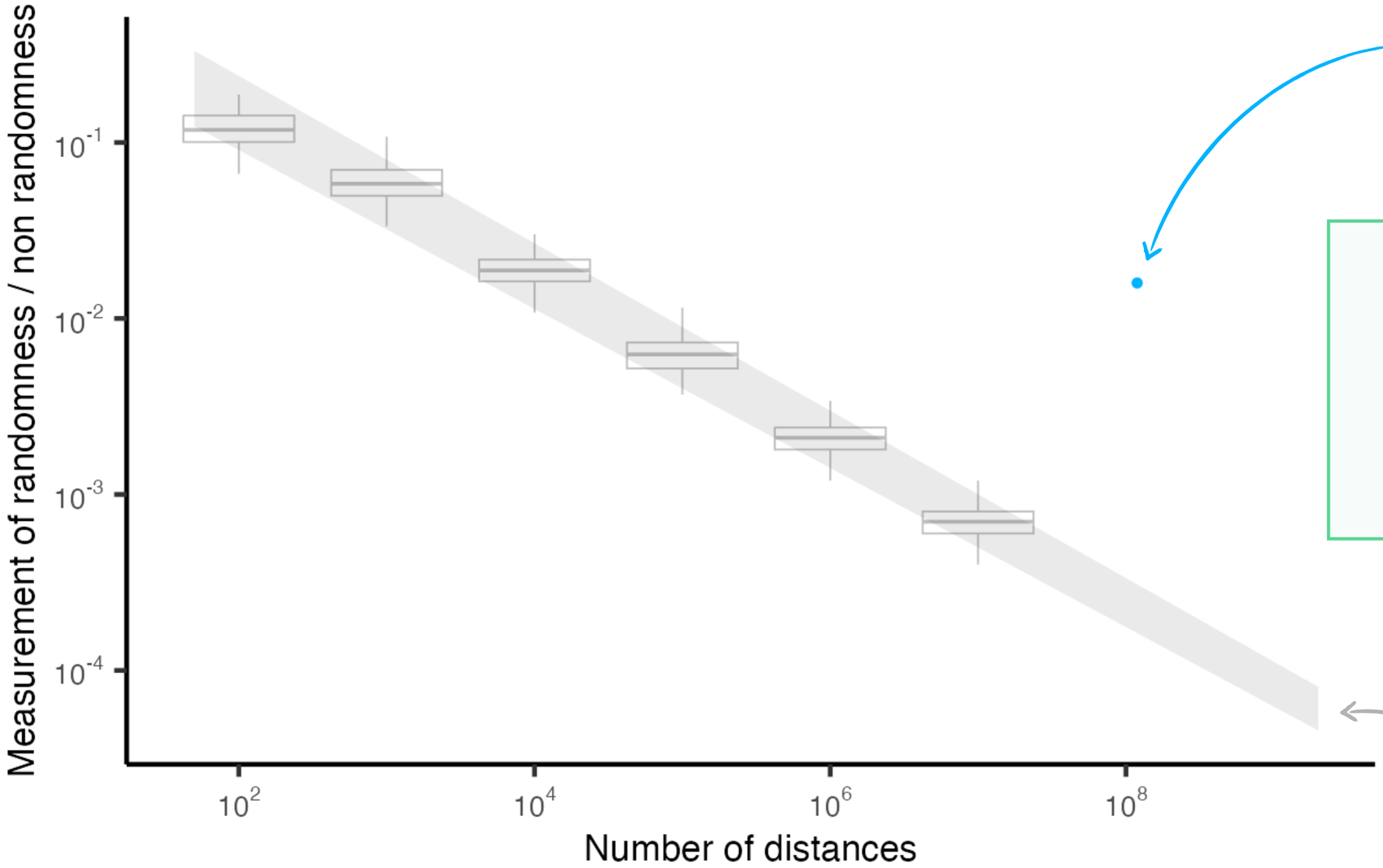




Differences?
→ potential interaction



ALL DISTANCES

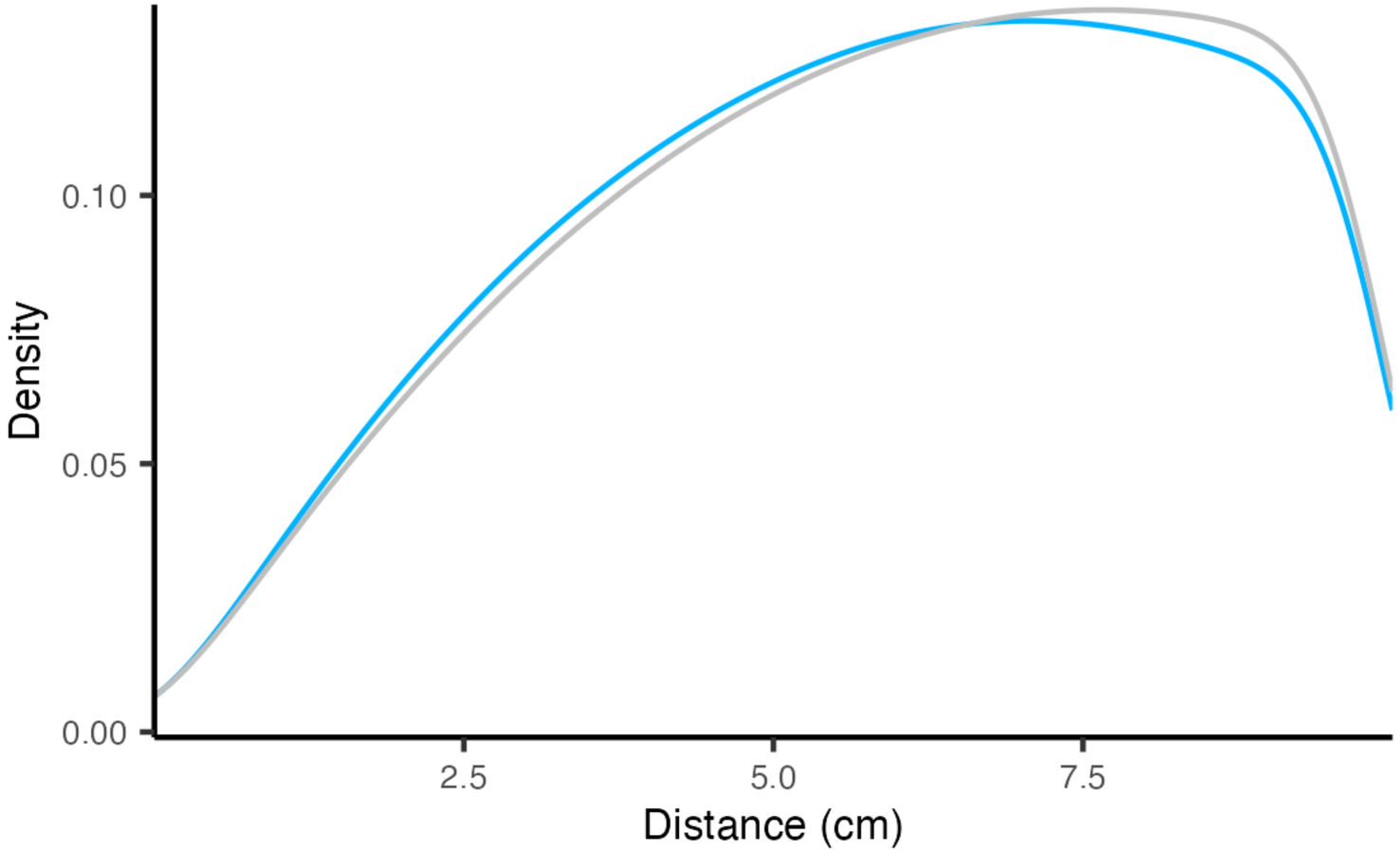


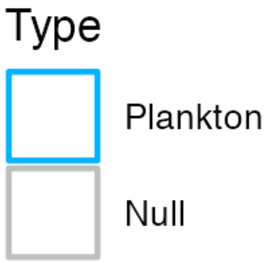
plankton distances

Plankton distances differ from those expected under a random distribution.

Area of randomness
Not significantly different from random

ALL DISTANCES





Planktonic organisms are closer than if randomly distributed.

INTRA-TAXONOMIC DISTANCES

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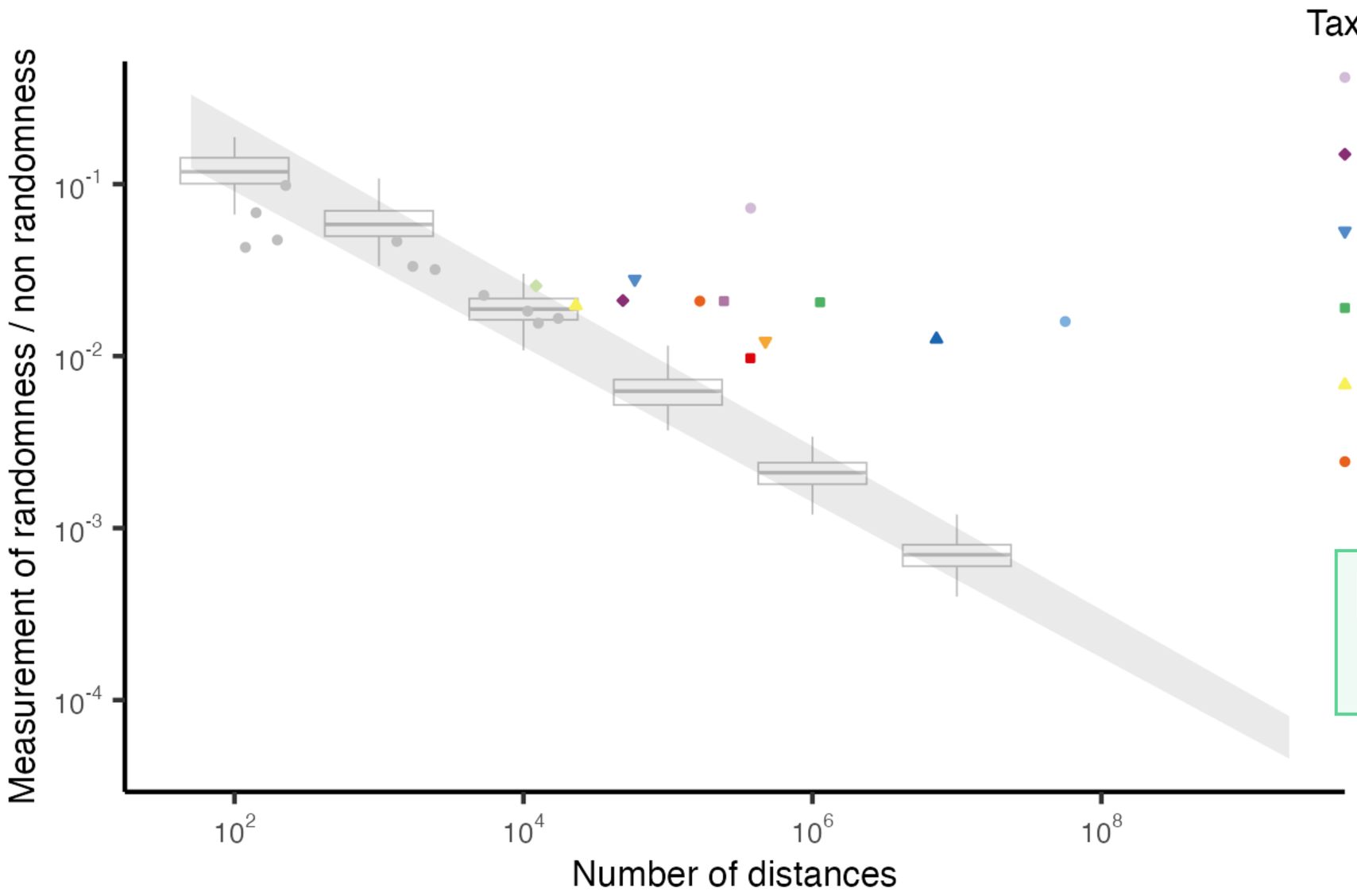
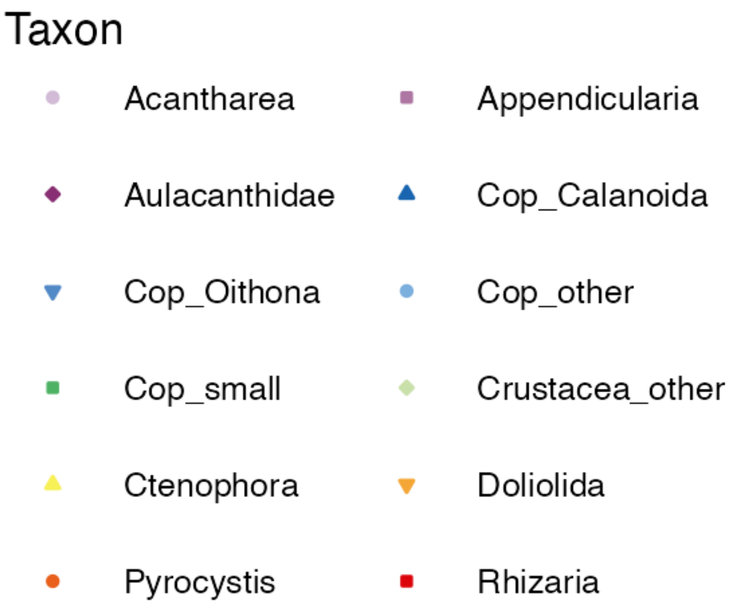
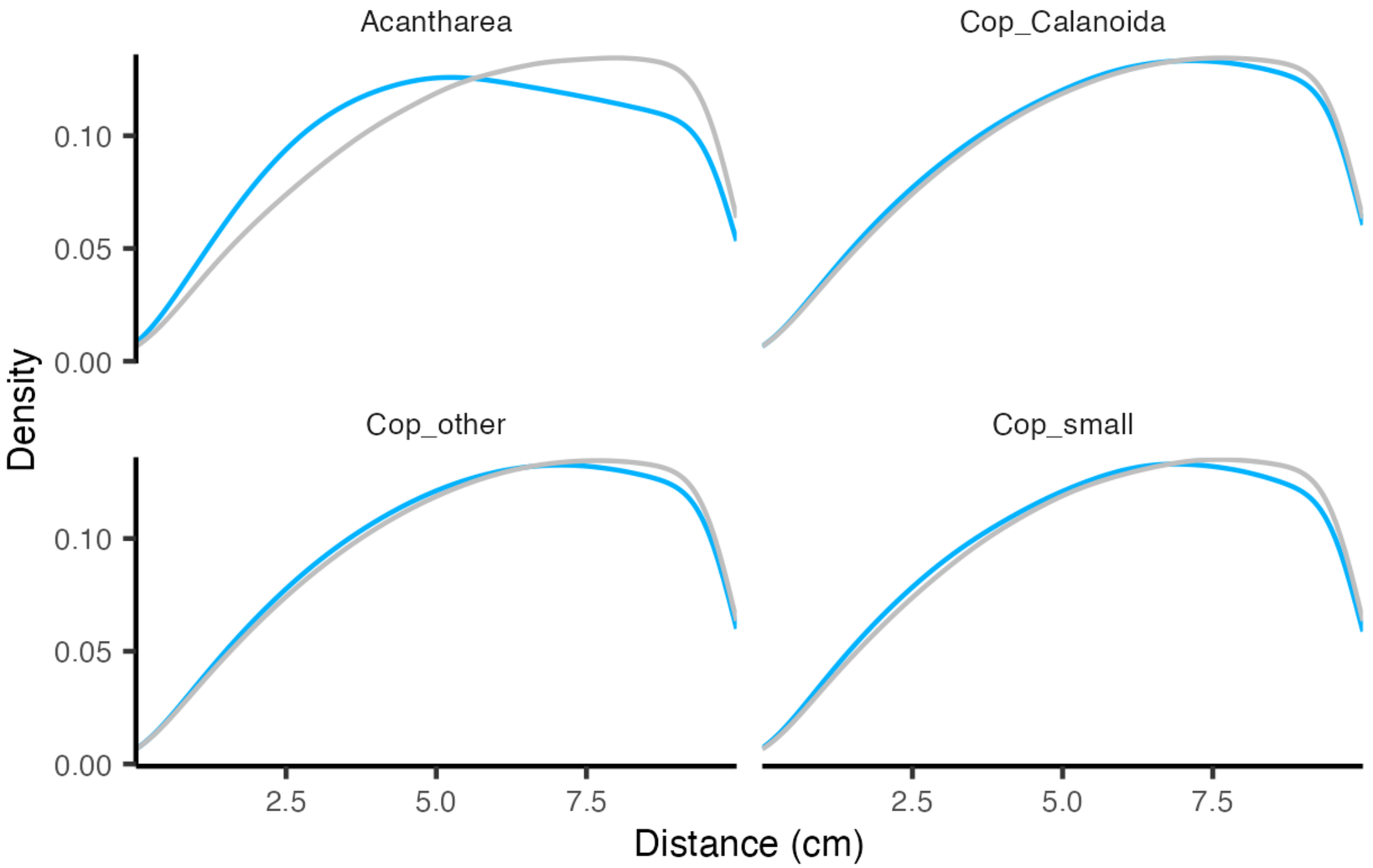
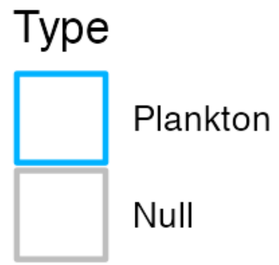




Non random distances for ~10 taxa.

INTRA-TAXONOMIC DISTANCES





Organisms are closer than expected.

INTER-TAXONOMIC DISTANCES

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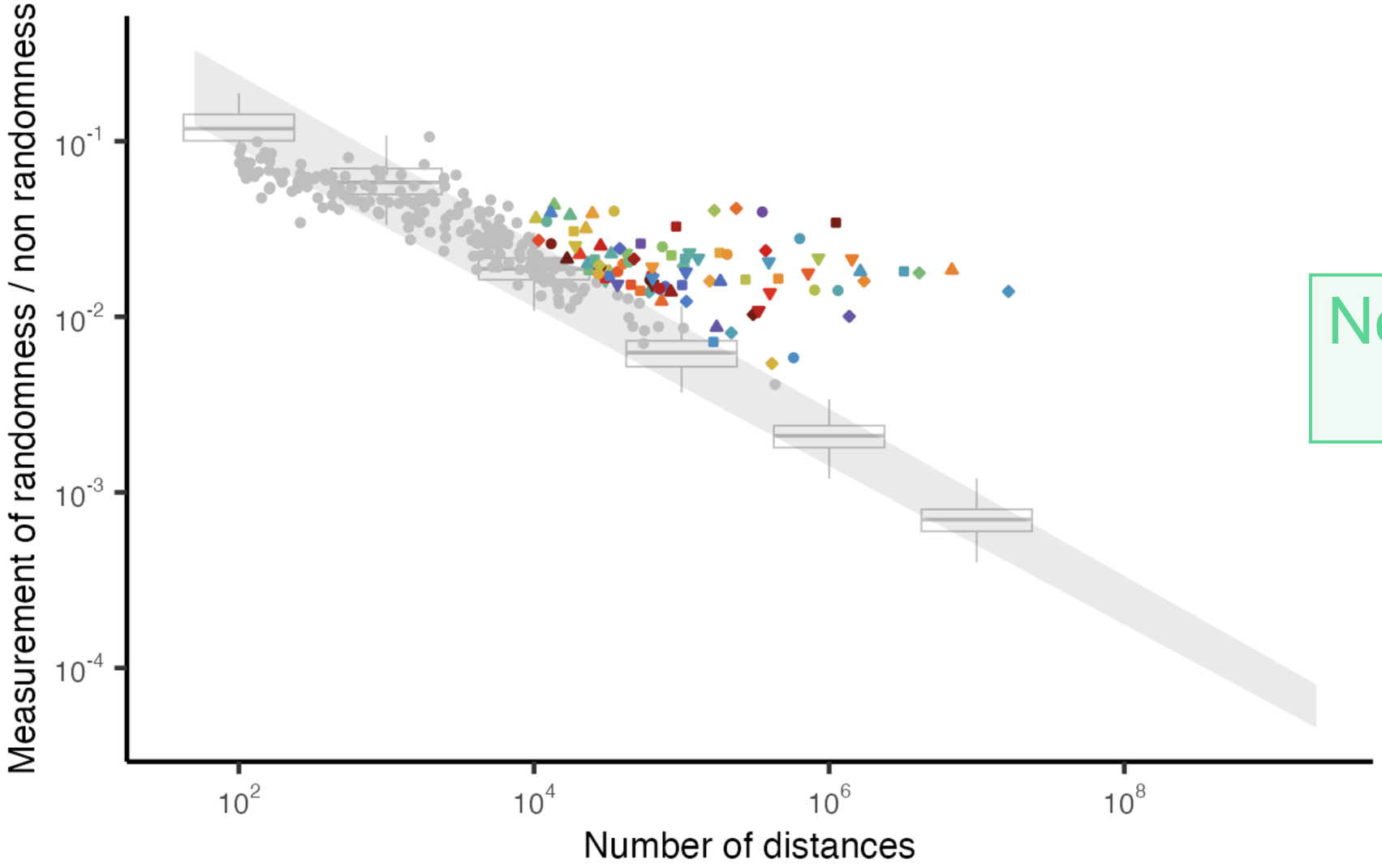
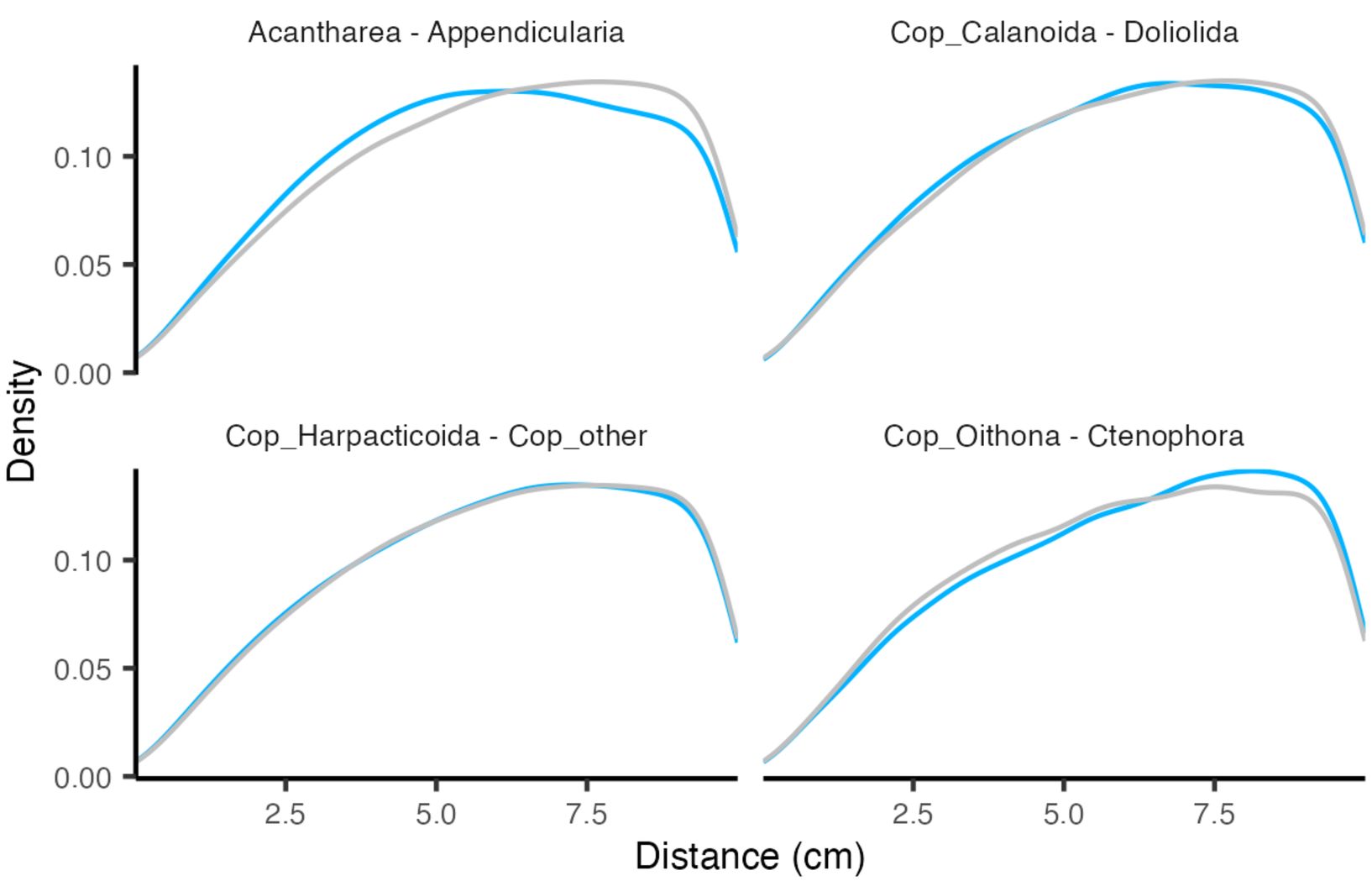
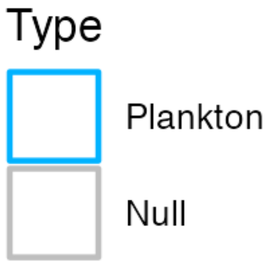


Non random distances for ~90 pairs.

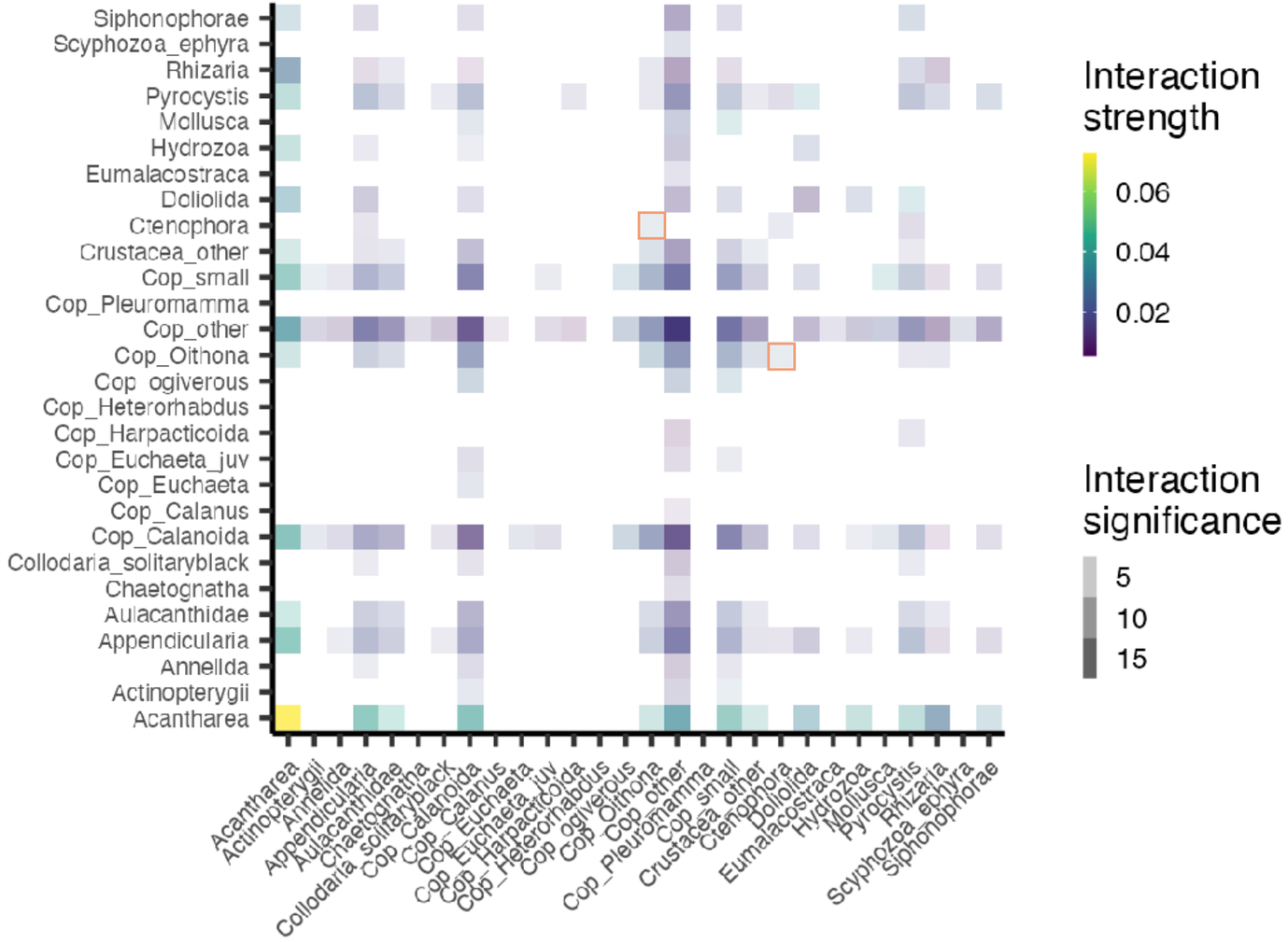
INTER-TAXONOMIC DISTANCES





Pairs are closer than expected **except one**.

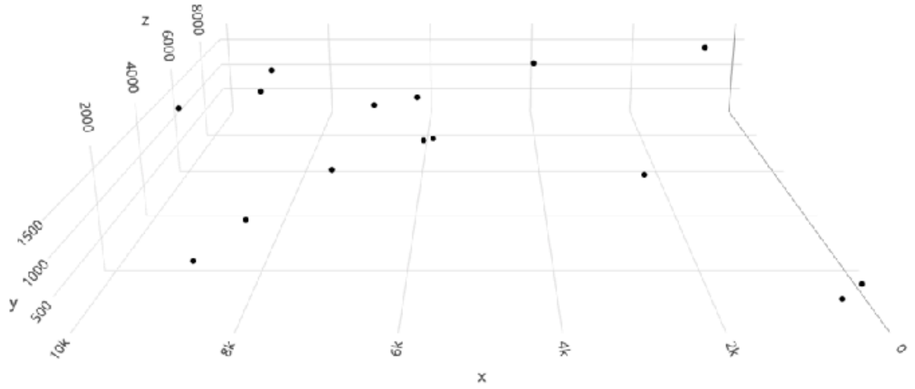
INTERACTION MATRIX & NETWORK



Next step: build a distance-based network.

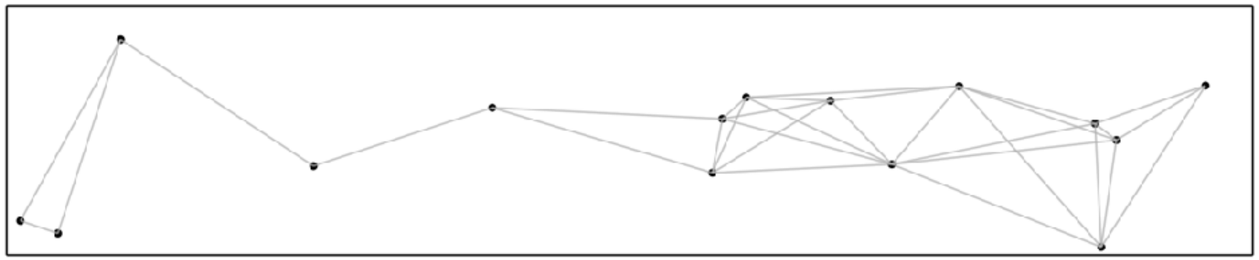
INTERPRETATION: A SIMPLE 3D AGENT-BASED MODEL

Random points in 3D

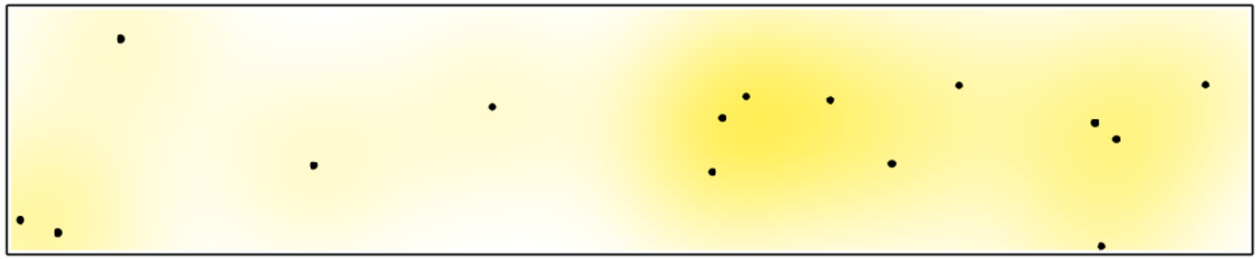


Original points

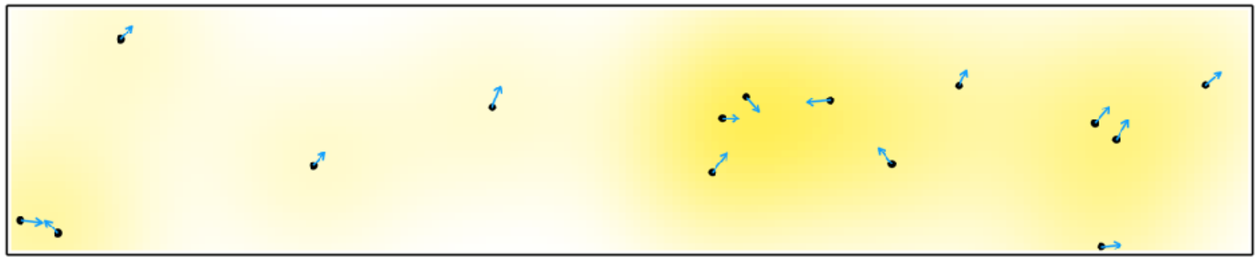
Distances before ↔ null distances



Density

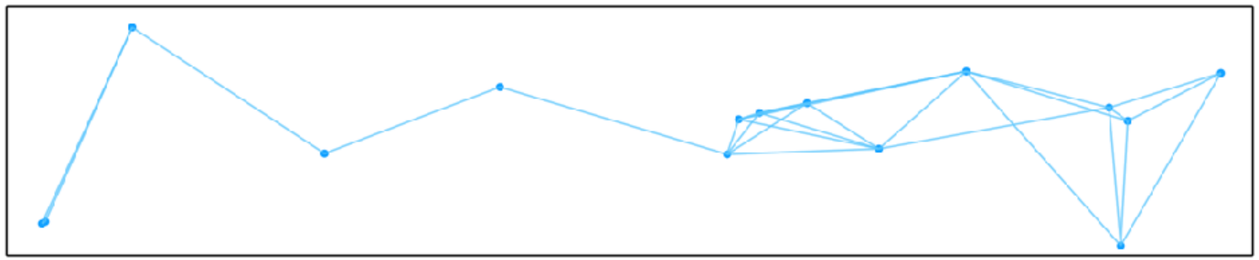


Displacement



New points

Distances after ↔ plankton distances



INTERPRETATION: A SIMPLE 3D AGENT-BASED MODEL

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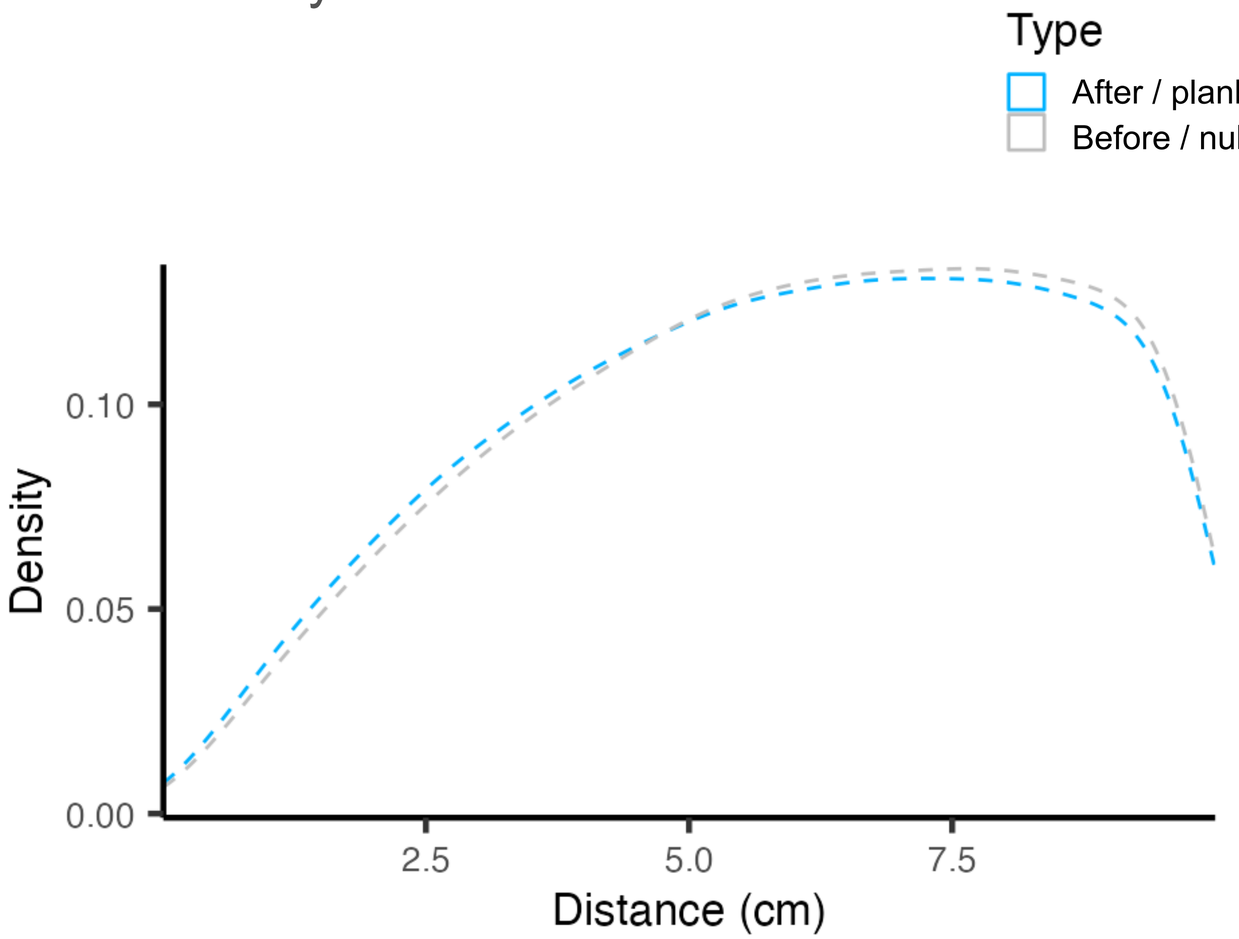
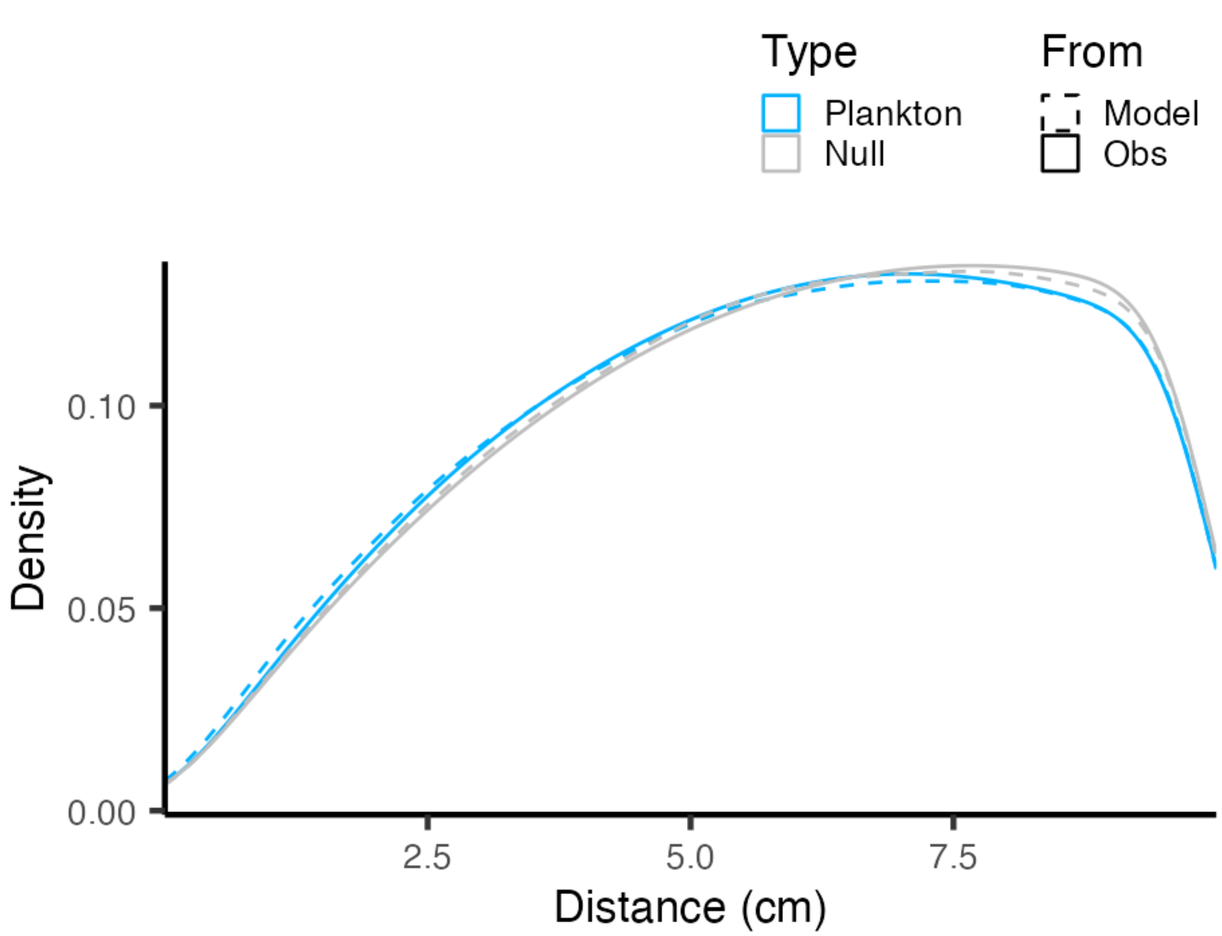
Model only



Distances get shorter

Model VS observations



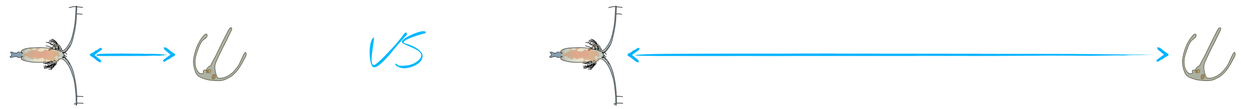
Good reproduction of observations

CONCLUSION AND NEXT STEPS

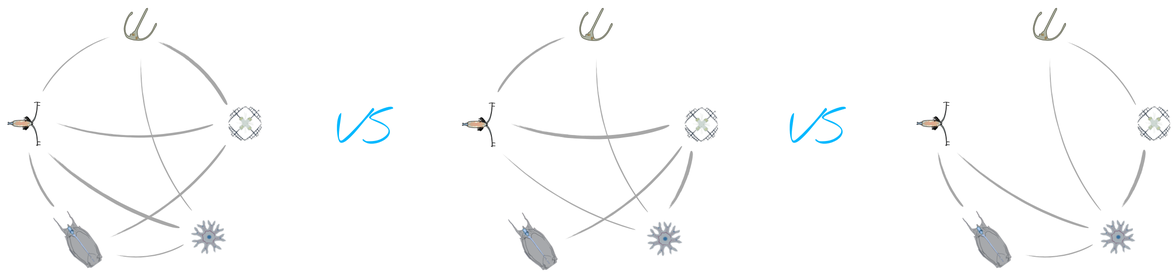
Distances between planktonic organisms carry ecological information.

Next steps

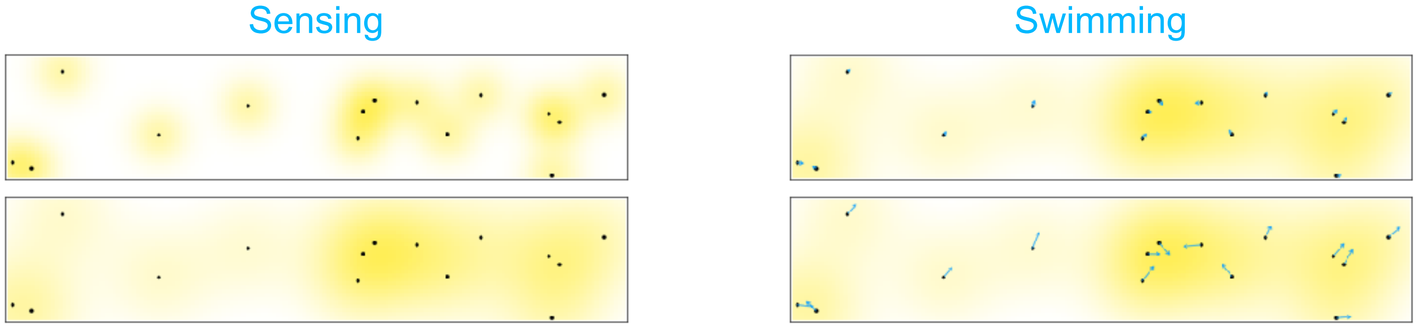
- Range of considered distances



- Networks
  - distance-based
  - co-occurence
  - empirical



- Fine-tune the agent-based model



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Thank you