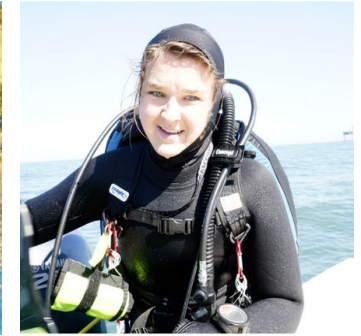
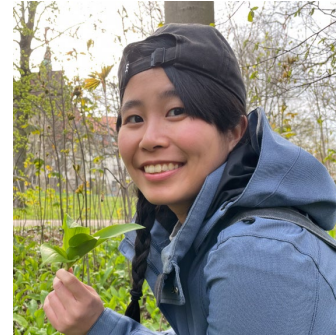


Diversity in Disguise: Leveraging Cryptic Coral Diversity for Conservation in South Florida

Carsten Grupstra
Assistant Professor
Department of Biological Sciences
Florida Atlantic University
Davie, FL



Acknowledgements



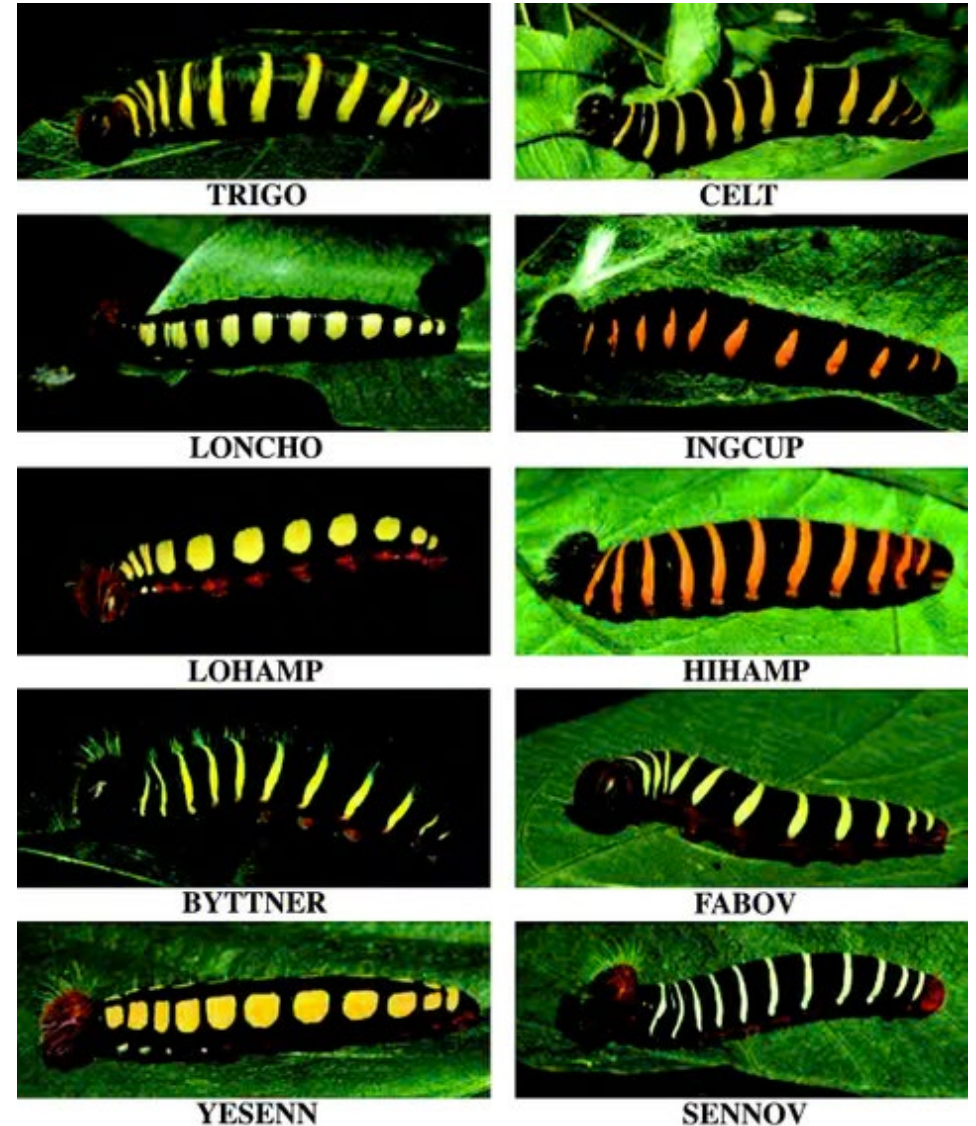
LTR:

- Dr. Sarah Davies
- Dr. Shelby Gantt
- Dr. Ben Glass
- Ally Swank
- Mu-Han Chen
- Payton Bryant
- Dr. Hannah Aichelman



Cryptic diversity

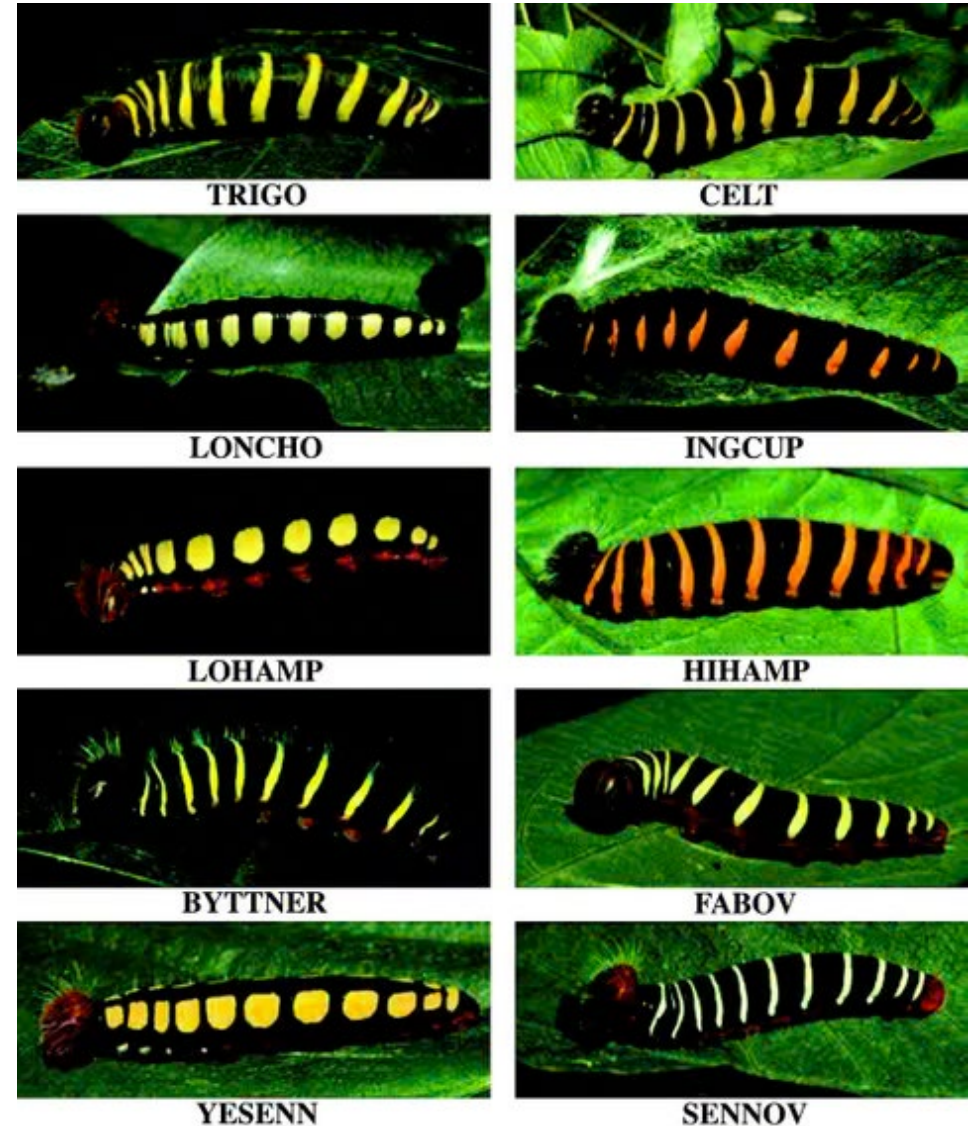
- Genetically distinct but morphologically similar populations



Caterpillars of the two-barred flasher butterfly hint at the existence of cryptic diversity.

Cryptic diversity

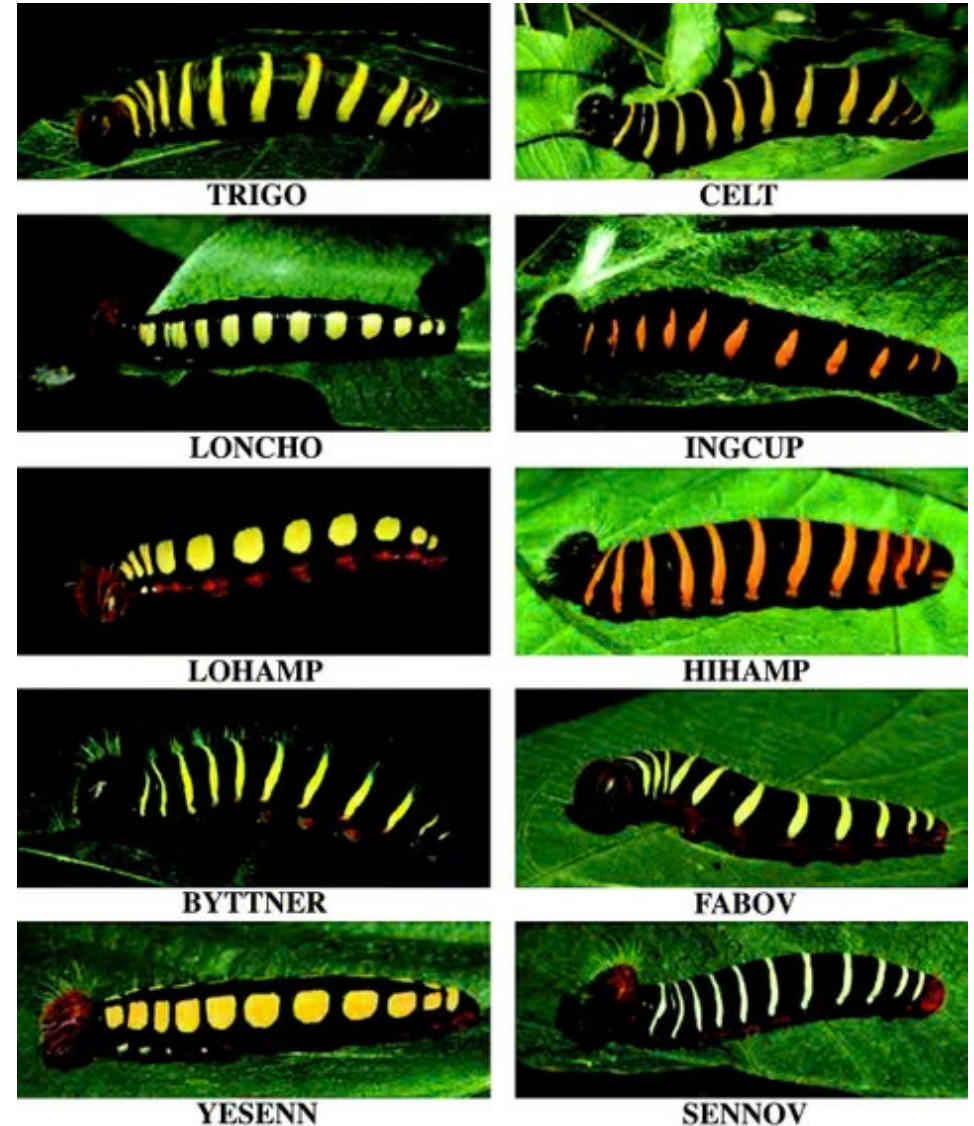
- Genetically distinct but morphologically similar populations
- Important for biodiversity accounts and management (e.g., population sizes)



Caterpillars of the two-barred flasher butterfly hint at the existence of cryptic diversity.

Cryptic diversity

- Genetically distinct but morphologically similar populations
- Important for biodiversity accounts and management (e.g., population sizes)
- Genome-wide sequencing methods are uncovering cryptic diversity at increasing rates, including in corals.



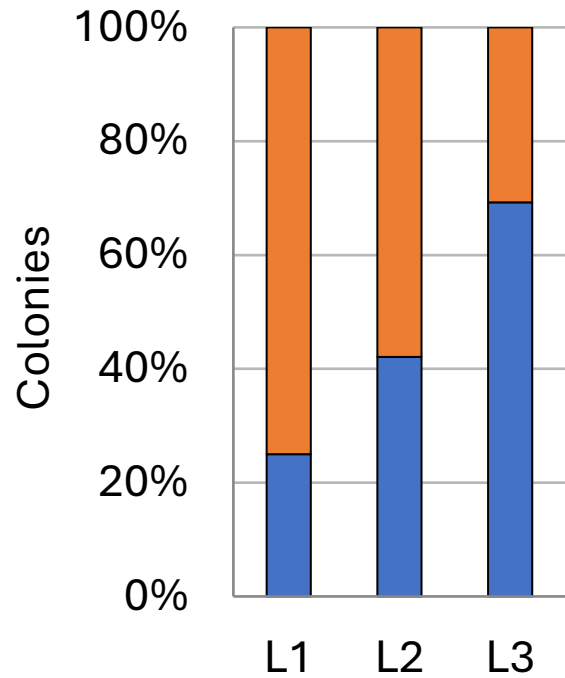
Caterpillars of the two-barred flasher butterfly hint at the existence of cryptic diversity.

Pacific cryptic *Porites*
lineages with differing
bleaching susceptibility

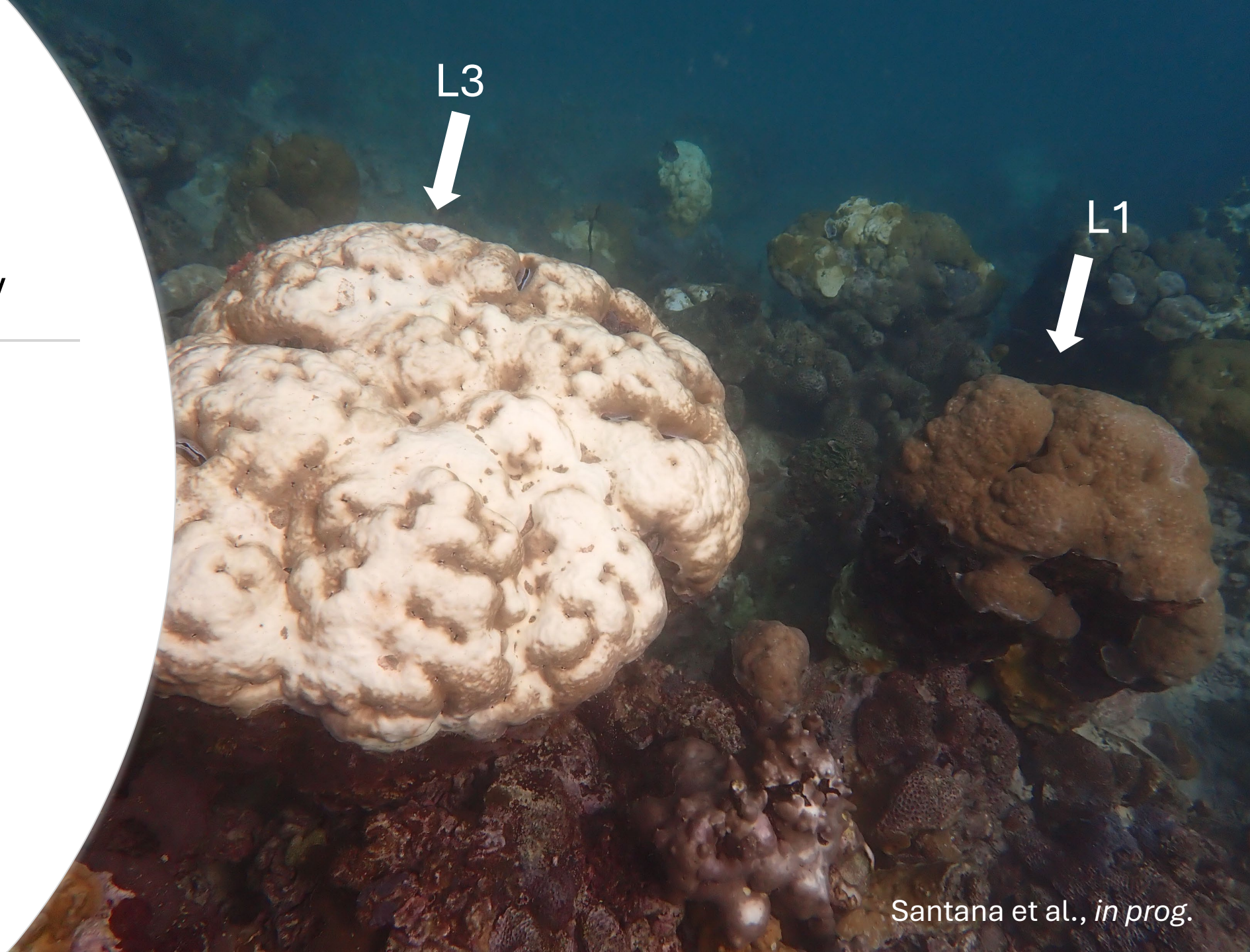


Santana et al., *in prog.*

Pacific cryptic *Porites* lineages with differing bleaching susceptibility



■ Bleached ■ Unbleached

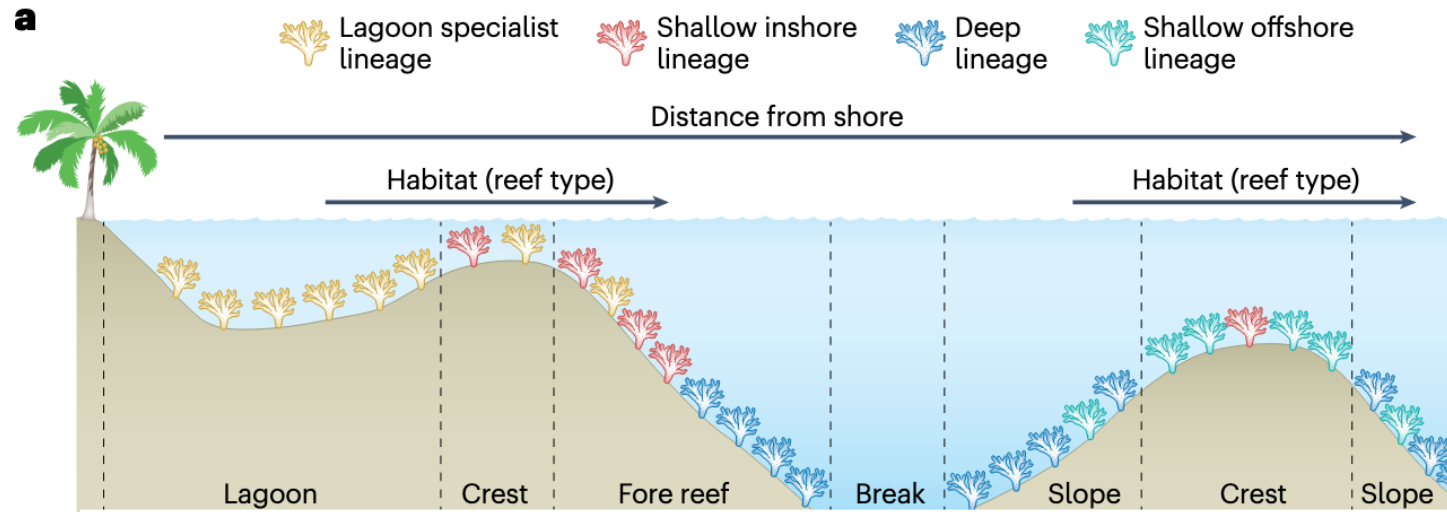


Santana et al., *in prog.*

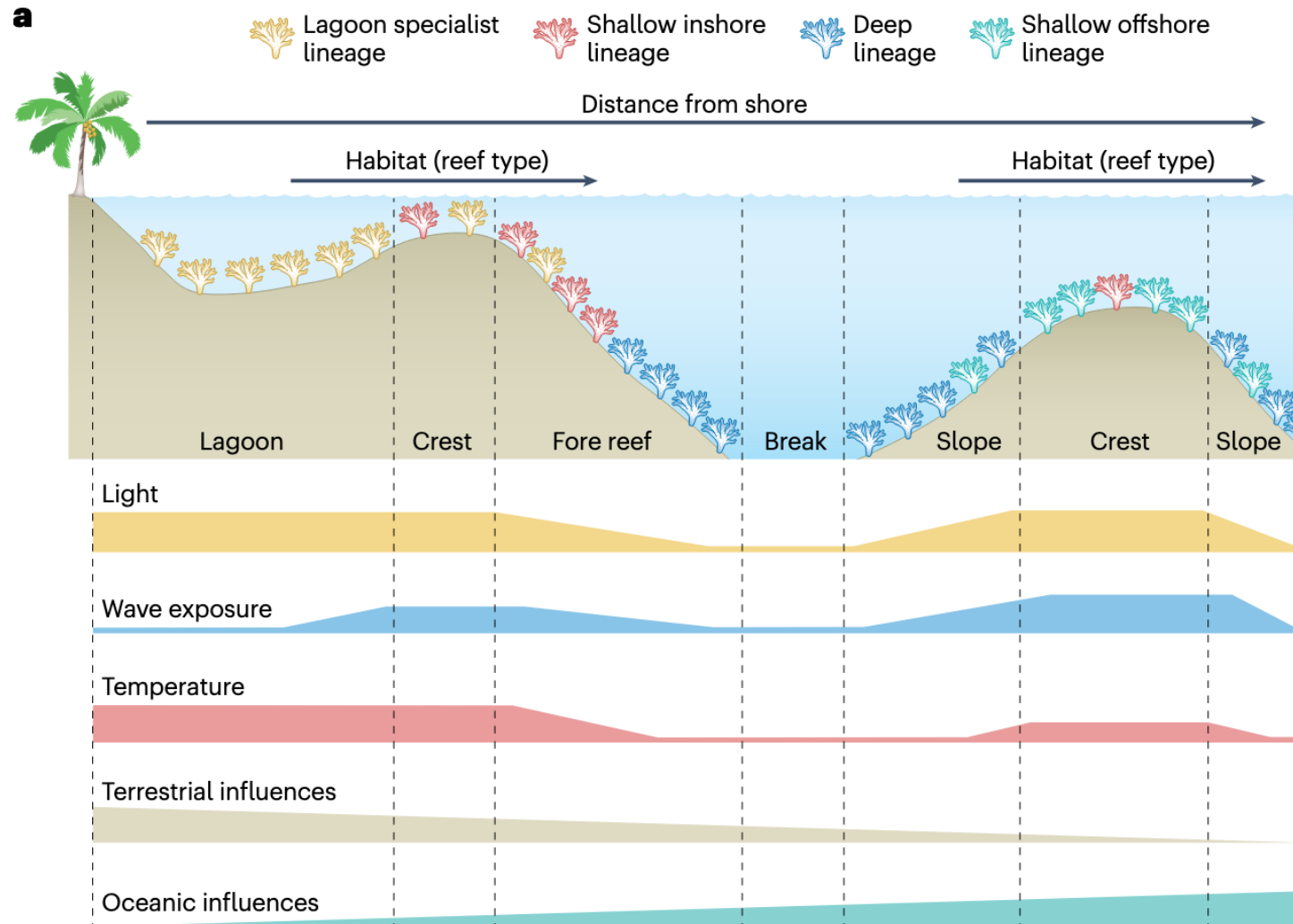
Cryptic lineages are everywhere...

- At least 21 stony coral genera...
 - *Acropora, Agaricia, Coelastrea, Diploria, Favia, Fungia, Galaxea, Leptoseris, Madracis, Montastrea, Orbicella, Pachyseris, Plesiastrea, Pocillopora, Porites, Psammocora, Pseudodiploria, Sreiatopora, Siderastrea, Stephanocoenia, Stylophora*
- ... Including corals in the Atlantic Ocean and the Florida Keys.

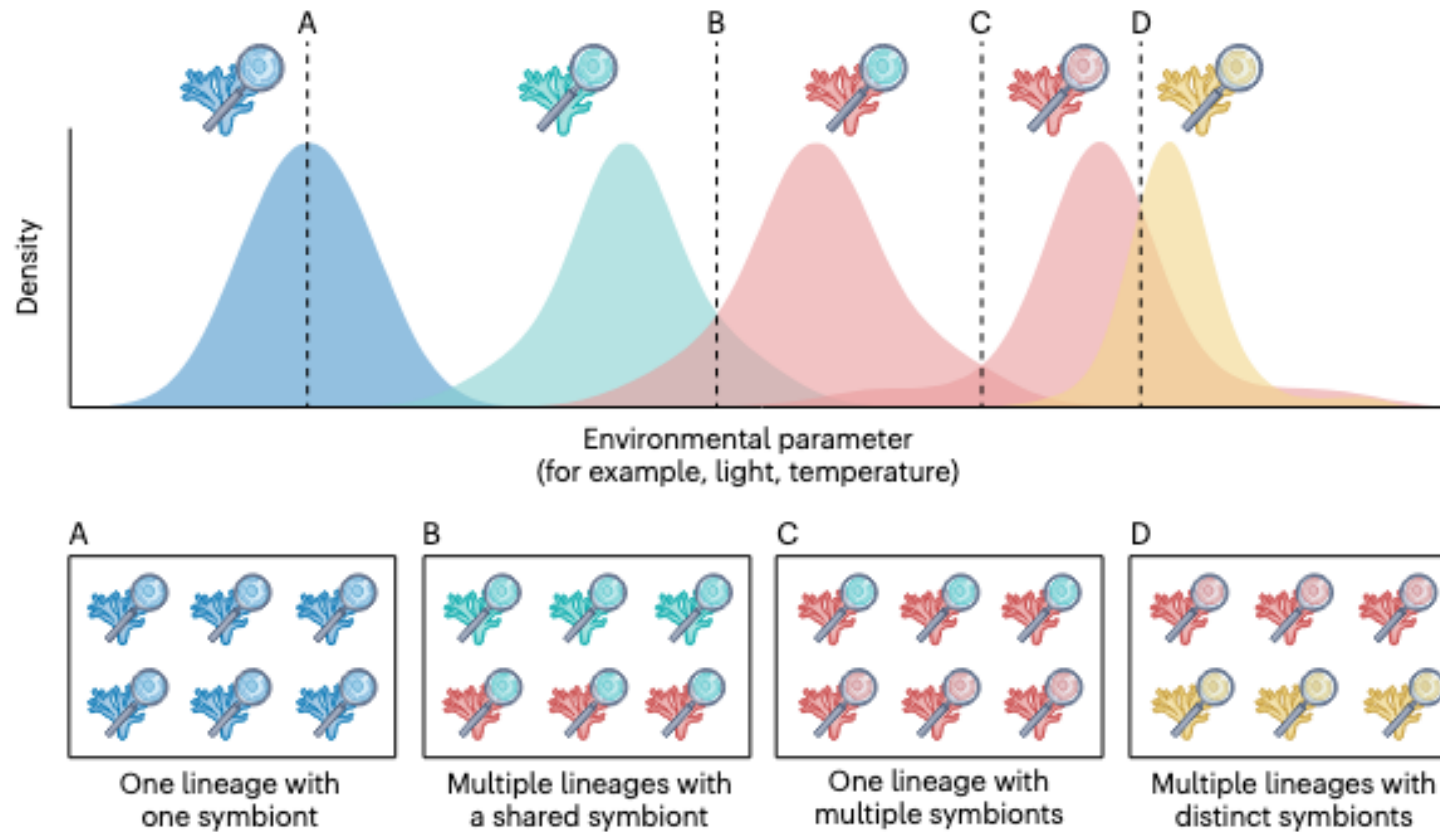
Cryptic lineages often have differing distributions



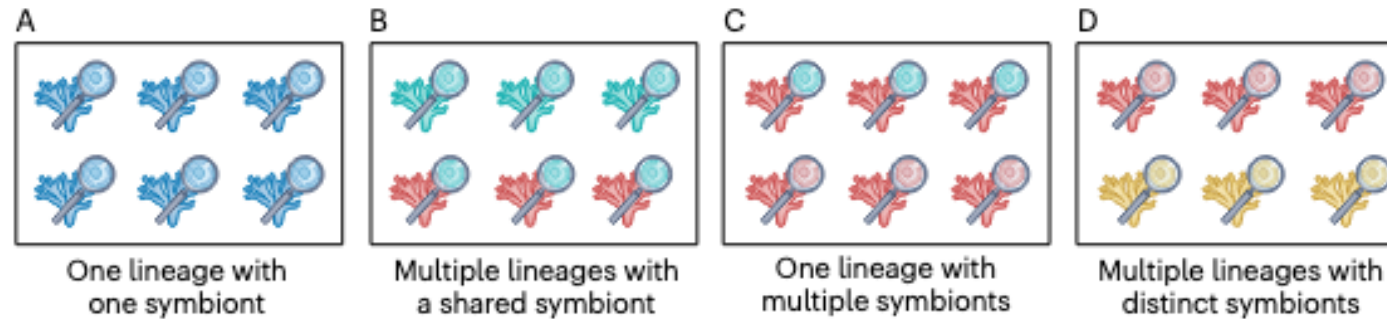
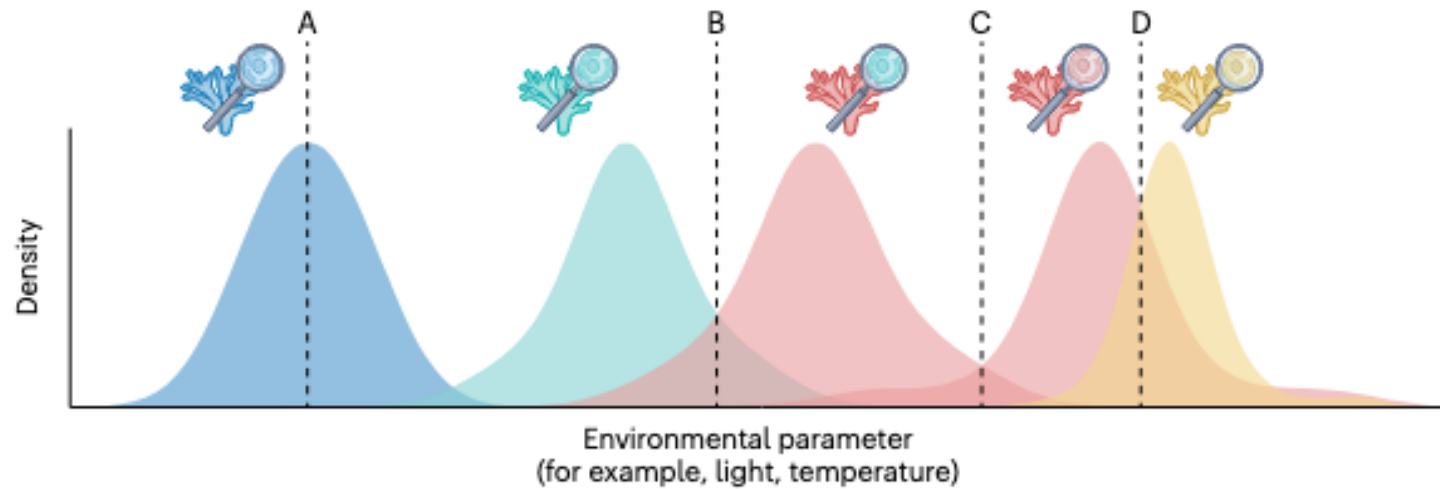
Cryptic lineages often have differing distributions



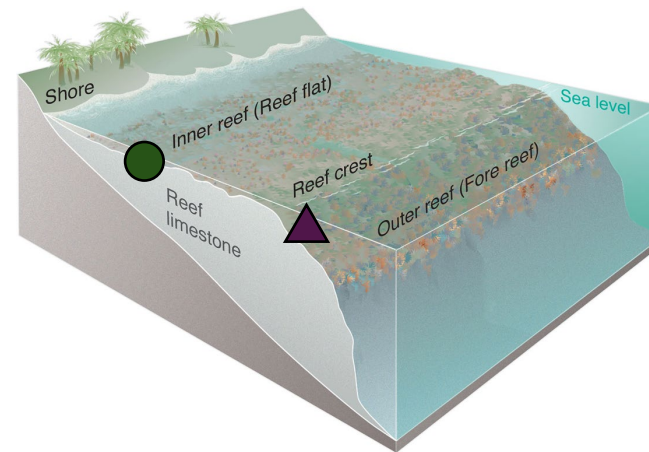
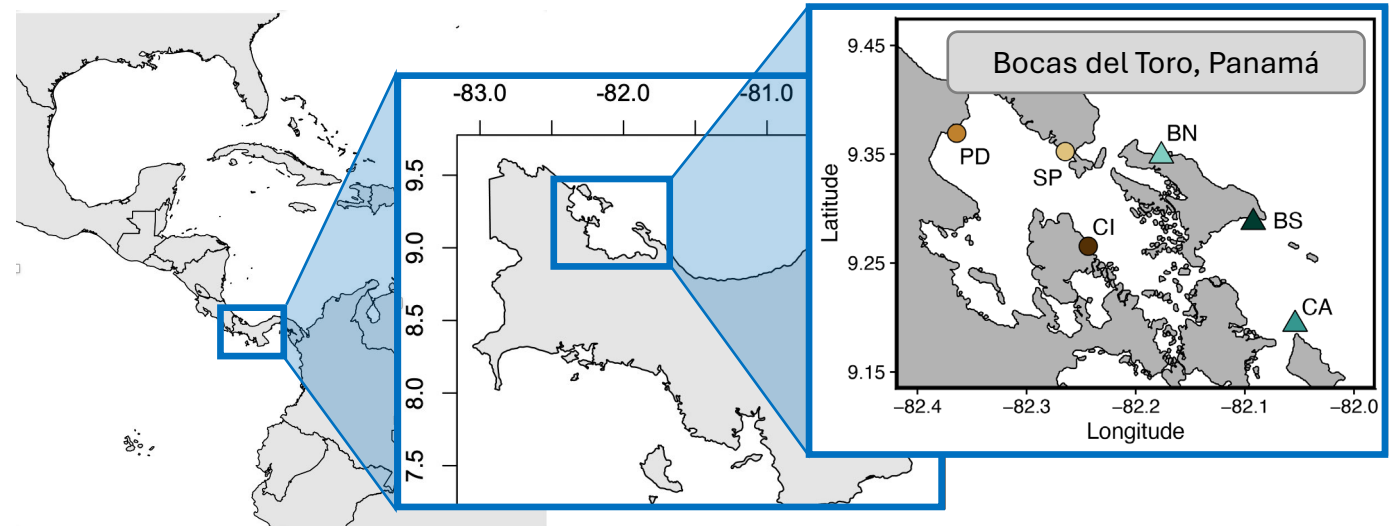
..and they often associate with distinct
Symbiodiniaceae species or strains



How do cryptic lineages in different habitats differ in terms of phenomes and algal partnerships, how does this influence thermal tolerance, and how can this be leveraged for conservation and restoration?



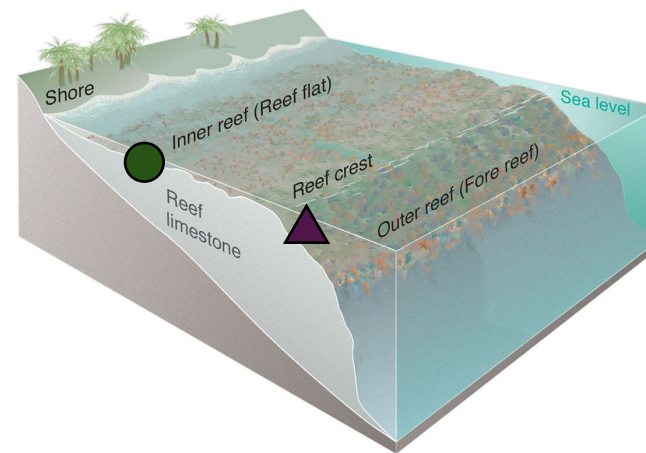
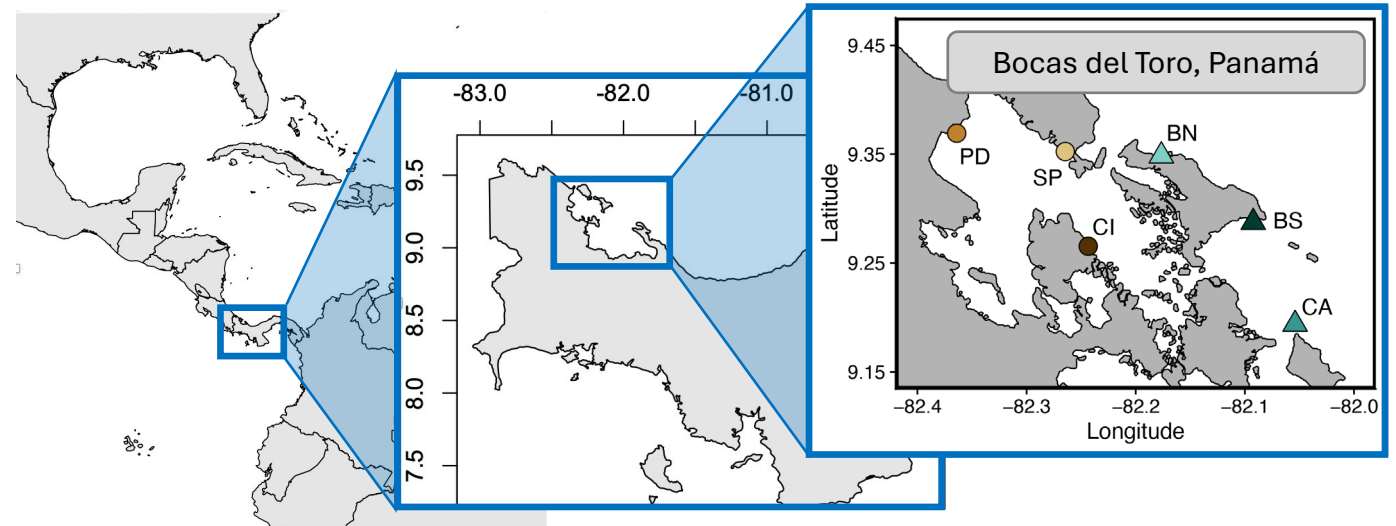
Cryptic lineages rule the reef



*Siderastrea
siderea*

Cryptic lineages rule the reef

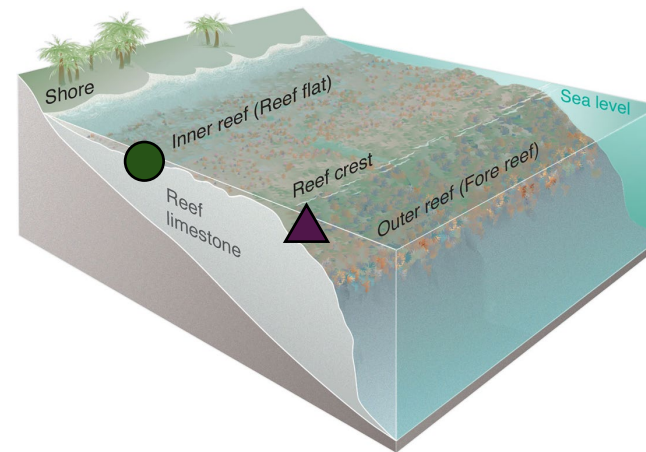
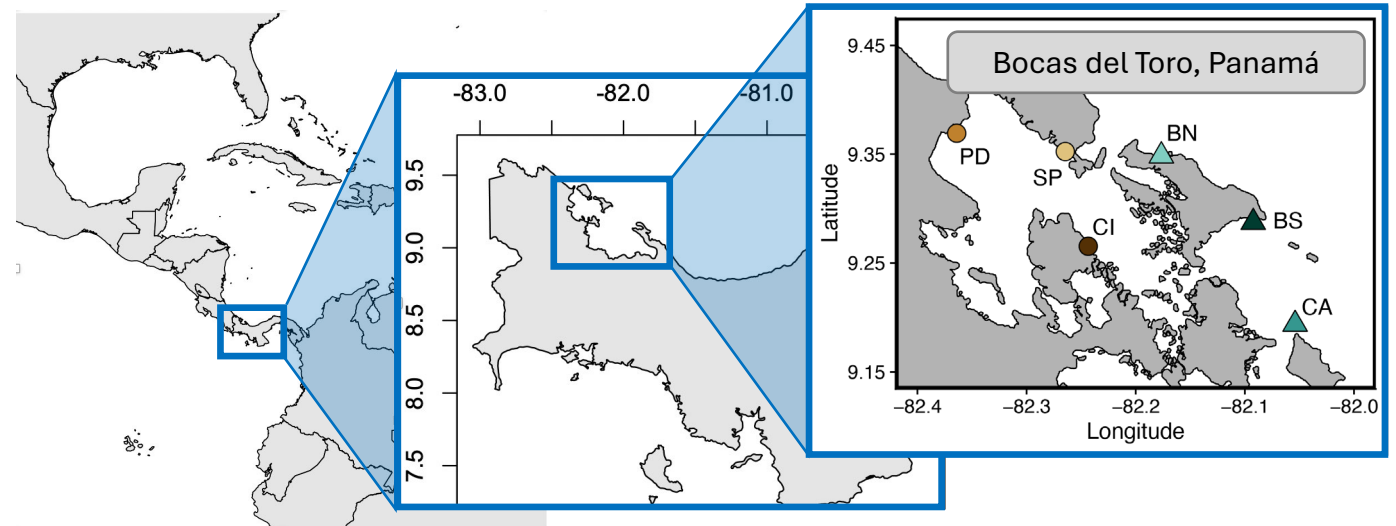
- Distributions across depths



*Siderastrea
siderea*

Cryptic lineages rule the reef

- Distributions across depths
- Morphological differences

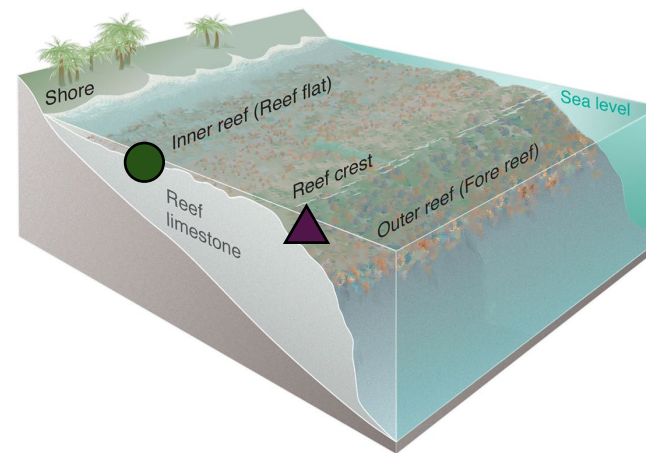
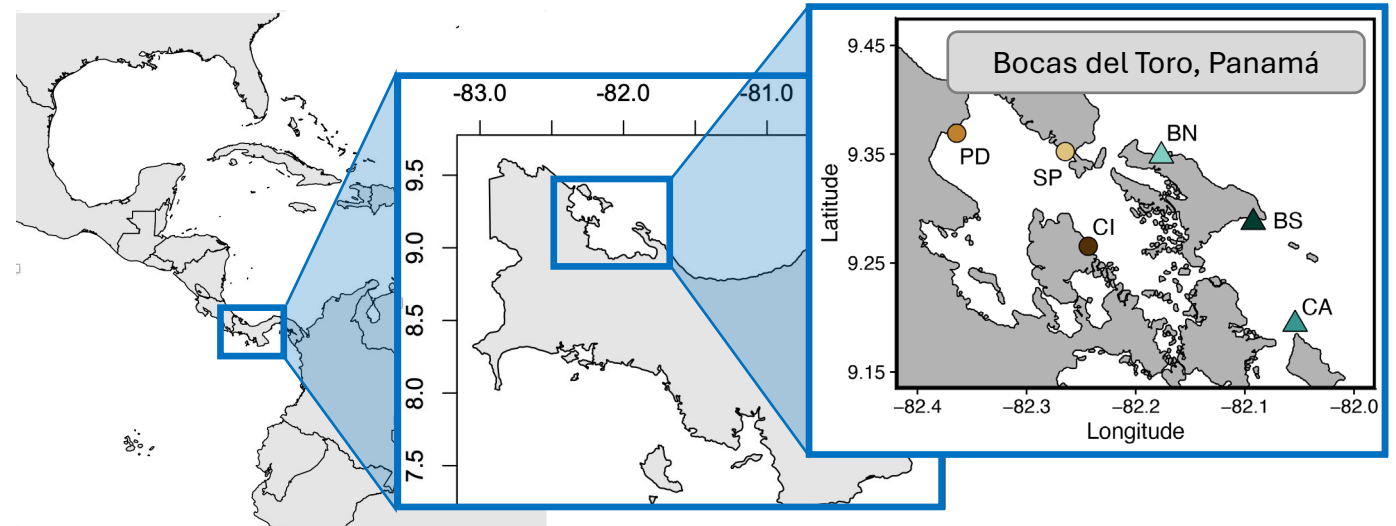


*Siderastrea
siderea*

Bocas del Toro, Panama

Cryptic lineages rule the reef

- Distributions across depths
- Morphological differences
- Symbiont associations

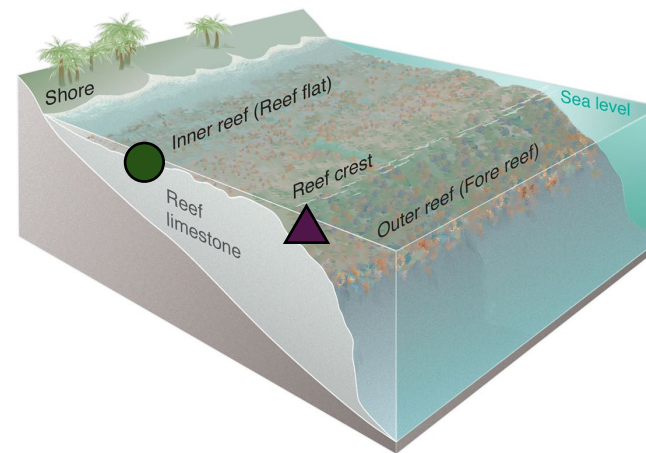
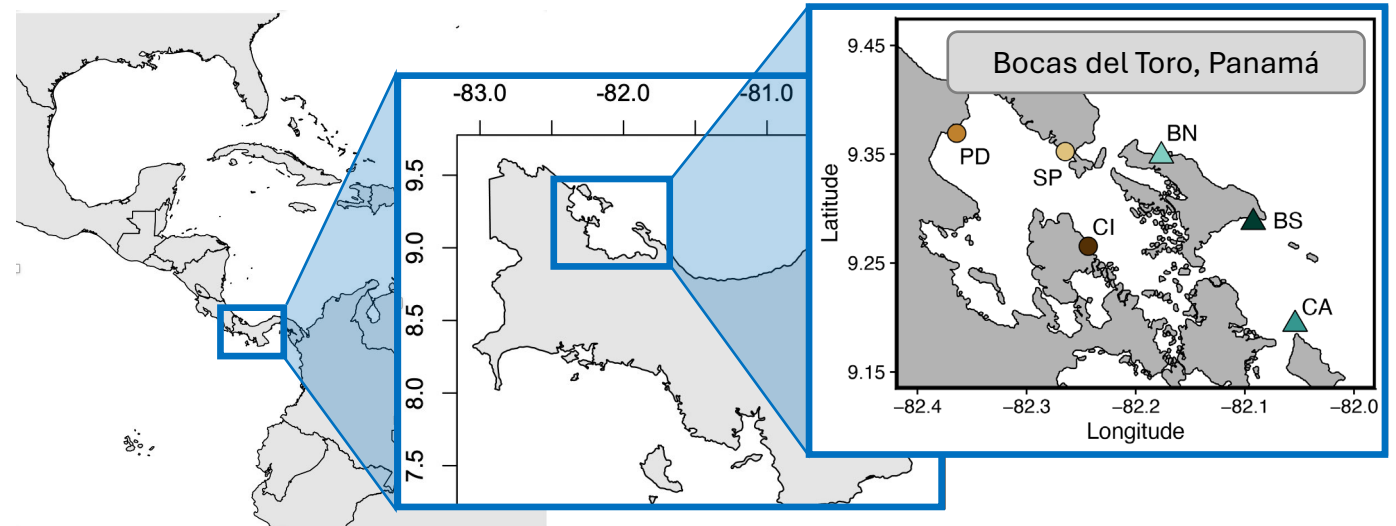


*Siderastrea
siderea*

Bocas del Toro, Panama

Cryptic lineages rule the reef

- Distributions across depths
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- Symbiont associations
- Phenomes

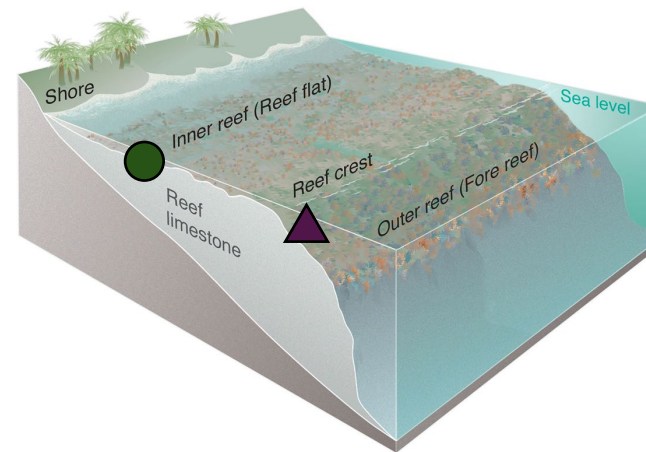
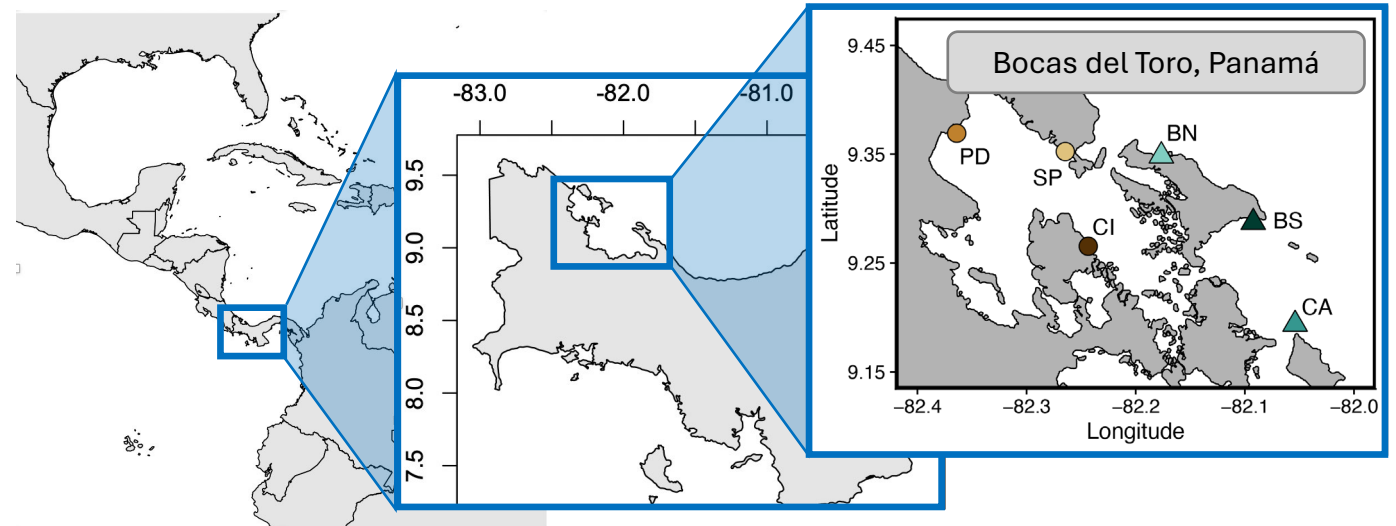


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siderea*

Bocas del Toro, Panama

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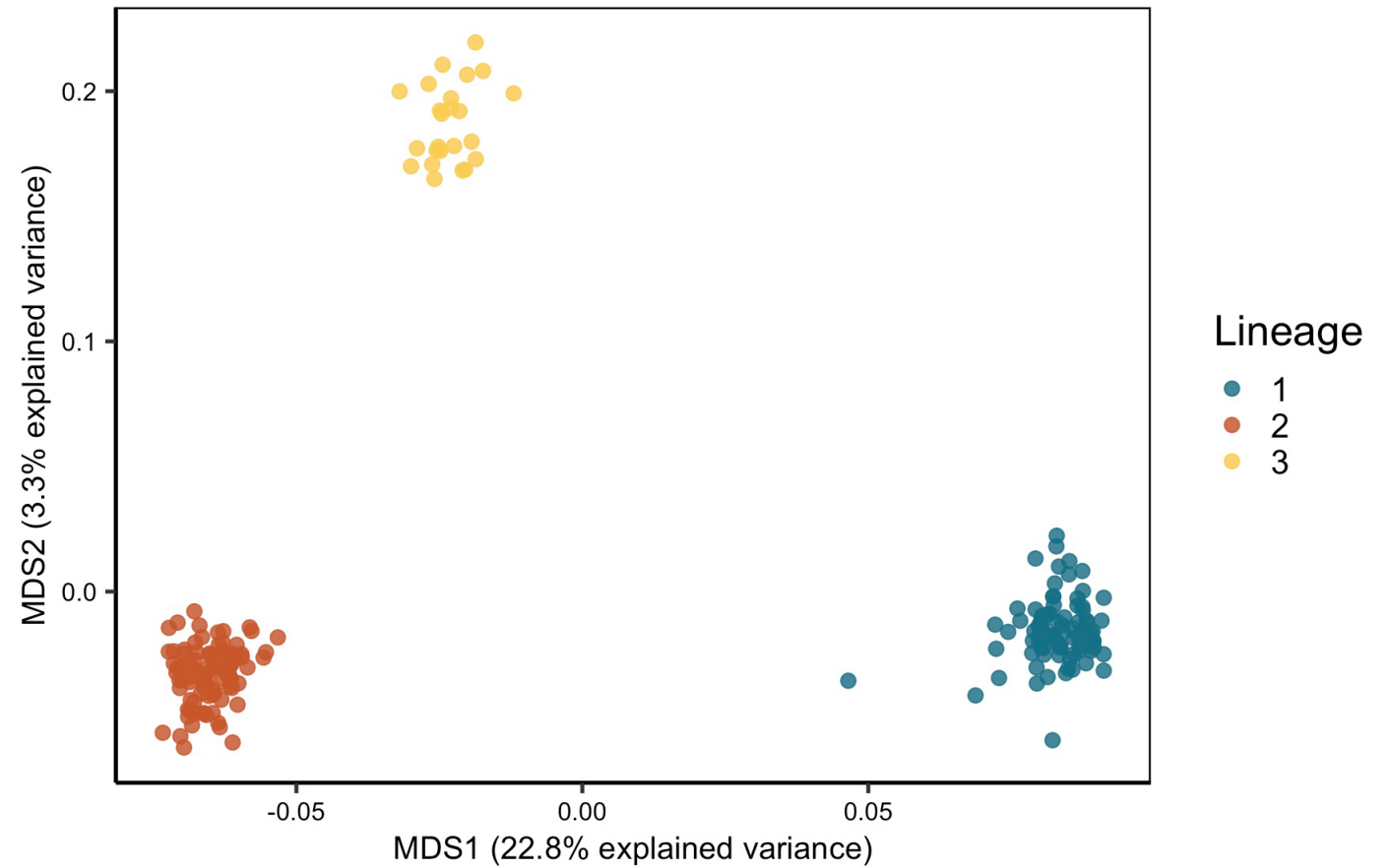
- Distributions across depths
- Morphological differences
- Symbiont associations
- Phenomes
- Bleaching susceptibility



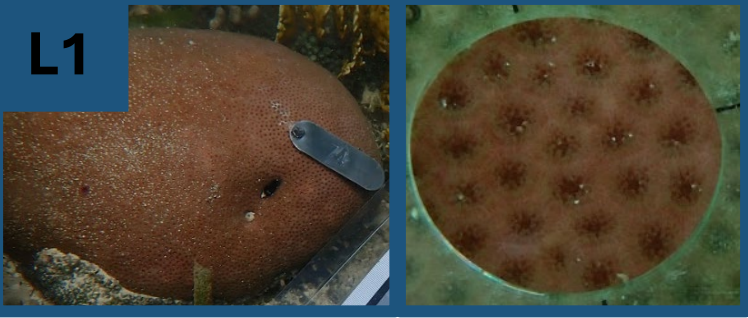
*Siderastrea
siderea*

Bocas del Toro, Panama

Three distinct lineages



L1

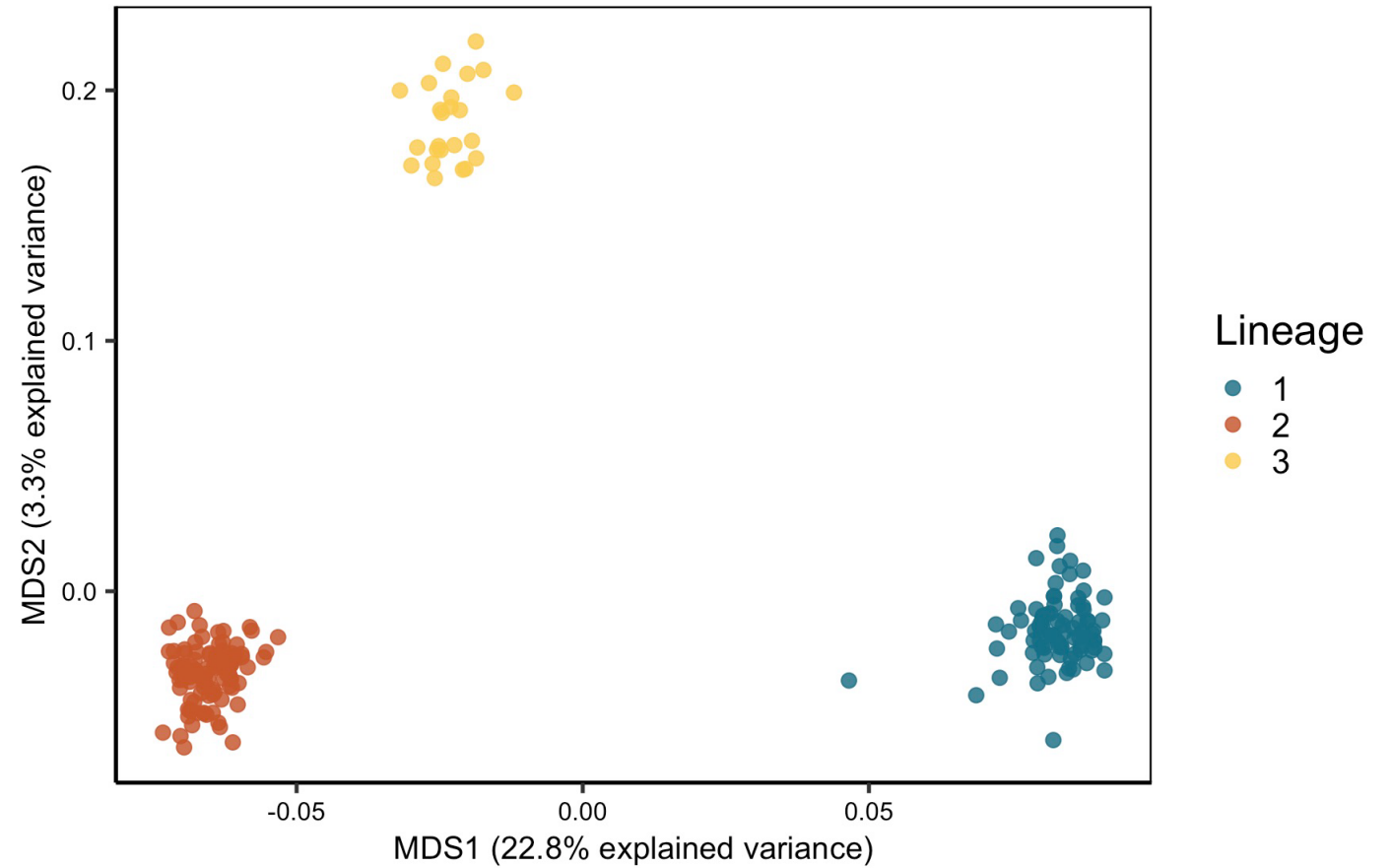


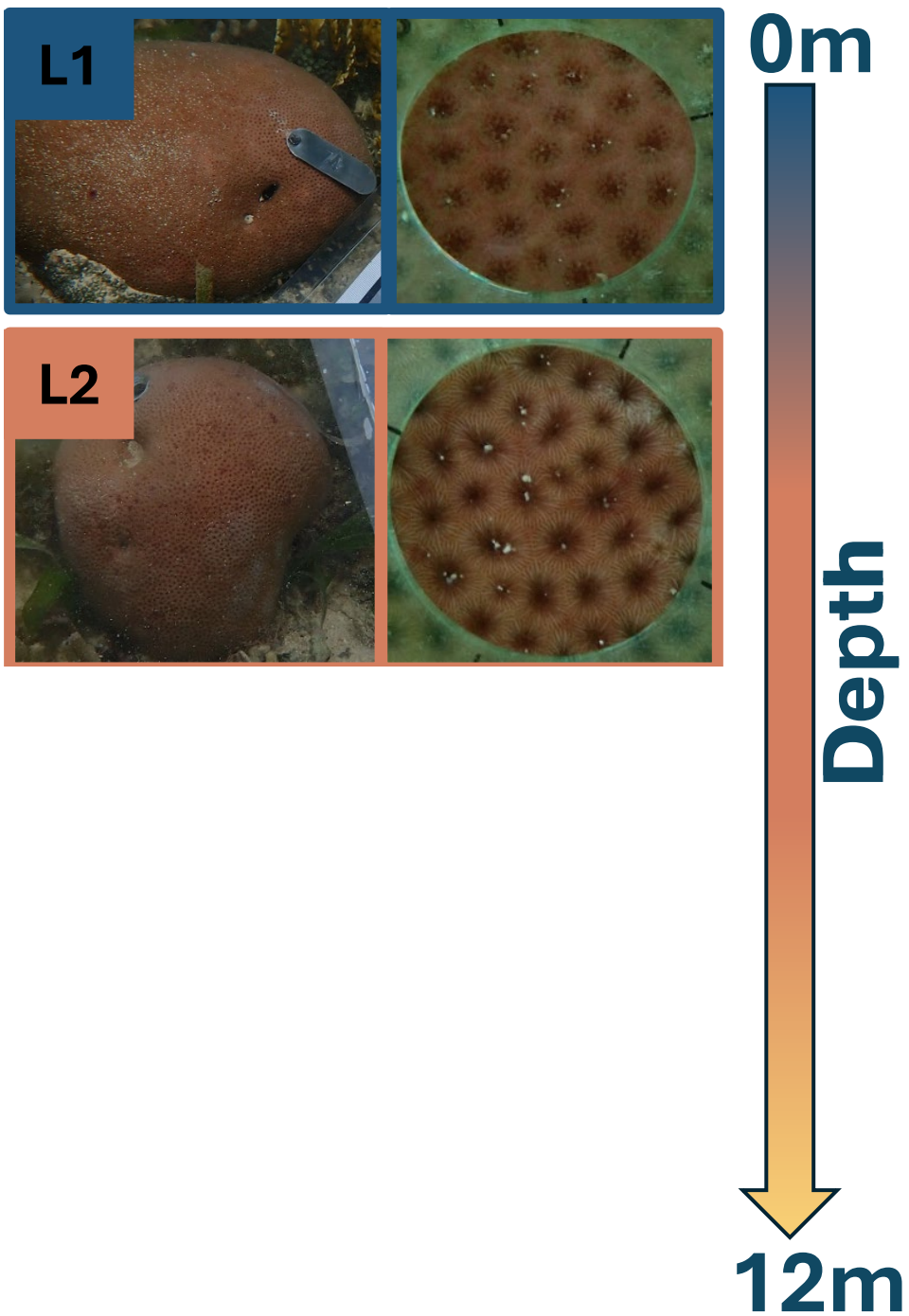
0m

Depth

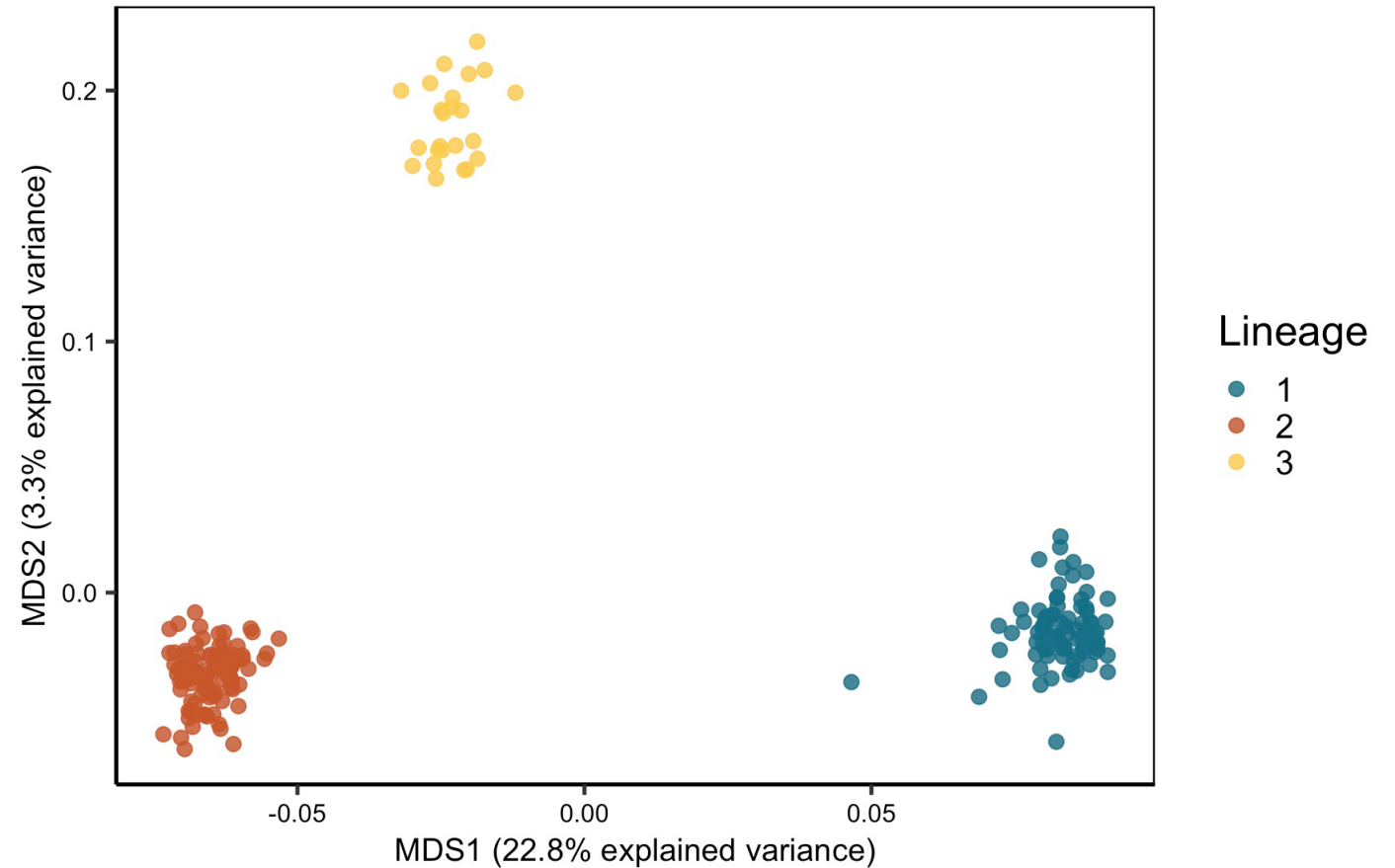
12m

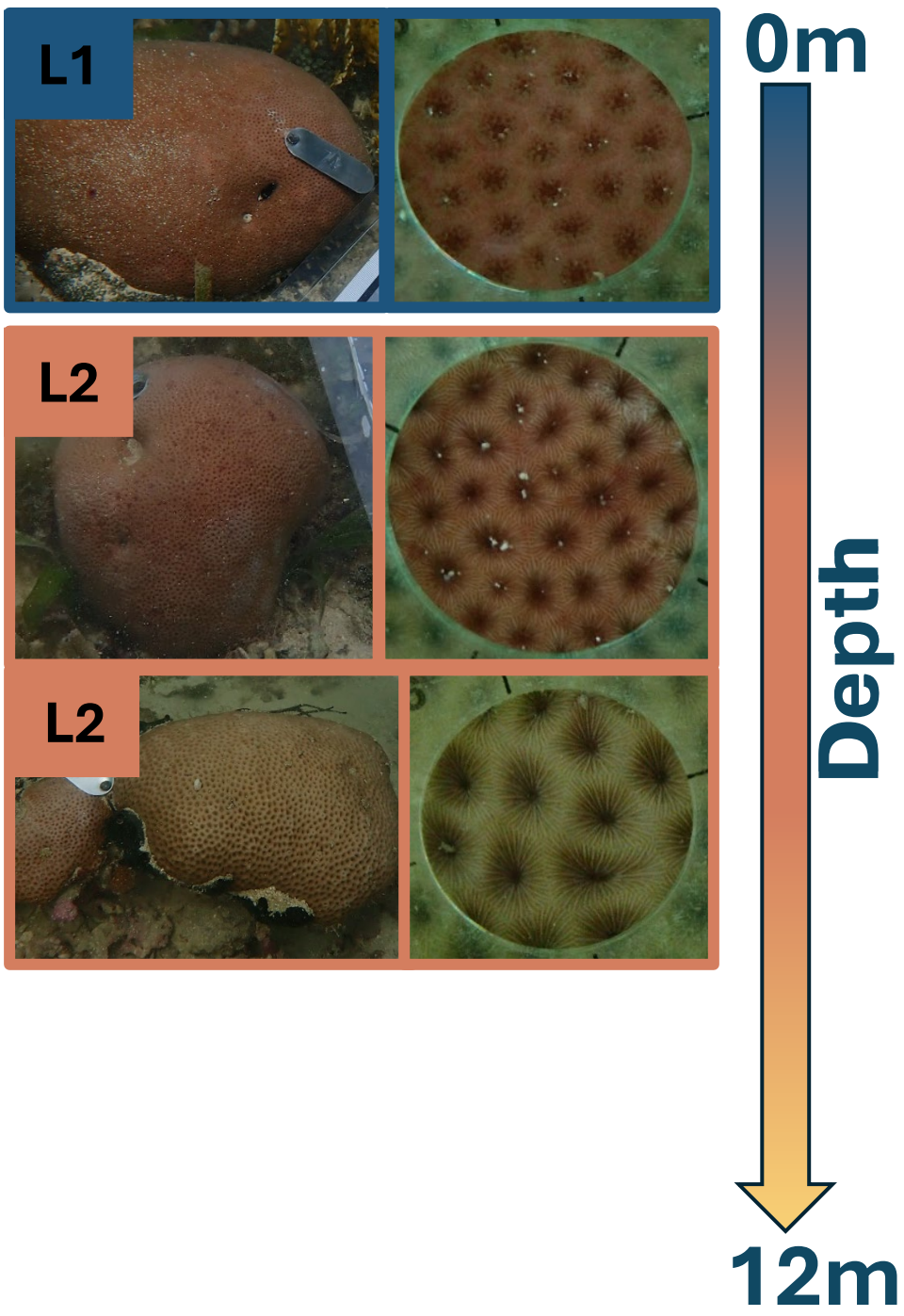
Three distinct lineages



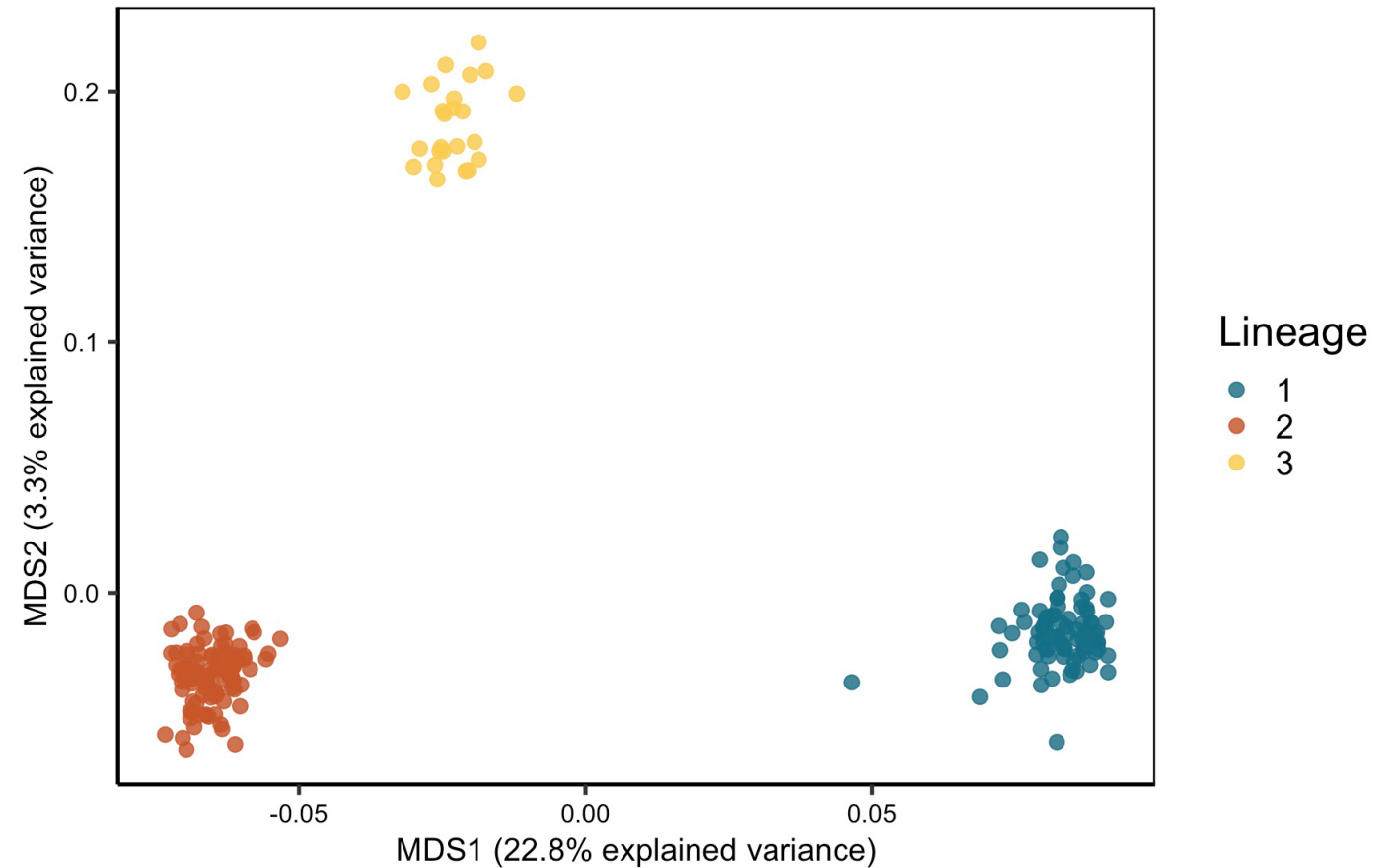


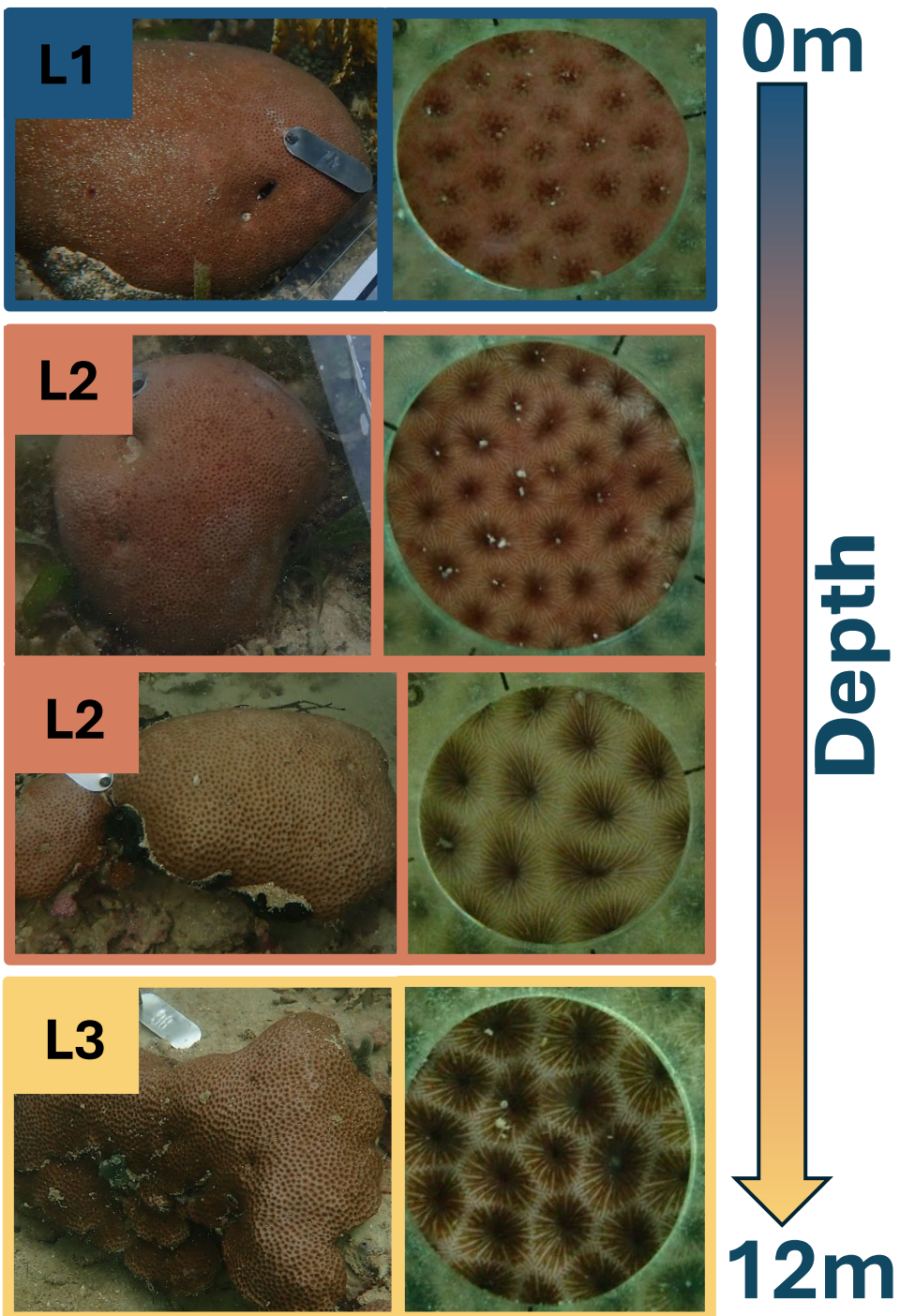
Three distinct lineages



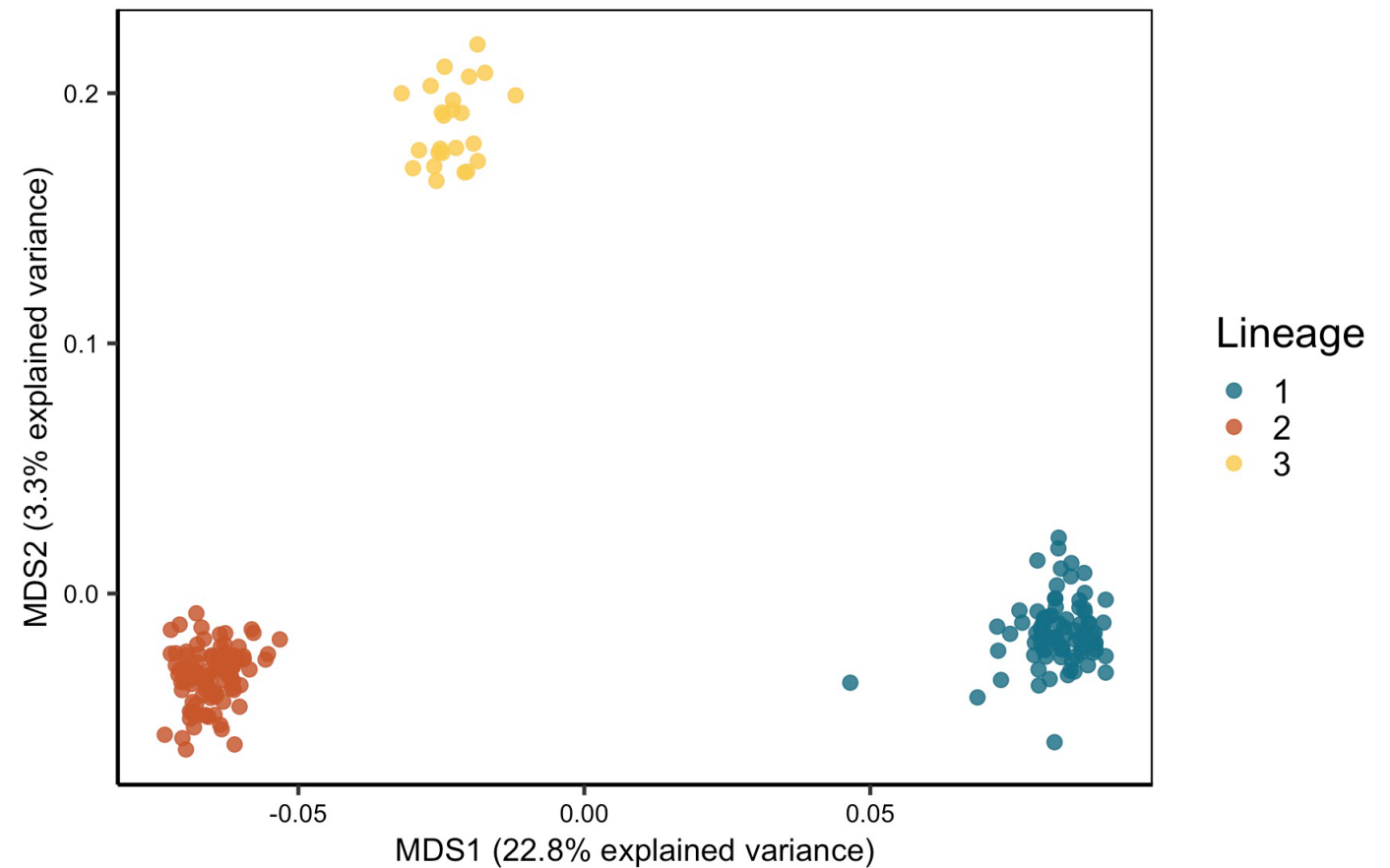


Three distinct lineages

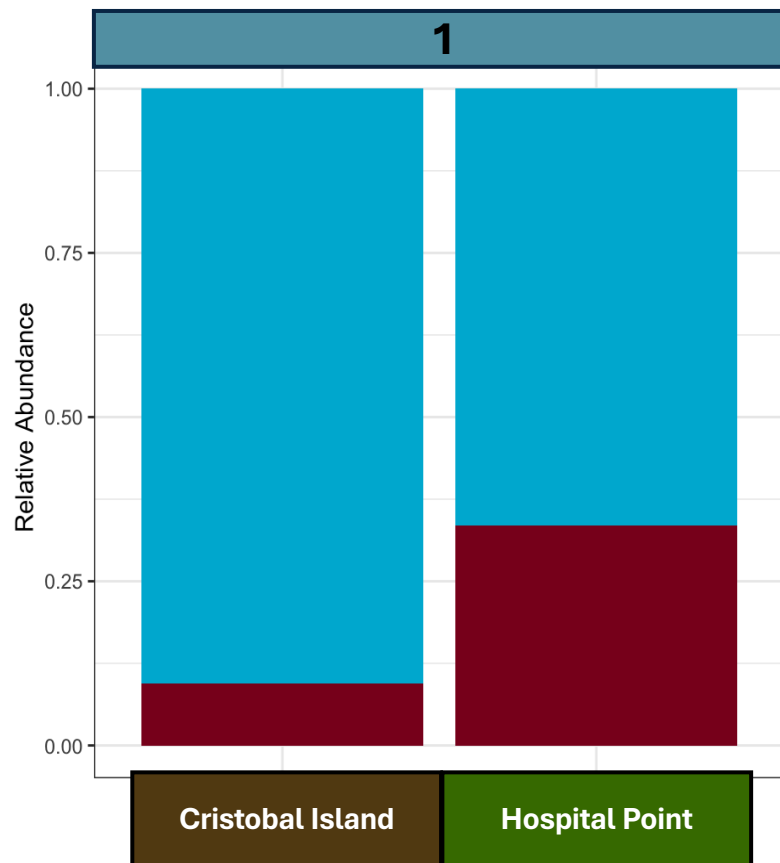




Three distinct lineages



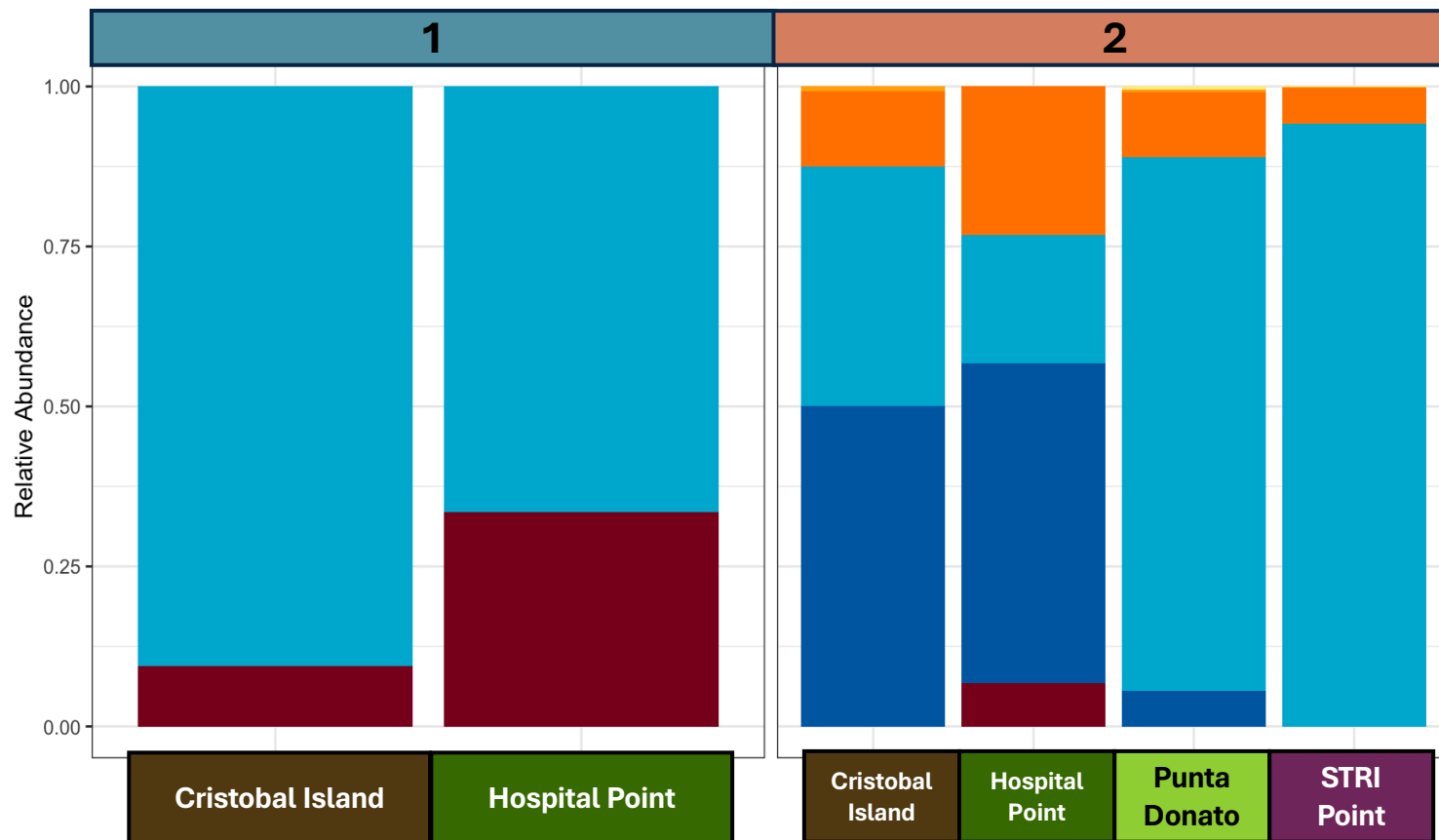
Lineages have different algal partners



Majority ITS



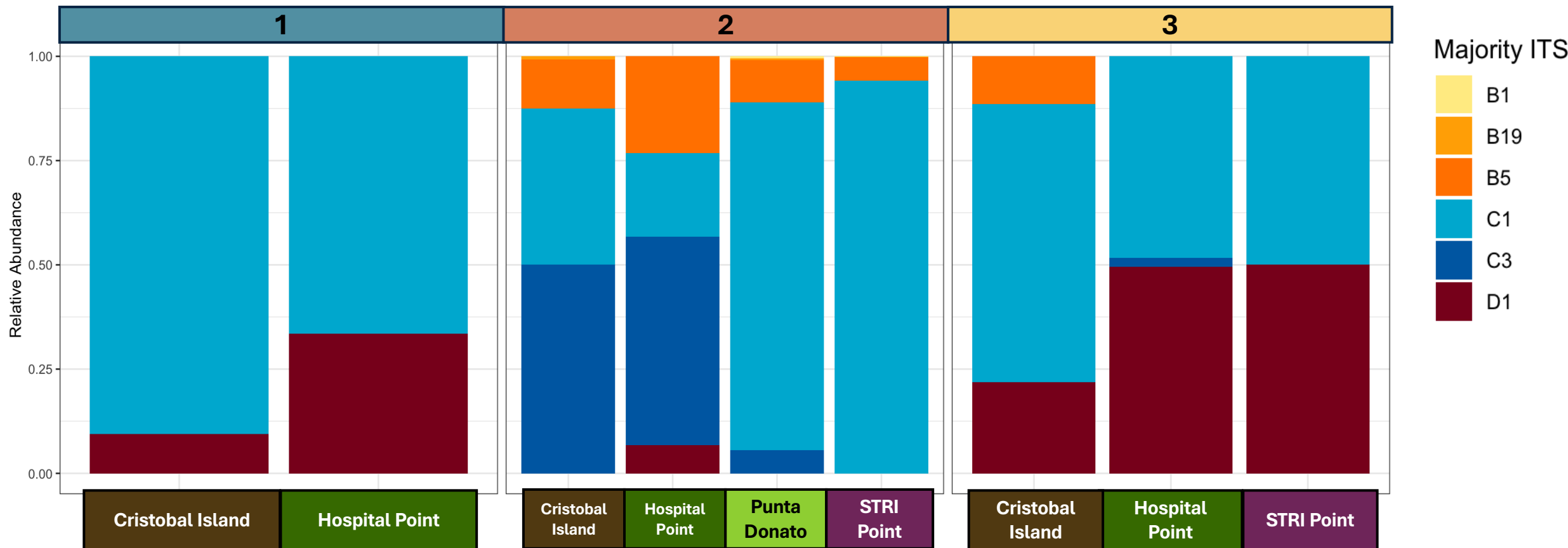
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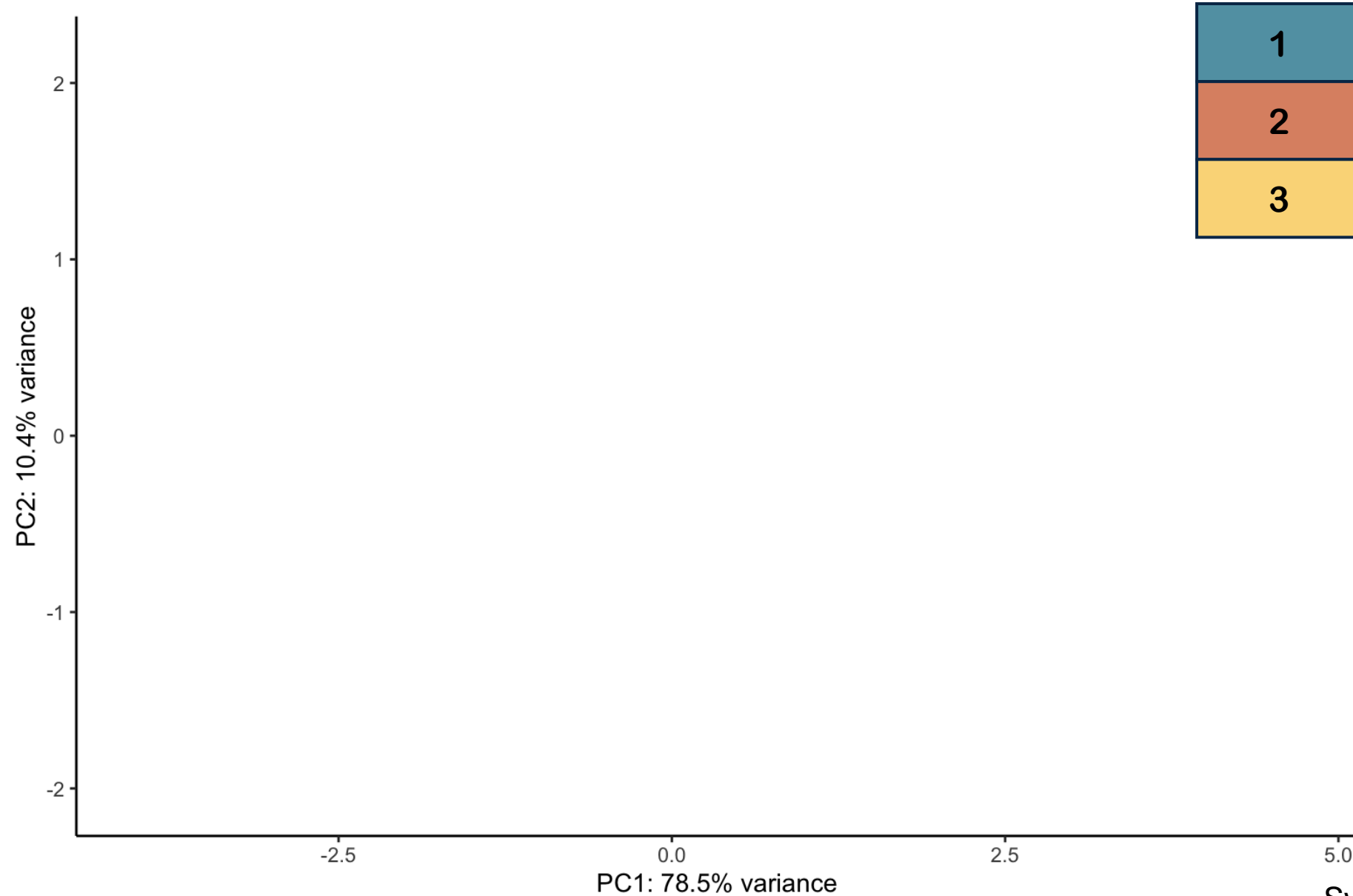
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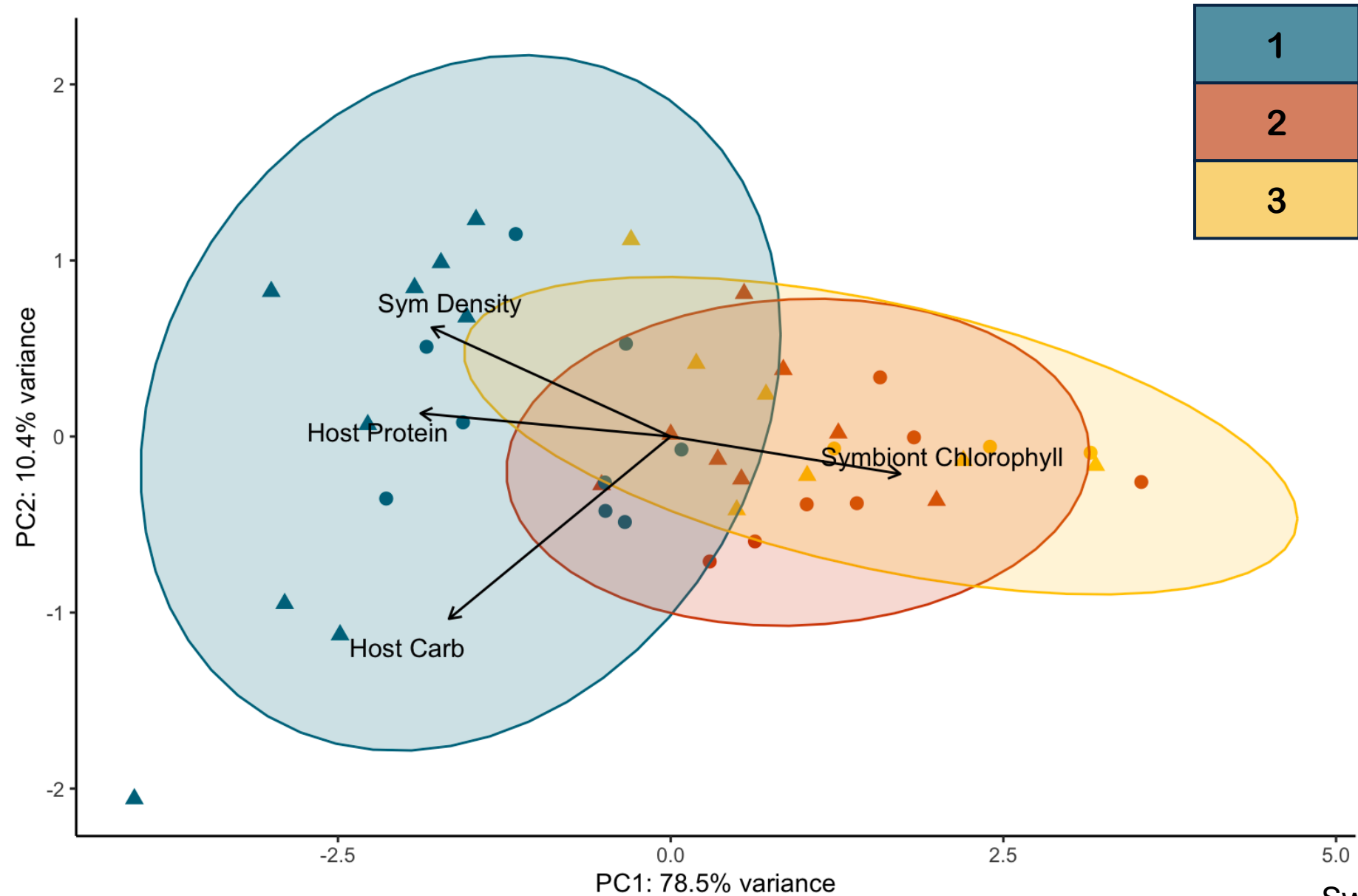
Lineages have different algal partners



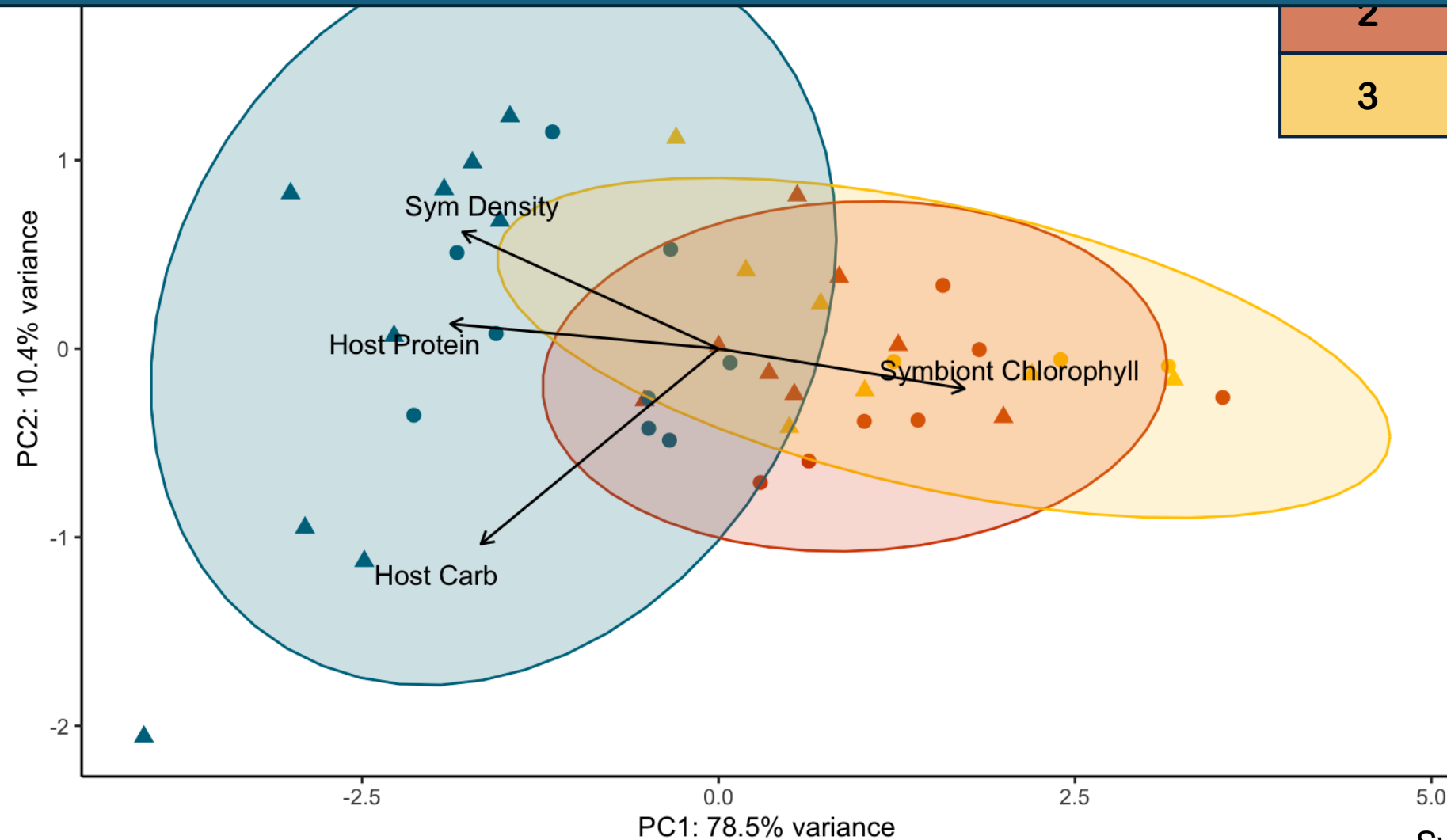
Phenomes differ among lineages



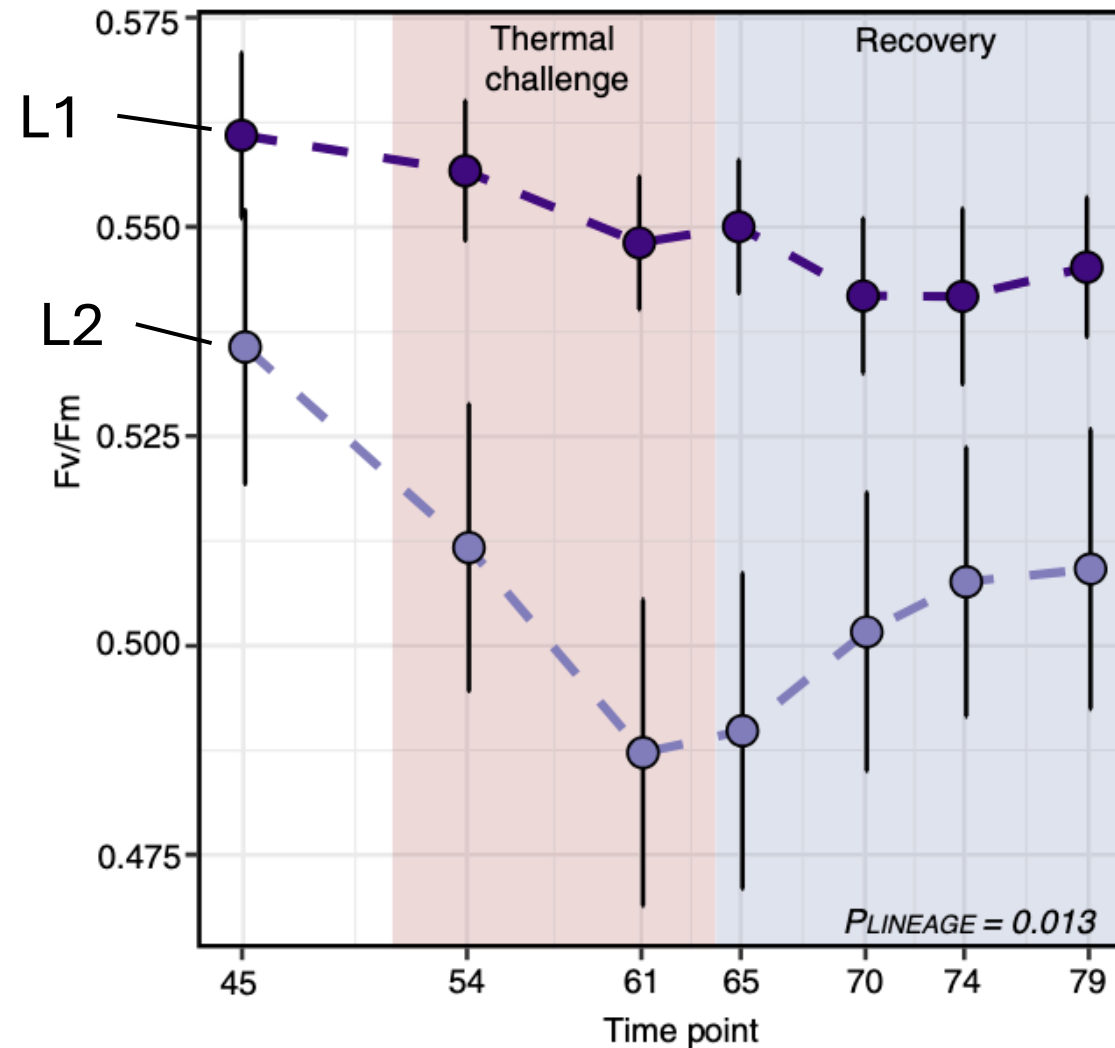
Phenomes differ among lineages



How do phenomes affect temperature tolerance?

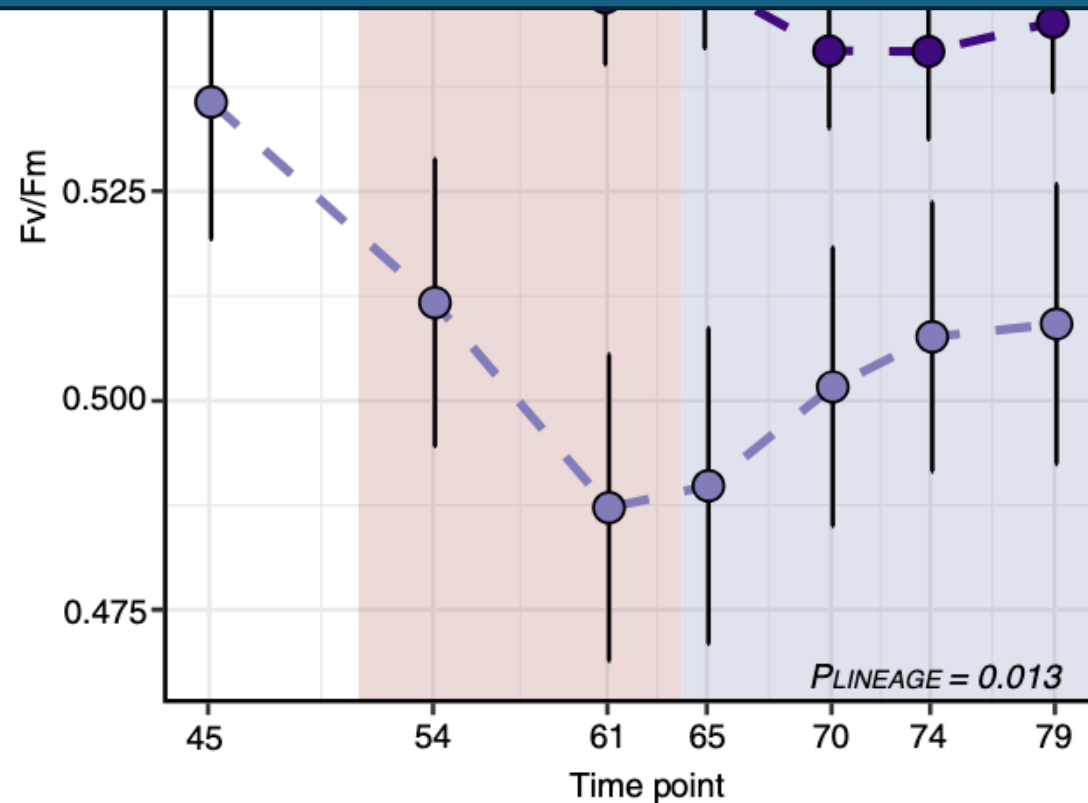


Lineages differ in terms of thermal response



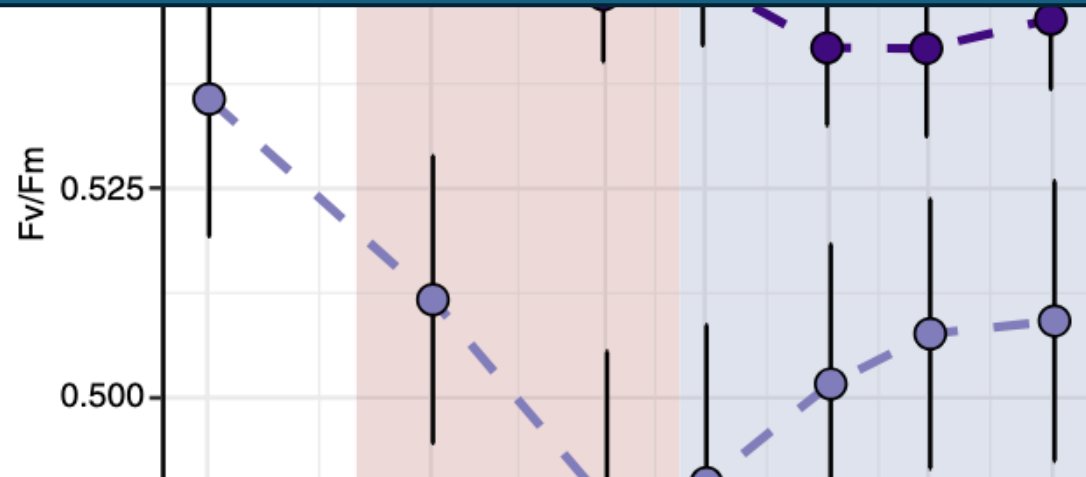
Conclusions:

- Cryptic lineages of *S. siderea* are differentially distributed across depths
- They may differ in terms of corallite morphology
- They differ in terms of phenomes and temperature tolerance



Conclusions:

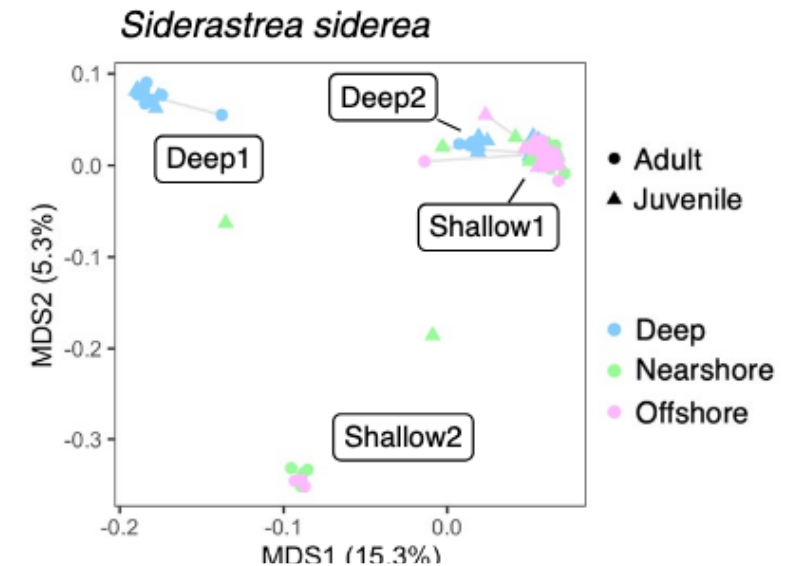
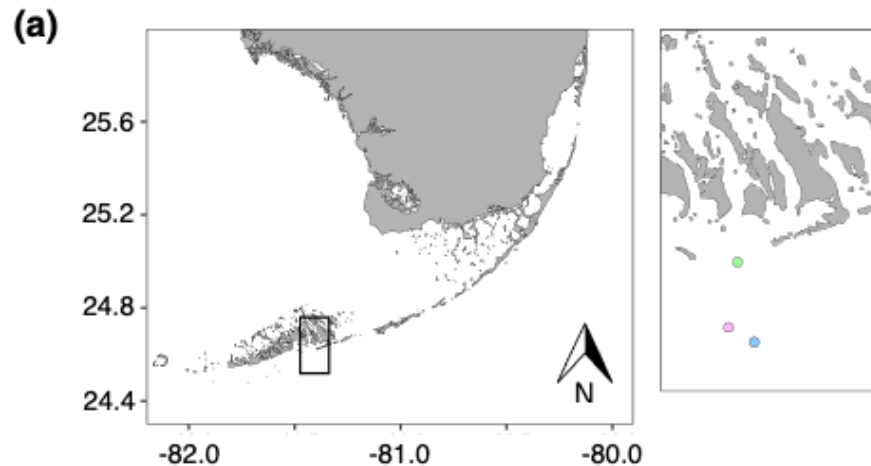
- Cryptic lineages of *S. siderea* are differentially distributed across depths
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What about the Keys?

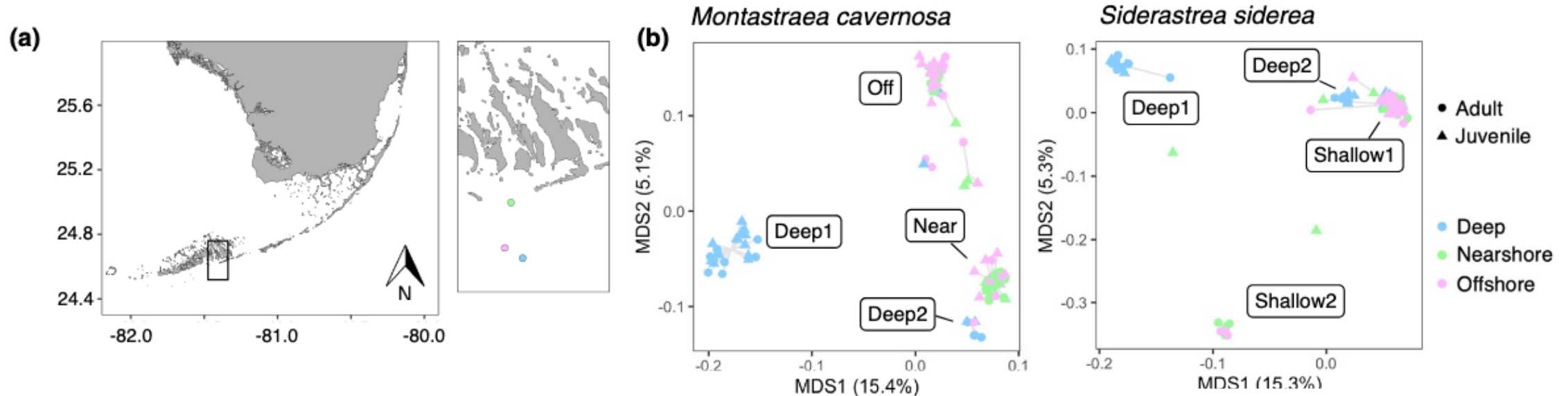
Cryptics in the Keys?

- *Siderastrea siderea* (4 lineages)



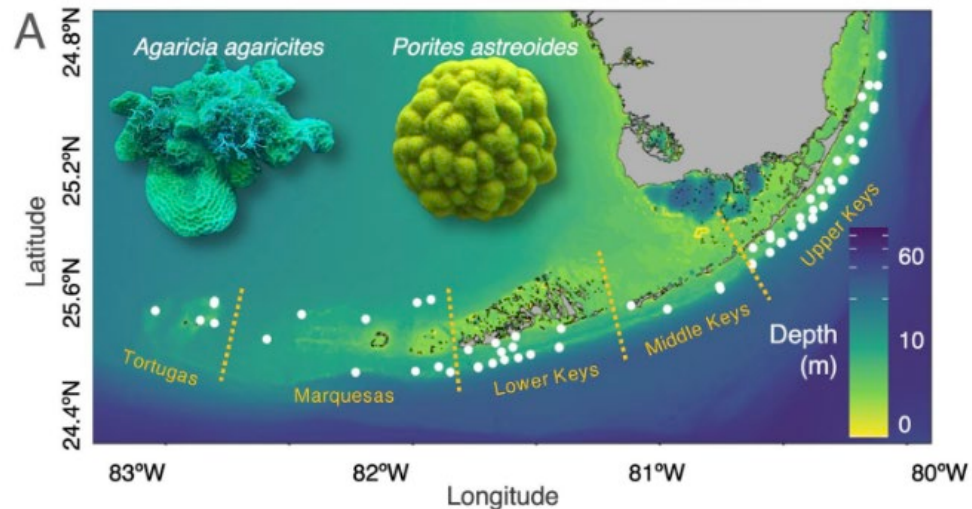
Cryptics in the Keys?

- *Siderastrea siderea* (4 lineages)
- *Montastrea cavernosa* (4 lineages)

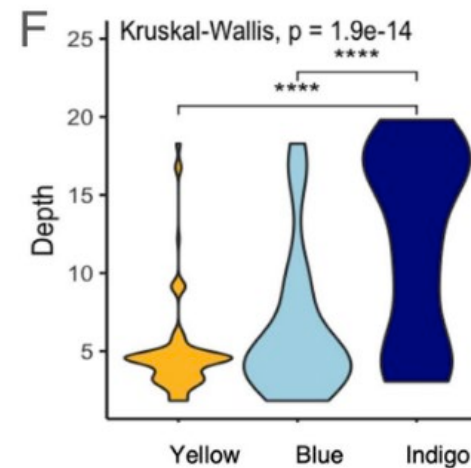


Cryptics in the Keys?

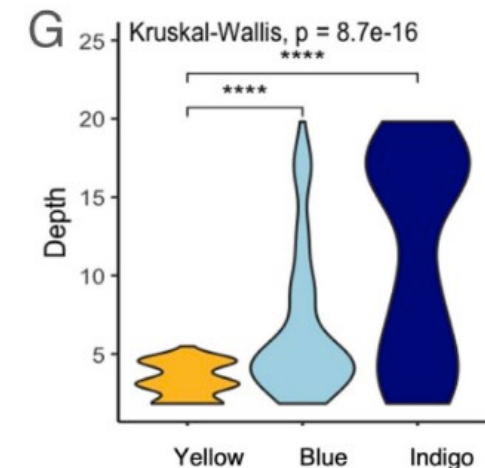
- *Siderastrea siderea* (4 lineages)
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- *Porites astreoides* (3 lineages)



A. agaricites

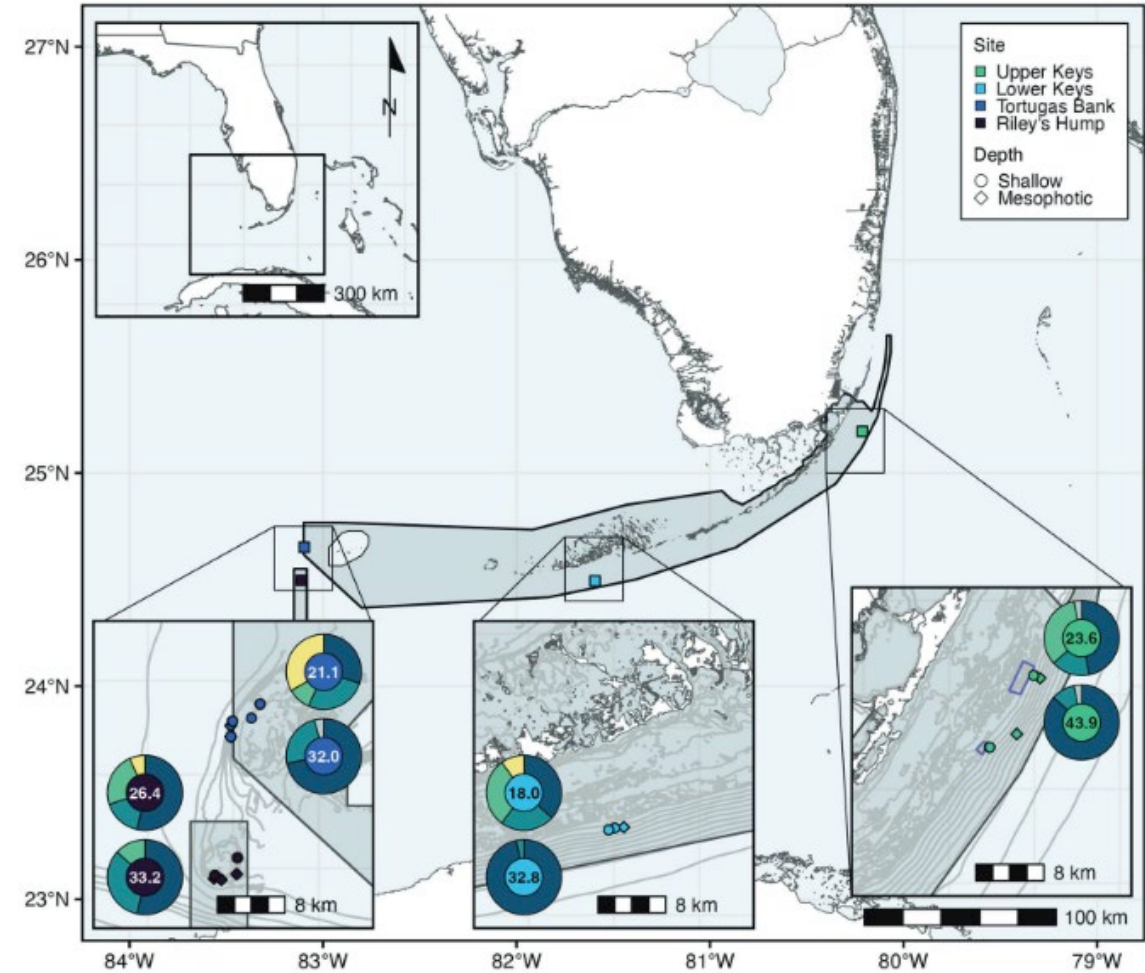
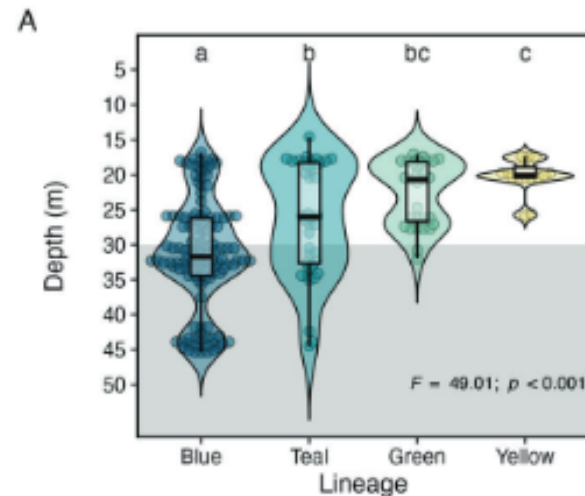


P. astreoides



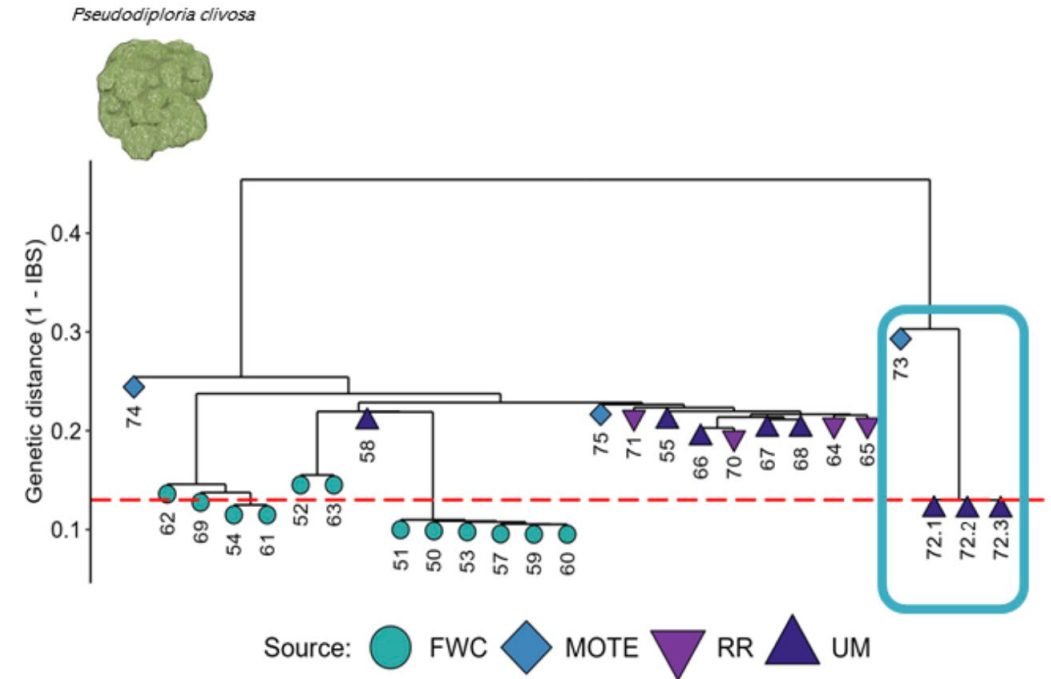
Cryptics in the Keys?

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- *Stephanocoenia intersepta* (4)



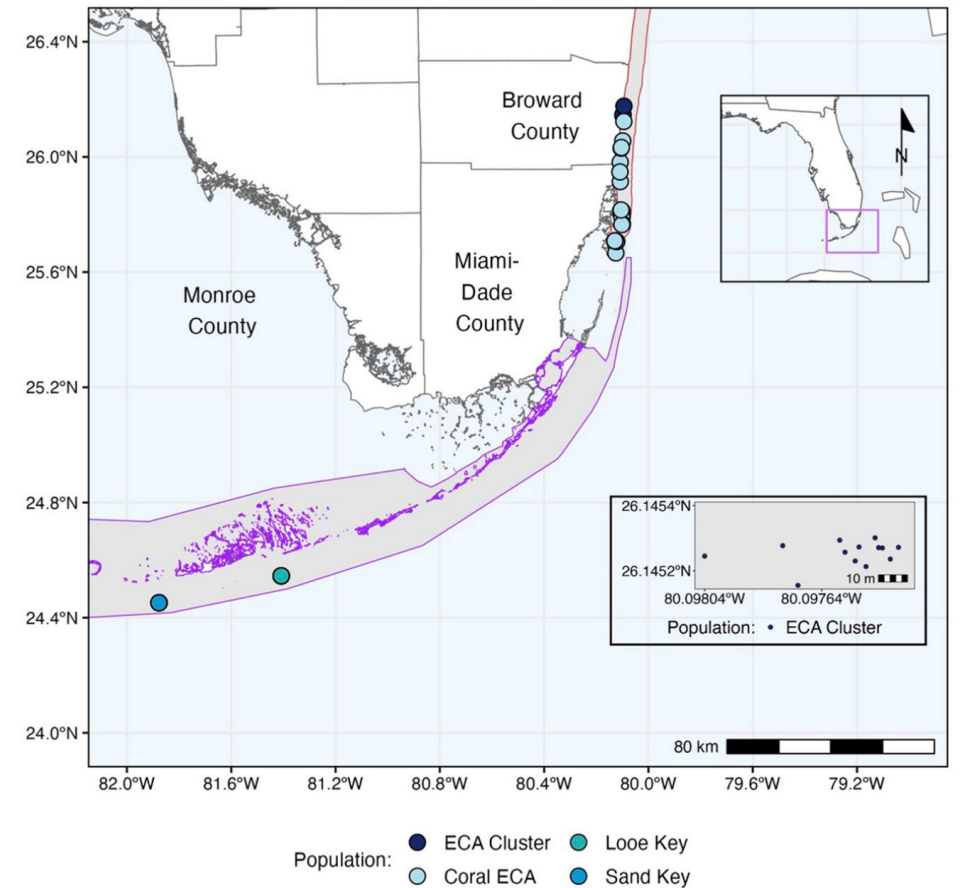
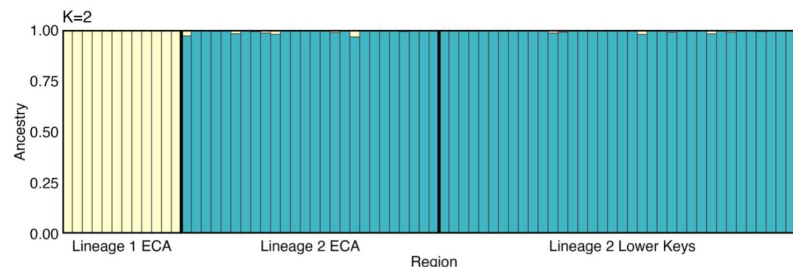
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- *Orbicella faveolata* (2 or more)



Other Florida corals that may have cryptic lineages (unconfirmed)?

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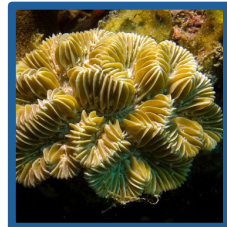
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- *Meandrina* sp.
 - 2+ species identified in Puerto Rico; Pinzón & Weil, 2011



There are likely other coral species with cryptic lineages in South Florida yet to be discovered.

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 - 2 lineages identified in Curacao; Chamberland et al., 2025
- *Favia fragum*
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- Different lineages may not be able to reproduce together or produce infertile offspring



Hopeful take-home message

- More diversity than previously thought



Hopeful take-home message

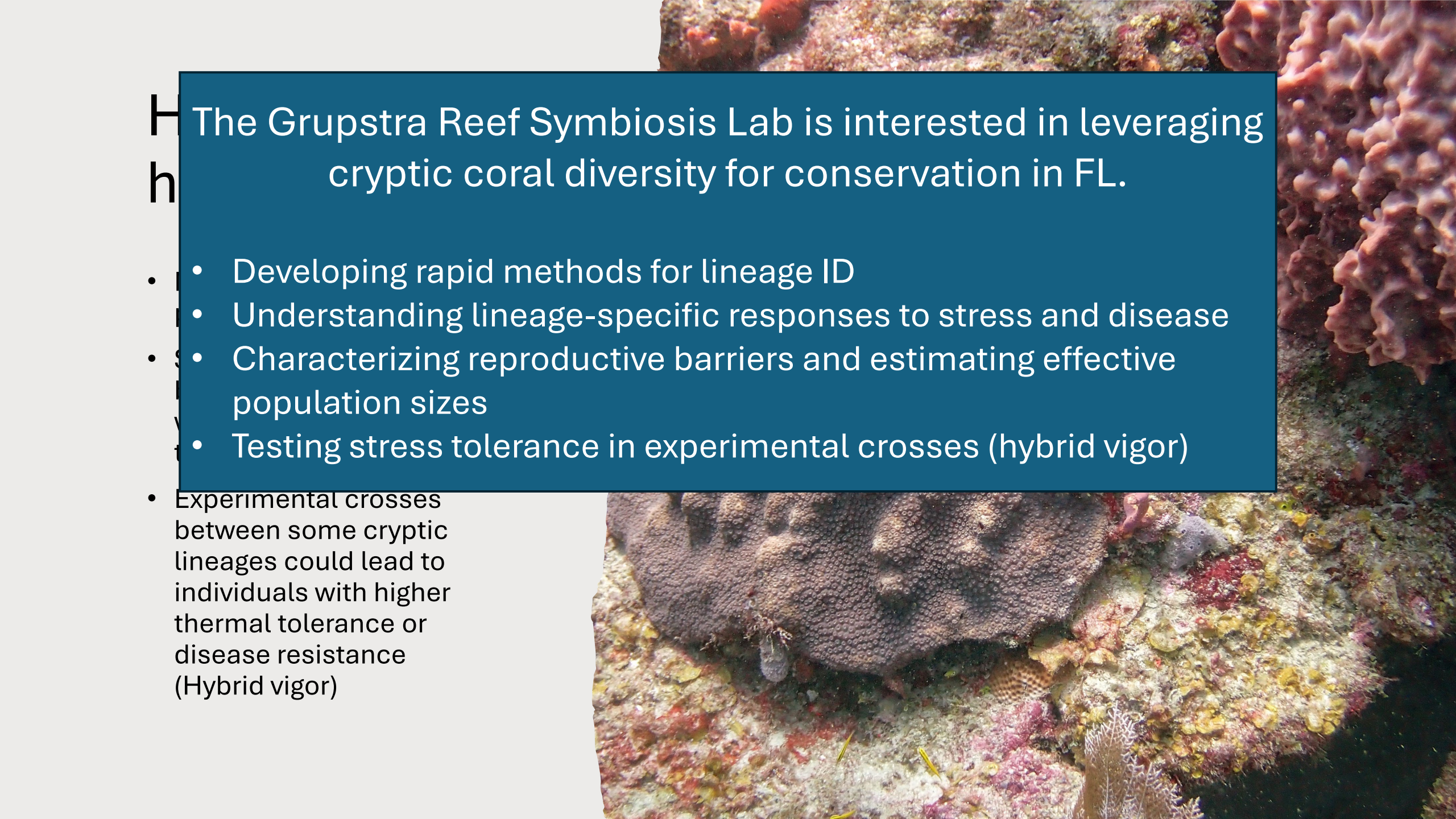
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Hopeful take-home message

- More diversity than previously thought
- Some lineages may be better equipped to deal with increasing seawater temperatures
- Experimental crosses between some cryptic lineages could lead to individuals with higher thermal tolerance or disease resistance (Hybrid vigor)

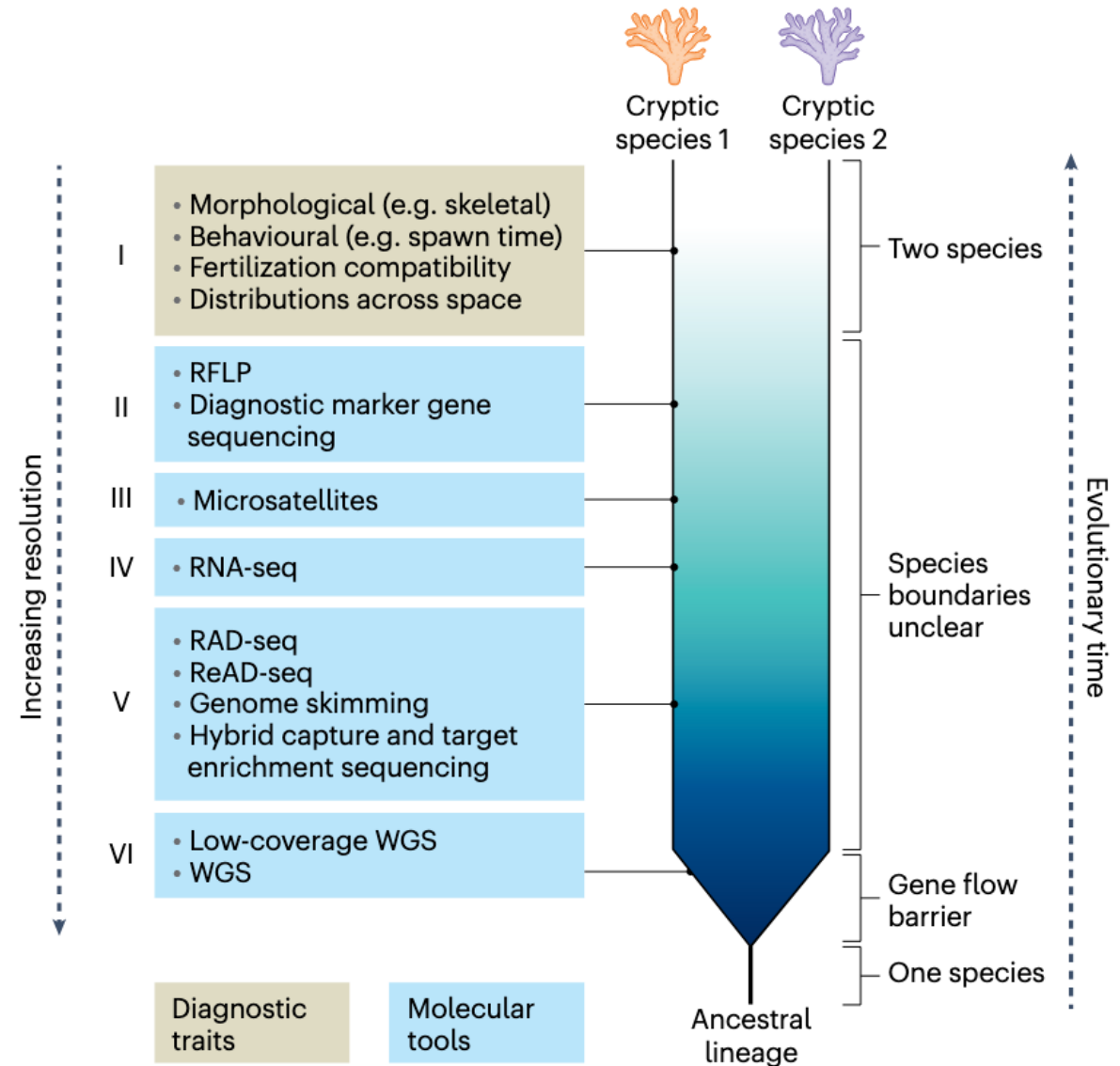




The Grupstra Reef Symbiosis Lab is interested in leveraging cryptic coral diversity for conservation in FL.

- Developing rapid methods for lineage ID
 - Understanding lineage-specific responses to stress and disease
 - Characterizing reproductive barriers and estimating effective population sizes
 - Testing stress tolerance in experimental crosses (hybrid vigor)
- Experimental crosses between some cryptic lineages could lead to individuals with higher thermal tolerance or disease resistance (Hybrid vigor)

How to identify cryptics?



An underwater photograph of a coral reef. The scene is dimly lit, with a blueish-grey tint. Various types of coral are visible, including branching corals and some with a feathery appearance. The coral is situated on a sandy seabed. The word "Questions?" is overlaid in the center in a white, sans-serif font.

Questions?