



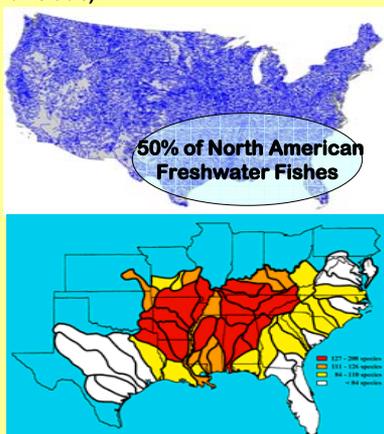
# Beta Diversity and Faunal Homogenization of Southern U.S. Fishes

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## Introduction

The southern United States supports one of the richest temperate freshwater fish faunas on Earth. Fishes of the region show high levels of endemism and are one of the most imperiled animal groups in North America (28% endangered, threatened, or vulnerable).



I examined beta diversity, the change in native species from one area to another, as expressed in dissimilarity measures and geo-spatial structure of this rich fauna among major river drainage units. I emphasized the total native fauna, faunal subsets, and transplanted species (i.e., a fish native to North America but introduced in a given drainage unit).

## Questions

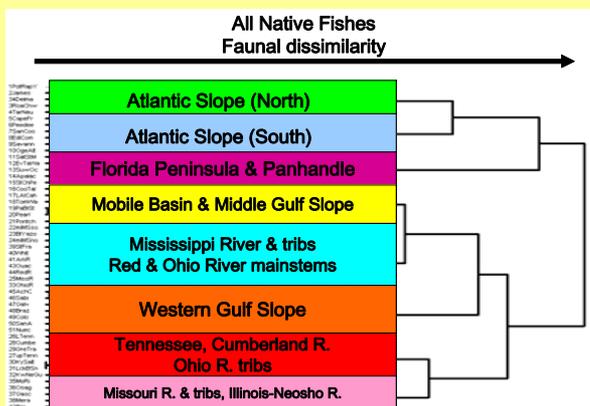
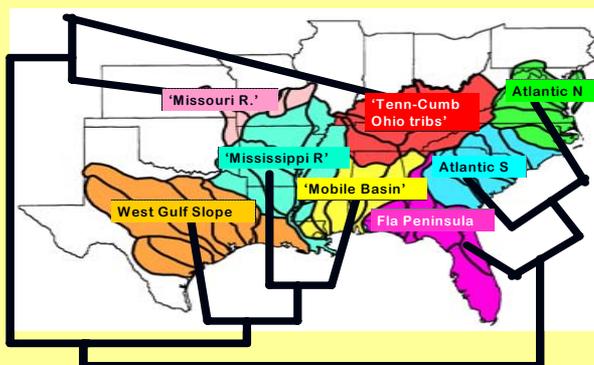
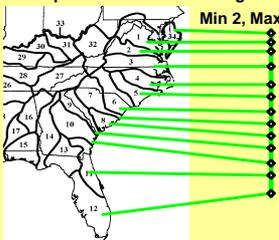
- Is the native fish fauna 'beta diverse' (i.e., highly spatially distinct and structured)?
- Are decreases in beta diversity from fish transplants detectable?
- Is native species density related to numbers of transplanted fishes?

## Methods and Data Analysis

I used 685 fish taxa allocated across 51 drainage units to construct pair-wise drainage unit faunal dissimilarity matrices (Jaccards distance). I constructed a drainage dissimilarity matrix based on nodal distances between drainage pairs. I used phenetic clustering (UPGMA), Mantel tests, and shape-and-boundary tests to compare dissimilarity and geo-spatial structuring among faunal subsets and drainage networks and to estimate changes in beta diversity associated with transplanted fishes.

### Example of Internodal Drainage Distance

Min 2, Max 34 nodes



## Drainage Unit Distances vs Faunal Similarity Matrices

Faunal matrix	Mantel r
All native fishes	0.827
Darters	0.685
Minnows	0.715
Catfishes	0.764
Suckers	0.641

All significant  $p < 0.001$



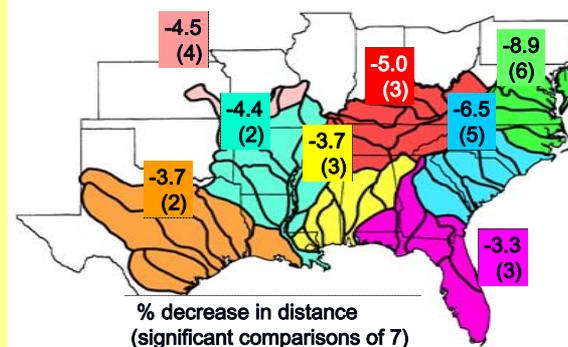
## All Natives & Faunal Subsets

(Mantel r)

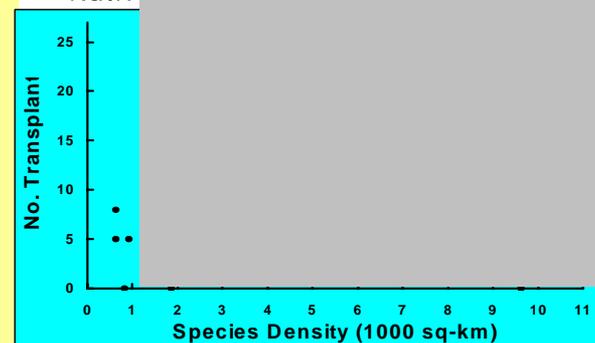
	Darter	Minnow	Sucker	Catfish
All	0.912	0.944	0.815	0.878
Darter	—	0.869	0.712	0.737
Minnow		—	0.837	0.786
Sucker			—	0.658

All significant  $p < 0.001$

## Beta-diversity Decreases Caused by Transplanted Fishes



## Native Species Density & Transplants



## Conclusions

- Geo-spatial structuring in the native fauna is very strong, producing highly distinct faunal regions.
- Structure is highly congruent with drainage interconnectivity for all major families.
- Transplants have decreased beta-diversity, and trends toward homogenization are apparent.
- Native species density constrains total numbers of transplants.
- Decreases in native species density portends higher probability of successful transplants and further homogenization.