Ideas

- AF, 9 Sept 2024 -

1. Diversification and influence in the archipelago Meta-network

How does evolutionary history, particularly diversification, influences the ecological roles species play in interaction networks?

(1) As clades of snails diversify, do they tend to shift from generalists to specialists, or vice versa?

H0: Diversification does not lead to significant changes in interaction patterns. Both generalist and specialist roles are randomly distributed across the phylogeny of snails.

H1: Diversification leads to predictable shifts in interaction roles, such that older or rapidly diversifying clades show different patterns of specialization/generalization. For instance, early-diverging lineages may be generalists, with more recent lineages becoming specialists due to niche partitioning or ecological constraints.

2. Diversification and network structure within islands

We will have networks with multiple snail species (>3) for four islands: Isabela, Santa Cruz, Floreana, and San Cristobal. We can describe the relationship between diversification in the clades of these islands and the structure of their networks.

(2) Does higher diversification lead to more fragmented (more modular) networks? This could be due to species partitioning their interactions more finely (niche partitioning) or greater divergence in interaction traits leading to more distinct network modules.

We could also observe that clades with higher diversification rates are more likely to include both generalists and specialists, which may increase network nestedness.

These three islands form a temporal gradient, so we might expect networks to be more specialized with island age due to increased coevolution with nematodes.

3. Congruence of modules in the archipelago Meta-network

Test what explains the archipelago network modules:

(3) Do modules correspond to specific islands, or are they a result of more recent diversification?

(4) Do modules correspond to specific phylogenetic clades?

(5) Do modules correspond to specific habitats or evolutionary history traits?

4. Evolutionary escape and impact on the meta-network

As snails radiated and adapted to new habitats, some environments—like arboreal or arid zones—became less favorable for nematodes. In response, parasites may evolve rapidly to cope with these host adaptations, given their greater evolutionary potential due to smaller body sizes. We can hypothesize that snail clades that underwent more extensive habitat diversification, or even switches between habitats (e.g., from humid to arid, and then to arboreal), may have "escaped" from a greater number of nematode taxa compared to clades restricted to specific habitats.Regarding the diversification in different habitats, we can ask:

(6) Do clades with higher habitat diversification show more unique interactions, whereas those with lower habitat diversification are more generalists in the meta-network?

To test the habitat-switching hypothesis, we could reconstruct ancestral habitats across the snail phylogeny. Since we've already calculated the probabilities of each habitat type (arid, humid, arboreal, terrestrial) for every snail species—including those without explicit habitat data—we could perform character-reconstruction on the phylogeny. By estimating the number of habitat switches per lineage, we can then investigate:

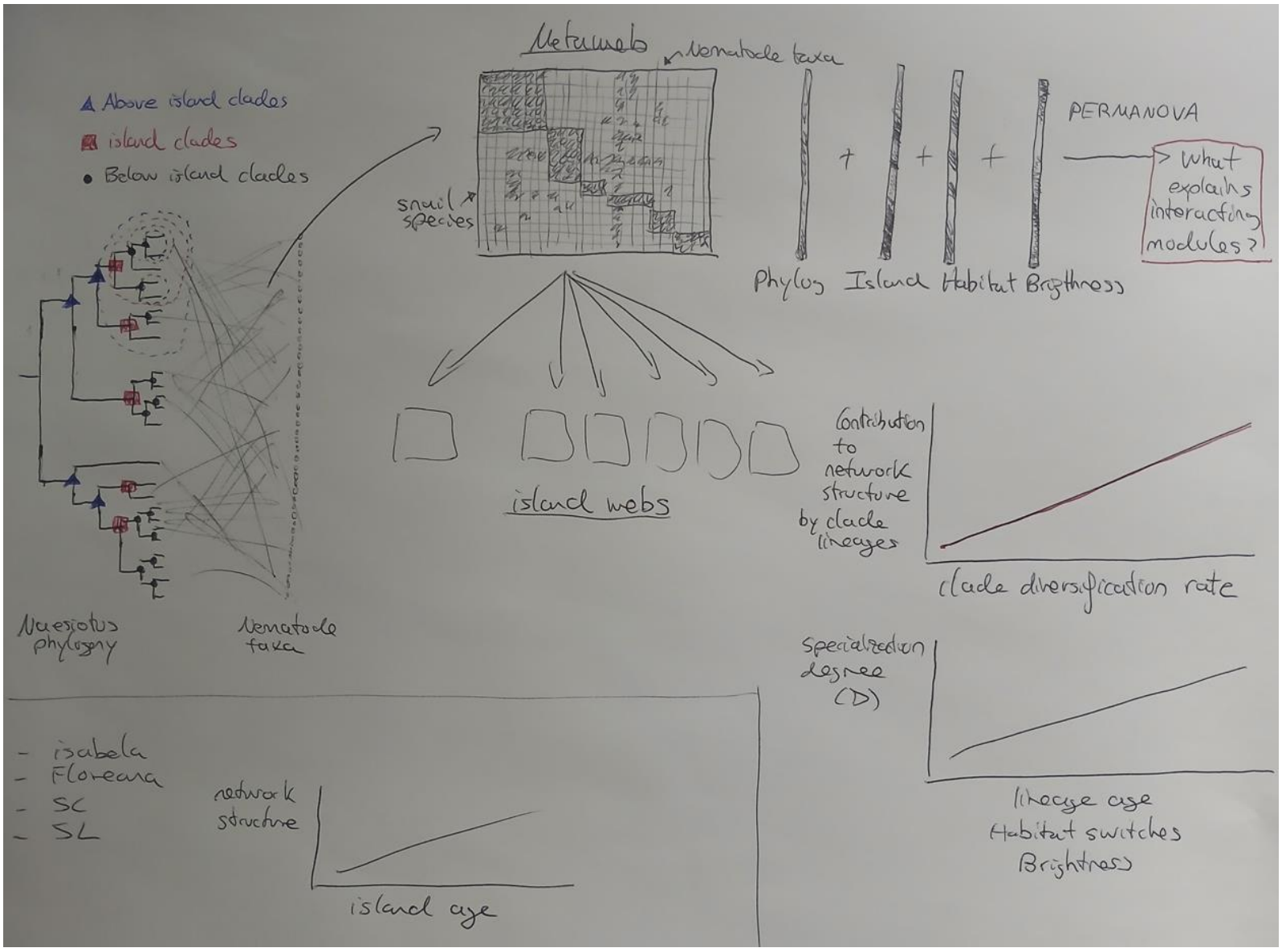
(7) do lineages with more habitat switches interact with less nematode taxa?

5. Macroevolution-network feedback (Bird predator – host diversification-host-parasite network)

Naesiotus snails exhibit a biotic selection signal that increases from younger to older islands, where their traits increasingly match the environmental background. This pattern has been linked to bird predation, as snails may adapt by becoming less conspicuous. We've already estimated brightness scores for all snail species, allowing us to ask:

(8) Does brightness correlate with the degree of specialization in the parasitic network? Or define interacting modules in the metanetwork? How does it correlate in island networks?

This could suggest a cascading effect of predation on the host-parasite network, where predator-driven adaptations in the host (snails) influence the parasitic network. With data on both nematode load and diversity for each snail species, we can explore whether reduced brightness (as an adaptation to avoid predators) has made snails more susceptible to parasitism. This, in turn, could impact bird predators—either by reducing snail densities or by increasing their own parasitic load via trophic transmission.


Above island clades
island clades
Below island clades
Naesiotus phylogeny
Nematode taxa
Metaweb
Nematode taxa
snail species
island webs
Phylog
Island
Habitat
Brightness
PERMANOVA
What explains interacting modules?
Contribution to network structure by clade lineages
clade diversification rate
Specialization degree (D)
lineage age
Habitat switches
Brightness
- Isabela
- Floreana
- SC
- SL
network structure
island age