

Aquatic macroinvertebrates as sentinels of changes in local stream conditions in East Texas

Courtney Plummer, Erin Shepta & Carmen G. Montaña

Department of Biology, Stephen F. Austin State University, Nacogdoches TX.



Introduction

Aquatic macroinvertebrates are excellent indicators for stream health because of their response to environmental changes and pollution. Their short lifespans and rapid response to change makes them good indicators for local scale assessment [1].

Biological assemblages used in biomonitoring programs have often been assessed through multimetric approaches, in which the metrics are assemblage attributes related to species composition, richness, abundance, and trophic function [2].

Study objective: To use aquatic macroinvertebrates to assess the habitat quality and biological conditions of a stream, La Nana Creek, impacted by different land use.

Study Site

La Nana creek is a perennial tributary of the Angelina River. From headwater to downstream reaches, the creek varies along a gradient of land uses (e.g., headwater (Site 1): rural-agriculture use vs downstream (Site 2): urban) (Fig. 1).

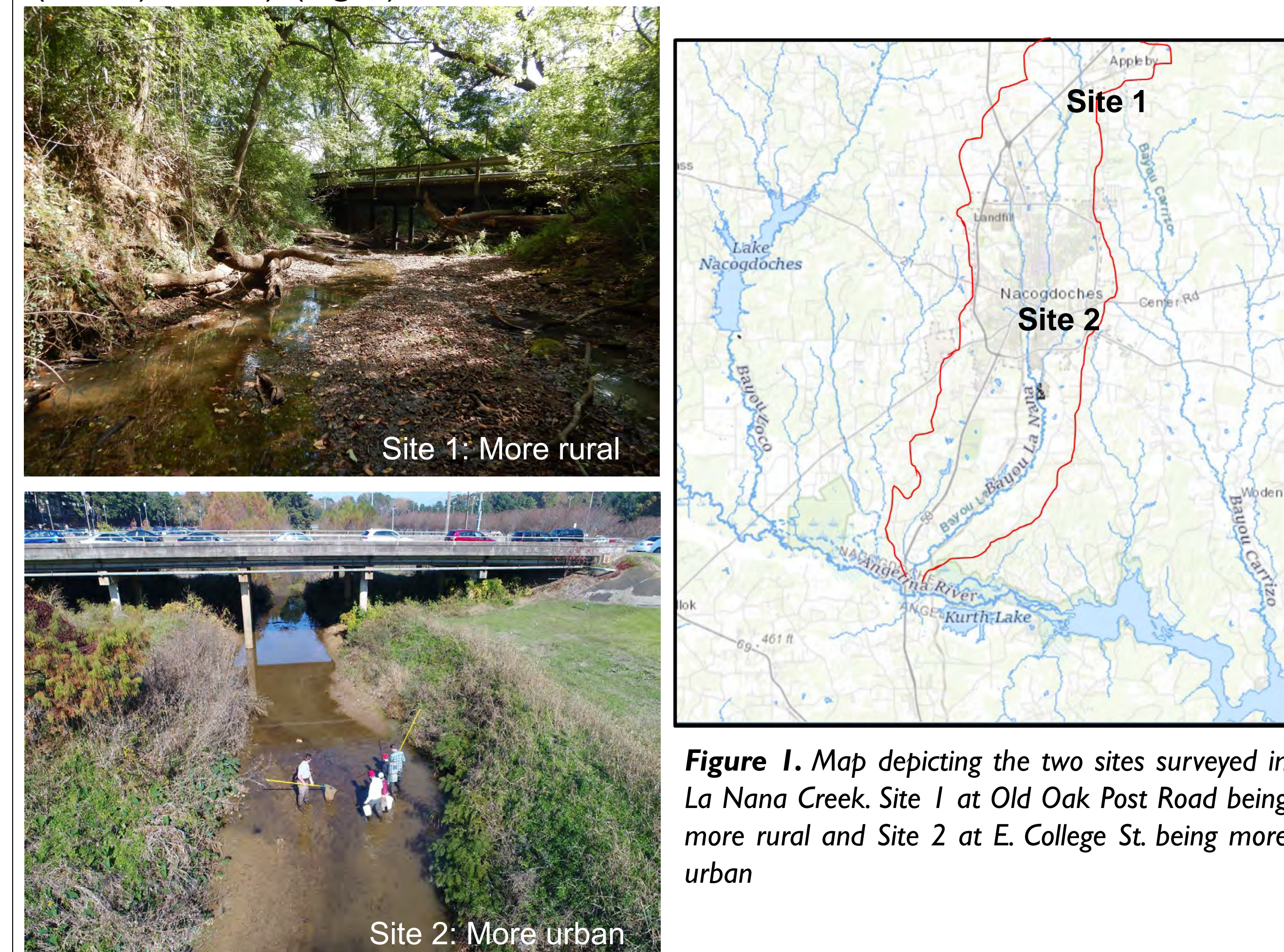


Figure 1. Map depicting the two sites surveyed in La Nana Creek. Site 1 at Old Oak Post Road being more rural and Site 2 at E. College St. being more urban

Methods

Macroinvertebrate assemblages were assessed in Fall 2020, Spring and Summer 2021.

Field Collection:

- Habitat assessment and water quality parameters were measured at each site using portable meters
- Aquatic macroinvertebrates were collected using kick-nets, rock washing, and leaf packs.

Laboratory Assessment:

- Macroinvertebrates were sorted, classified to lowest taxonomic level possible, and quantified.
- Average abundance, species richness, and Shannon-Weiner Diversity Index were calculated for each site and season.

Results

In-stream Site Characteristics

Site 1 and Site 2 showed variation in land use, substrate types, and water quality (Fig. 2). Sites also varied according to season where both sites had increased TDS, salinity, and presence of emergent macrophytes in the spring and increased water depth in the summer.

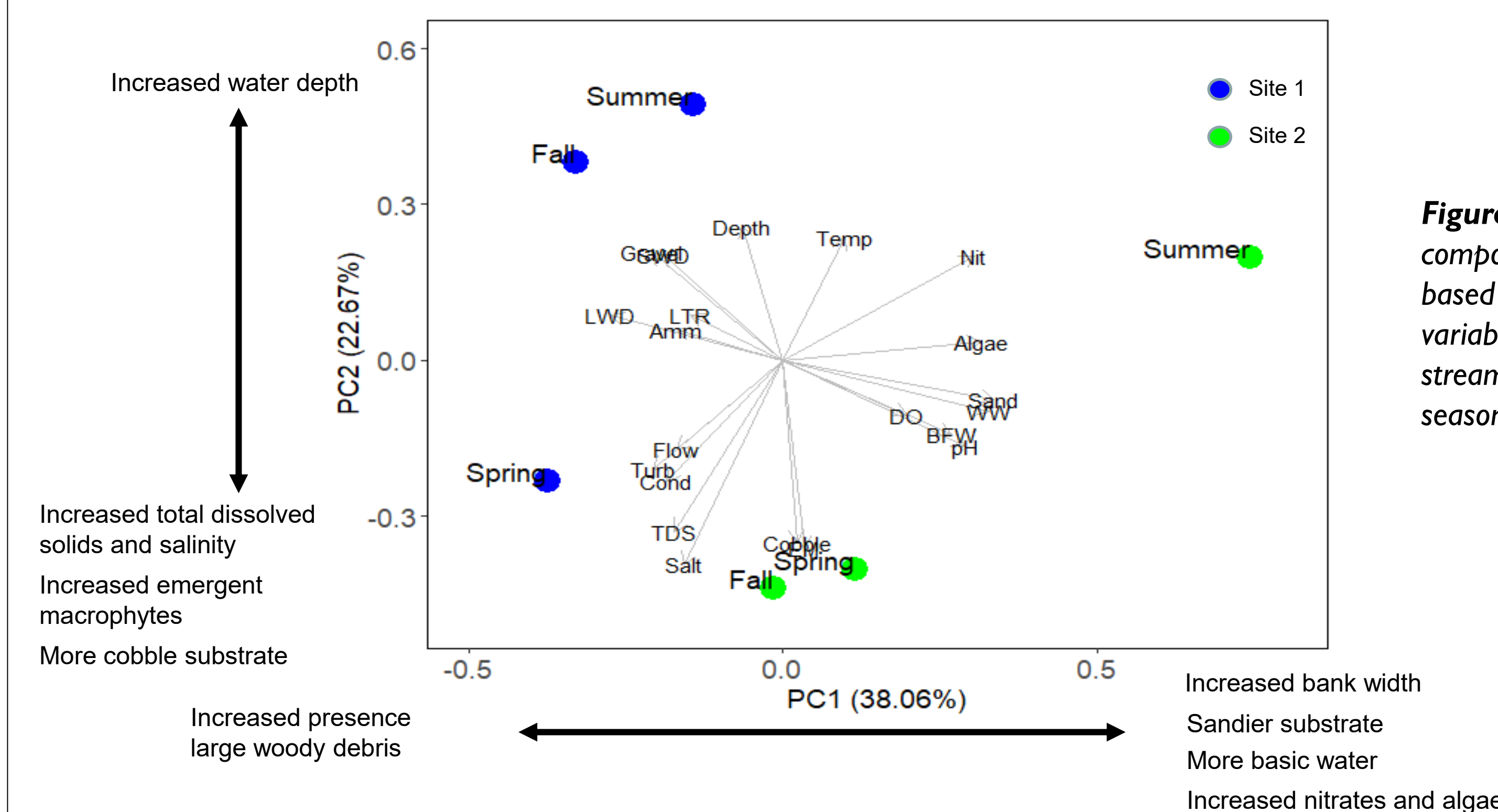


Figure 2. Principal component analysis (PCA) based on 21 environmental variables measured at each stream site across three seasons

Assemblage Spatial-Temporal Variation

On average, Site 2 had more individual taxa and higher richness compared to Site 1 (Fig. 3a,b). Shannon diversity index suggested that on average greater diversity was observed at Site 1 (Fig. 3c, Table 1).

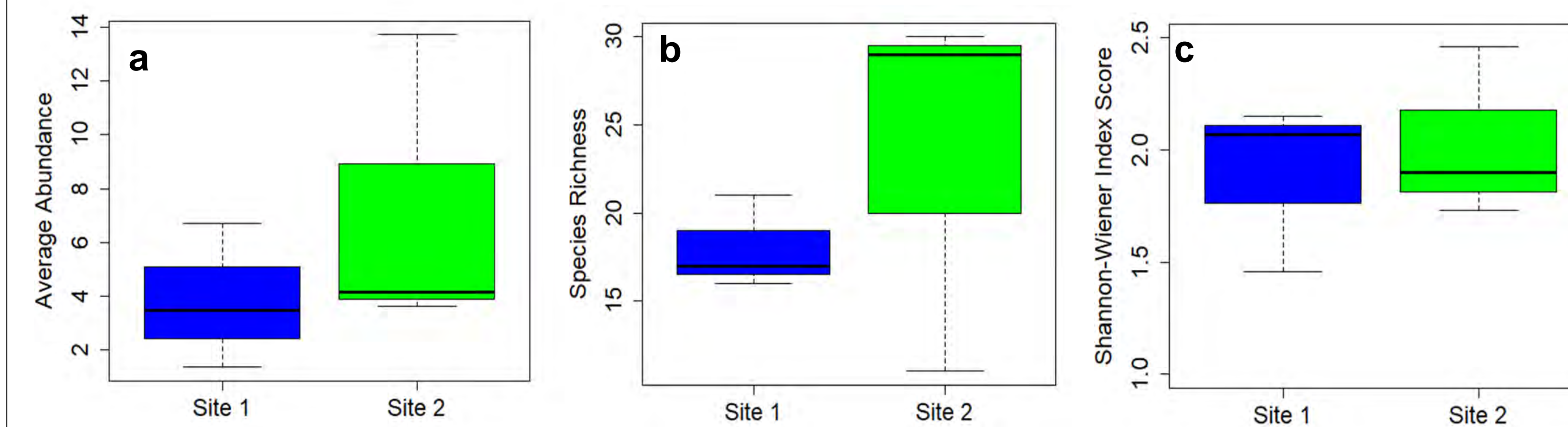


Figure 3. Macroinvertebrate assemblage metrics according to stream site. a) Average abundance individual taxa, b) species richness between sites and c) Shannon diversity index between sites.

Macroinvertebrate taxa showed seasonal variation between sites (Fig 4). On average, Site 1 had greater abundance of individual taxa during the fall season and high diversity in spring and summer (Fig. 4c). Site 2 reported the greater abundance in the spring season (Fig. 4a) and had higher species richness for fall and spring, and high diversity in fall season (Fig 4. b,c)

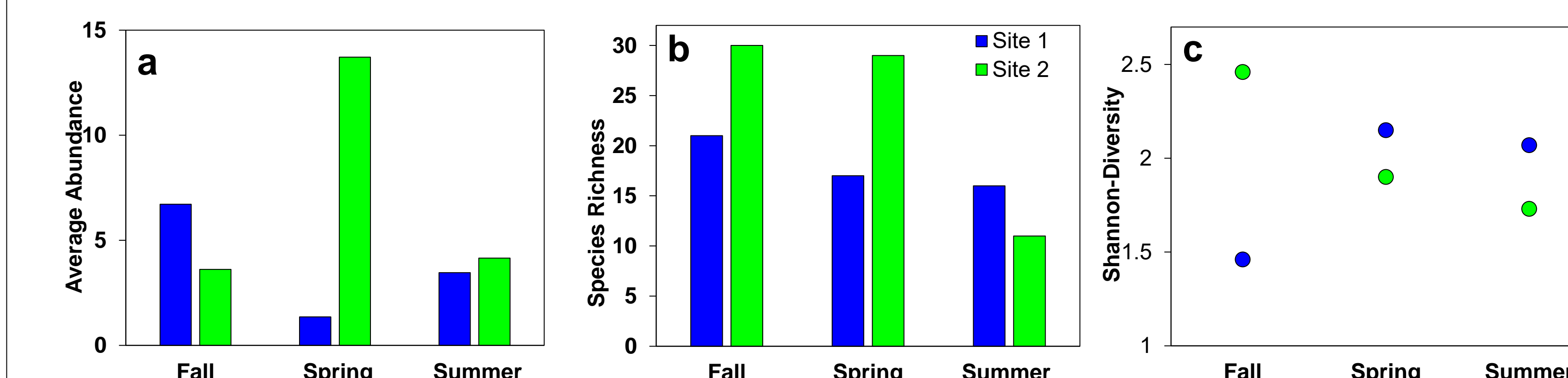


Figure 4. Seasonal variation of macroinvertebrate assemblage metrics according to stream site. a) Average abundance individual taxa, b) species richness and c) Shannon diversity index.

Macroinvertebrate Taxa

A total of 28 taxa occurred in Site 1 and 34 taxa in Site 2. Five trophic groups were identified: predators, shredders, scrapers, collector-filters, and collector-gatherers. Shredders were only found during the summer at site 1. The other four groups were found consistently at both sites for each season.

Taxa	Family	Site 1	Site 2
Basommatophora	Physidae	x	x
	Planorbidae	x	x
Coleoptera	Elmidae	x	x
	Dryopidae	x	x
	Gyrinidae	x	x
Decapoda	Cambaridae	x	x
Diptera	Ceratopogonidae	x	x
	Chironomidae	x	x
	Tabanidae	x	x
	Tipulidae	x	x
	Simuliidae	x	x
Ephemeroptera	Baetidae	x	x
	Caenidae	x	x
	Heptageniidae	x	x
Hemiptera	Gelastocoridae	x	x
	Gerridae	x	x
	Hydrometridae	x	x
	Mesoveliidae	x	x
	Nepidae	x	x
Megaloptera	Corydalidae	x	x
	Sialidae	x	x
Odonata	Aeshnidae	x	x
	Coenagrionidae	x	x
	Cordulidae	x	x
	Gomphidae	x	x
	Lestidae	x	x
	Libellulidae	x	x
	Plecoptera	Perlidae	x
Perlodidae		x	x
Trichoptera	Helicopsychidae	x	x
Trombidiformes	Hydropsychidae	x	x
	Philopotamidae	x	x
	Phryganeidae	x	x
Veneroida	Hydracarina	x	x
Tricladida	Corbiculidae	x	x
	Hirudinea	x	x
	Oligochaeta	x	x

Table 1. Macroinvertebrate taxa collected from La Nana Creek, Nacogdoches, Texas.

Table 2. Average EPT index for each site and all seasons. Site 1 was rated Good-fair and Site 2 rated Good [3].

Season	Site 1	Site 2
Fall	14.29	10.00
Spring	23.53	34.48
Summer	25.00	45.45
Average	20.94	29.98
Rating	Good-fair	Good

Some aquatic macroinvertebrate collected at La Nana Creek



Discussion

Both sites had pollutant sensitive macroinvertebrate taxa including families in Ephemeroptera and Trichoptera. Species within the order Plecoptera (*Isoperla* spp. and *Perlesta* spp.) contained sensitive taxa that was reported only during the Spring. At Site 2, high abundance of the invasive Asian clam was found during the spring season. Overall, Site 1 had a higher diversity while Site 2 had higher abundance and richness. Site 1 had a higher percentage of large woody debris and more canopy cover which could have provided better habitats and feeding opportunities. Continuation of monitoring of these sites in La Nana creek will help understand changes in stream diversity and habitat quality.

References:

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