Combining available prey and foraging behavior to predict resource-use differences among competing bird species

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Background

- Coexistence often explained via niche partitioning
- Resource use often determined by proxies, e.g., behavior, microhabitat, morphology
- However, do proxies translate to actual differences?
- Similarly foraging species may not consume the same resources
- Need to assess whether differences in foraging behavior allow for coexistence

Study system

- Five species of migratory warblers (Parulidae, same family featured by MacArthur) wintering in Jamaican wet limestone forest
- Known to 1) be food limited and 2) compete both intra- and interspecifically for food

Predictions

1. Competing species differ in diet
2. Species differ in foraging behavior
3. Available prey and foraging behavior explain diet
4. Differences between species in foraging behavior explain observed differences in resource use

Methods

- Observed diets obtained by emetic
- Available prey sampled from major substrates using hanging sticky traps (airspace), tree collar traps (bark surfaces), branch clips (distal foliage & twigs)
- Diets compared using Pianka’s index (overlap) and PERMANOVA (ordination of differences)
- Behavioral differences between species tested with Bayesian categorical mixed models
- Expected diets generated by averaging relative abundance of each insect taxon across substrates weighted by use of that substrate by each bird species
- Expected and observed diets compared using zero-inflated negative binomial mixed models
- Differences in expected and observed diets of each species pair tested with randomized linear regression

Results

- Higher than expected dietary overlap due to opportunism involving ants
- Species differ in overall prey selection
- Differ greatly in foraging substrate
- Foraging behavior and available prey predict diet
- Combination of three methods sampling available prey weighted by foraging behavior better predicts observed diet than any single method
- Differences in foraging behavior explain differences in resource use in 5 of 6 species pairs

Conclusions

- Despite large differences in foraging behavior, birds consume similar prey
- Small but important differences in resource use are consistent with foraging difference
- Differences in foraging behavior lead to differences in diet and can act as a coexistence mechanism
- However, it may not be an efficient mechanism as large differences in foraging behavior lead to small differences in resource use
- Not relying on foraging behavior alone as a surrogate allowed clarity on both opportunism and subtle behavioral differences important to winter survival

Future directions

- How well do these mechanisms actually explain coexistence at multiple spatial scales?
- How do changes in overall resource abundance influence level of resource overlap?
- What evolutionary drivers influence the structure of resource overlap and specialization?

Citations


Legend

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<th>AMRE</th>
<th>Black and-white Warbler</th>
<th>BAWW</th>
<th>Black-throated Blue Warbler</th>
<th>BTTW</th>
<th>Northern Parula</th>
<th>NOPA</th>
<th>Worm-eating Warbler</th>
<th>WEWA</th>
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*Indicates greater overlap than expected by null model

Expected diets explain observed diets†

Pairwise differences in observed and expected diets‡

Expected proportion of diet

Differences in expected and observed diets of each species pair tested with randomized linear regression

† WEWA was excluded in analysis as lacked quantitative data on available prey in dead leaf clusters

Key:

- AMRE: American Redstart
- BAWW: Black and-white Warbler
- BTTW: Black-throated Blue Warbler
- NOPA: Northern Parula
- WEWA: Worm-eating Warbler

Graphs showing observed and expected diets, as well as pairwise differences between species.