Fish Assemblage Use of Constructed Woody Microhabitats In Sand-Bed Streams of the Upper Gulf Coastal Plain

Melvin L. Warren Jr.,[1] Andrew L. Sheldon,[2] and Wendell R. Haag,[1]
(1)USDA Forest Service, Center for Bottomland Hardwoods Research, Southern Research Station, Oxford, MS
(2)Biological Sciences, University of Montana (retired), Missoula, MT

Abstract

We investigated fish use of standardized, constructed woody microhabitats (cane bundles) in four north Mississippi sand-bed streams with different degrees of channel degradation and natural instream woody cover. The streams described a disturbance gradient: Lee Creek (deeply incised, least depth and wood), Cypress Creek (channelized, low depth and wood), Puskus Creek (natural channel, moderate depth and wood) and Chewalla Creek (natural channel, deepest, highest wood). We deployed replicate cane bundles over one year (six samples). We focused on three measures of microhabitat use: fish occupancy, abundance, and assemblage structure. Across all streams, we captured 30 fish species representing eight families. Fishes used bundles least in the most disturbed stream (7% occupancy) but showed similar occupancy in the others (20-27%). Mean fish abundance in bundles differed greatly between the two most disturbed streams but was intermediate and similar in the least disturbed streams. Fish assemblages in bundles were distinct among streams. Pairwise effect sizes in assemblage similarity described a gradient from the most to least disturbed stream. Small wood in these sand-bed streams is obviously an important but dynamic component of fish habitat, but responses of fishes to that habitat are mediated largely by the disturbance history of the stream.

Objectives

- Examine fish use of standardized, constructed woody microhabitats (cane bundles) in streams with varying disturbance histories and amounts of naturally derived instream woody material .
- Focus on four responses of fishes:
  - Occupancy
  - Abundance
  - Assemblage composition
  - Assemblage structure

Study Region

- Little Tallahatchie River system (Yazoo Riv
Mississippi River)
- Holly Springs National Forest
- Southeastern Plains
  - Northern Hilly Gulf Coastal Plain
- Irregular hills (30-91 m), clay-sand soils (highly erodible)
- Mixed Hardwood-Pine Forests, 1000-1500 mm ppt/yr
- Most perennial streams, spring or groundwa
- Minimally disturbed small, perennial strean
fish species.

Study Design

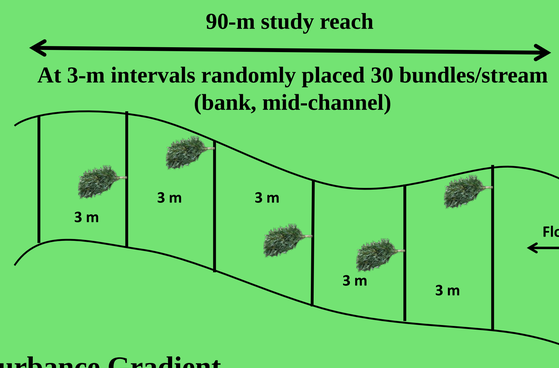
- 4 study streams
- Sampled after 14-day exposure
- 6 exposures (March, May, June, October, September, February)
- Analysis
  - Habitat, PCA (Principal Components Analysis)
  - Abundance, bootstrap 95% CI (10^4 resamples)
  - Assemblage composition, MRPP (Multiresponse Permutation Procedure)
  - Assemblage structure, PCA

Sand-bed Streams

- Few bed controls (e.g., large wood, clay lenses)
- Wood forms primary hard substrate
- Channelization/incision decreases wood recruitment to and retention in the channel

Cane bundles

- Installed by driving rebar in substrate
- Enclosed bundle with seine to capture fishes
- Identified , measured, and released fishes
- Recorded depth and current at point of capture



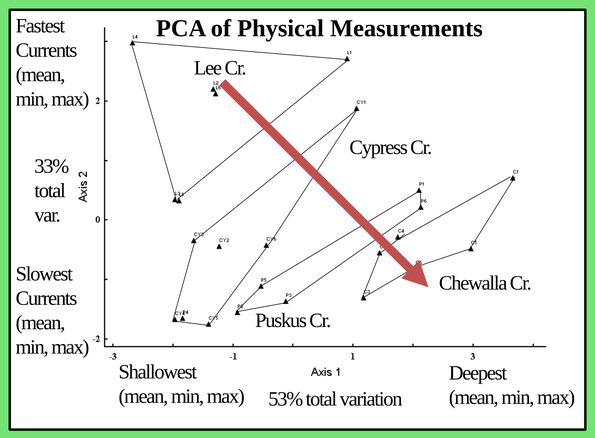
Disturbance Gradient

Lee Creek- deeply incised, least depth and instream wood

Cypress Creek-channelized, low depth and instream wood

Puskus Creek-natural channel, moderate depth and instream wood

Chewalla Creek-natural channel, deepest, highest wood

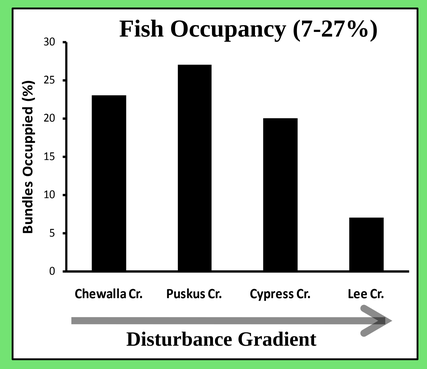


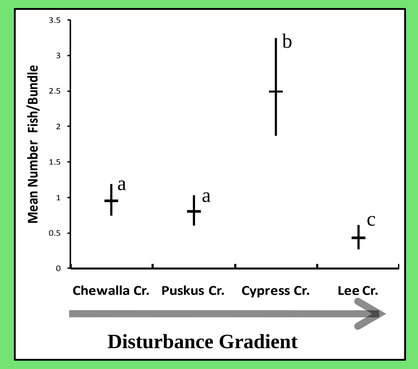
Fish Use of Bundles Across Streams

Diversity:
- 30 fish species
- 699 individuals

- 9 fish families
- 0.25-0.46 spp./bundle

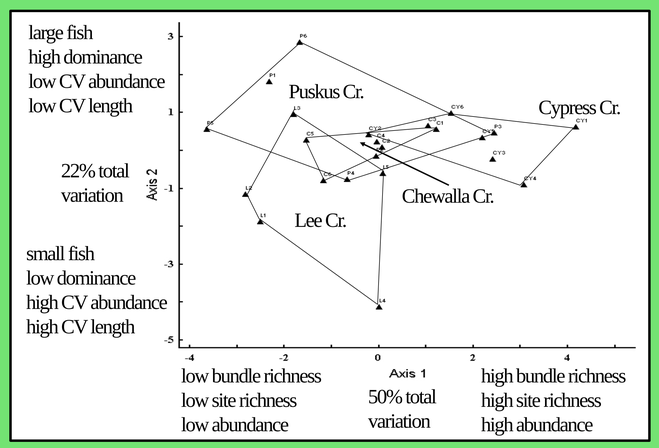
Size:
- Mean 45 mm standard length
- Range : 20-140 mm standard length





Differences in Fish Assemblage Composition in Bundles Among Streams (MRPP)

	Puskus Creek effect size (P-value)	Cypress Creek effect size (P-value)	Lee Creek effect size (P-value)
Chewalla Creek	0.053 (0.03814*)	0.063 (0.00757)*	0.094 (0.00439)*
Puskus Creek		0.078 (0.01065)*	0.083 (0.00058)*
Cypress Creek			0.109 (0.00381)*



Conclusions

- Use and diversity of woody microhabitats was high in most streams.
- Use was least in the most disturbed stream but similar in the others.
- Abundance in bundles differed greatly between the two most disturbed streams but was intermediate and similar in the least disturbed streams.
- Assemblages in bundles were distinct among streams.
- Assemblage composition was most different in the two disturbed streams and least different in the two undisturbed streams.
- Assemblage structure across time and streams was complex and did not follow a simple linear disturbance gradient but again contrasted the two most disturbed streams with the two least disturbed systems showing intermediacy.