Spatial Assessment of Aquatic Macroinvertebrate Communities in Tributaries of Lake Dardanelle

Brendon K. Mitchell, Alex W. Gillies, Ben S. Johnson, Ethan H. Dodson, and Kyler B. Hecke

Background

- Aquatic macroinvertebrates are key bio indicators of water quality and can be used to catch changes in the health of the aquatic system as they are sensitive to environmental changes (Smith and Samways 2007).
- These macroinvertebrate communities can significantly change with varying land-use practices on surrounding riparian area (Kim et al. 2019).
- Spatial relationships of macroinvertebrate communities are rarely assessed, especially in Arkansas.
- We wanted to assess the macroinvertebrates communities of 6 tributaries of Lake Dardanelle.
- We assessed 6 tributaries of Lake Dardanelle (Bakers Creek, Shoal Creek, Spadra Creek, Middle Fork Illinois Bayou, Hurricane Creek, and Mill Creek) and compared them for spatial differences of aquatic macroinvertebrate communities.

Objectives of Study

- *Objective 1:* To determine the aquatic macroinvertebrate communities in 6 tributaries of Lake Dardanelle.
- *Objective 2:* To compare these communities and determine diversity and abundance differences between waterways.

FIGURE 1: Map of the Lake Dardanelle Reservoir watershed and six tributary sites (black balloon marker).

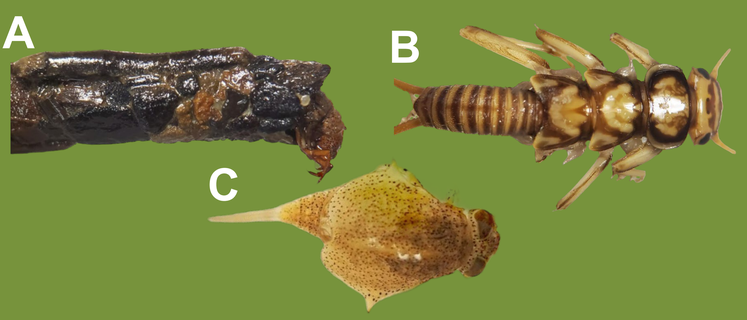

FIGURE 3: Limnephelidae caddisfly (A), Perlidae stonefly (B), Baetiscidae mayfly (C).

Methods

- Macroinvertebrates were collected from 6 local tributaries (Hurricane Creek, Spadra Creek, Mill Creek, Bakers Creek, Middle Fork Illinois Bayou, and Shoal Creek) within the Lake Dardanelle watershed (Figure 1).
- Macroinvertebrates were collected during two different sampling periods, Spring of 2022 and 2023.
- Macroinvertebrates were collected using d-frame kick nets (Smith and Samwyas 2007). Sampling took place for 1-hour and covered all habitat types during each sampling period. There were between 8-10 people per sampling period.
- Each specimen was given at least 2 vouchers in the field and more precise identification down to family was completed with Swift SM-80 dissecting microscopes. Identifications were done using microinvertebrates.org (Kautz et al. 2022).
- Abundance estimated among at sites by estimating Simpson's and Shannon's Diversity Indices.
- Bray-Curtis was used to compare sites and determine whether sites showed overall more similarity or dissimilarity.

Results

- 45 unique macroinvertebrates were observed among all sites (Fig. 2).
- Heptageniid mayflies (101) were the most abundant macroinvertebrate among all sites.
- Spadra Creek was the most diverse site with 24 unique species while Hurricane Creek was the least diverse with only 13 unique species.
- On average (mean ± sd) Shoal Creek (0.76 ±0.29) and Bakers Creek (0.69 ±0.27) were more dissimilar with all sites than Hurricane Creek (0.58 ±0.24), Middle Fork Illinois Bayou (0.56 ±0.23), Mill Creek (0.64 ±0.26), and Spadra Creek (0.64 ±0.26).
- Bray-Curtis comparison showed that Bakers and Shoal Creek had the greatest degree of differences compared to the other tributaries (Table 1).

Table 1. Bray-Curtis distance comparisons, Shannon's (H) and Simpson's (1-D) Diversity indices estimates, and evenness (E) estimate.

	Bray-Curtis Distance										
	BC	HC	IBMF	MC	ShC	SpC	Mean	SD	H	D	E
BC	-	0.66	0.63	0.70	0.86	0.61	0.69	0.27	2.16	0.85	0.78
HC	0.66	-	0.41	0.53	0.73	0.55	0.58	0.24	2.01	0.82	0.78
IBMF	0.63	0.41	-	0.50	0.69	0.55	0.56	0.23	2.31	0.87	0.82
MC	0.70	0.53	0.497	-	0.75	0.71	0.64	0.26	2.40	0.88	0.82
ShC	0.86	0.73	0.6850	0.752	-	0.79	0.76	0.29	2.56	0.94	0.95
SpC	0.61	0.55	0.55	0.71	0.79	-	0.64	0.26	2.71	0.92	0.5

Discussion

- Differences in macroinvertebrate communities among all 6 tributaries suggest variation in habitat and water quality within each waterway.
- The differences between macroinvertebrate communities in these streams are likely due to the varying land use practices and riparian disturbances among each tributaries' watershed (Kim et al. 2019; Effert-Fanta et al. 2019).
- Agriculture tends to dump excessive amounts of nutrients into the waterways nearby when there is declined riparian area and will significantly affect the diversity and integrity of these waterways (Gichana et al. 2015; Medupin 2020).
- This research will aid in the understanding of how varying land use practices and riparian disturbance influence the communities of aquatic macroinvertebrates and how using annual aquatic macroinvertebrate data can cdetect early patterns of degrading habitat and water quality (Resh et al. 2013).

Literature Cited

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