BIODIVERSITY OF AQUATIC INVERTEBRATES IN THE DOG RIVER WATERSHED

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Biodiversity of aquatic invertebrates in waterbodies can provide valuable information regarding the condition of particular ecosystems. The diversity of species in an area can tell a lot about stream health providing information on what type of life exists there. Collecting this type of data and presenting results has the potential to aide local organizations in formulating plans to maintain or improve stream health. This study aims at sampling the aquatic invertebrates in two areas of the Dog River Watershed that have similar elevation and topography. The first area is located off of Leroy Stevens Road in Halls Mill Creek within a remote setting, while the second area is near the intersection of Halls Mill and Azalea Roads in Moore Creek. The specimens were collected through D-net and bucket collection and preserved in 95% ethyl alcohol for identification. Invertebrates were identified after they were collected for the same amount of time at each site on three different occasions. This study shows that there are not only differing amounts in the volume of specimens collected, but also differences in the composition. Future studies can go further in identifying the reasons for these differences and ways to manage any identifiable problems, if any exist.

Keyword: biodiversity, aquatic invertebrates, watershed

Introduction

Studying biodiversity within the Dog River Watershed can potentially identify problems that could be caused by a variety of reasons. High biodiversity levels indicate healthy streams, while low biodiversity levels indicate poor stream health. When biodiversity levels are high, it would be indicated by more diverse composition of aquatic invertebrate families indicating cleaner water where invertebrates can thrive. By studying two areas of similar elevation, but a good distance apart, I can potentially identify if some species are located in one area and not in others. The diversity of stream headwaters can greatly contribute to the biodiversity of the stream systems. It is important to maintain the

biodiversity of stream and ditch systems because it is essential in maintaining the local ecology and riparian network (Meyer 2007). Small streams can vary greatly in biotic characteristics providing a variety of habitats for a broad range of species. While small streams offer a vast amount of habitats, their small size is also sensitive to disruption, therefore the presence of particular aquatic invertebrates could potentially assist in identifying disruption to the local ecosystem. For example, according to Meyer, "Unique faunal assemblages have been linked to characteristic water chemistries of springs, reflecting different levels of contamination of their ground-water sources" (2007). This type of statement reflects the importance of the potential for documentation of aquatic invertebrates, such as insects, in telling the local community about the health of the stream. Additionally, maintaining local diversity of aquatic insects and keeping up with a general comparison is important because "40% of the North American aquatic insect fauna can be found in the Southeast [with] much of this richness in small springs and streams" (Meyer 2007). This gives further reason to look into the local biodiversity within the Dog River Watershed.

Similar studies have looked at small bodies of water and the relative biodiversity to aide in conservation goals. One study in particular by Williams, found that "the findings, as a whole, suggest that ponds and other small waterbodies can contribute significantly to regional biodiversity" (2003). This study identified a variety of macroinvertebrates and accounted for the occurrence of rare species. Identifying the local biodiversity in these streams is imperative for management of the local ecosystem. As time has progressed, the need to manage both the land and water together has been

recognized. Studies regarding local biodiversity in areas such as these can aide in efforts to provide long-term sustainability.

Based upon the aforementioned information and personal interest, I studied two areas in different locations, but with similar elevation, vegetation, and general land use. I collected and compared samples from a remote creek with swamp-like areas off of Leroy Stevens Road in Mobile, AL within Halls Mill Creek (Site A) with a more residential waterway that is part of Moore Creek near the intersection of Halls Mill Road and Azalea Rd (Site B) as shown in Figure 1. Comparing areas like this that contain leaf litter breakdown and dense vegetation can be helpful in finding aquatic invertebrates that could indicate the health of the watershed (Hutchens 2002).
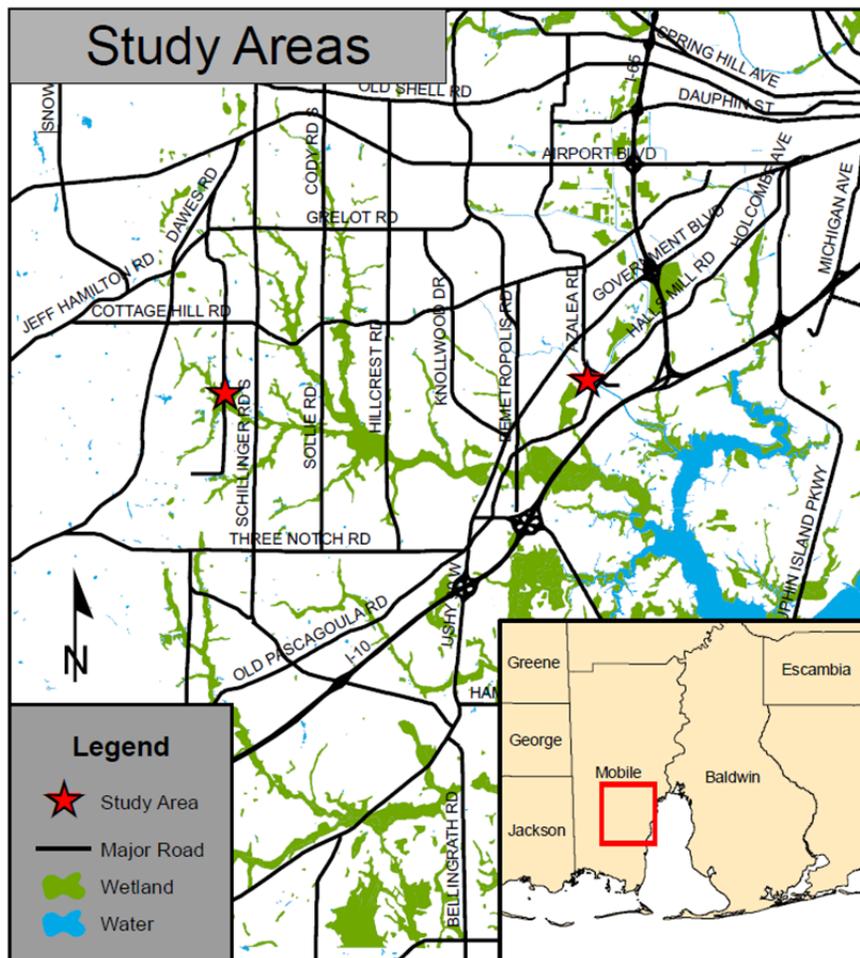

Figure 1- Map of Site A and Site B in the Dog River Watershed

Research Question

What are the differences in the composition of aquatic invertebrate families collected from Site A in Halls Mill Creek and Site B in Moore Creek? Can any patterns regarding these differences be found?

Methods

I collected aquatic invertebrates from two study areas and compared the collections for the different families of invertebrates found. Site A, at 30°37'21" N, 88°13'55"W, is located off of Leroy Stevens Road at the edge of Halls Mill Creek. This area is in a relatively remote setting, but a bridge has been constructed in the past few years. Site B, at 30°37'36"N, 88°8'10"W, is located on Moore Creek at the intersection of Azalea Road and Halls Mill Road. The main area of site collection at Site B can be found approximately 0.75 miles northwest of the bridge in a stream flowing into Moore Creek. A five gallon bucket and D-net were used to collect samples from both sites. Each site was sampled three separate times with the same techniques. The same collection methods were performed at each because of the importance of how each study area is sampled (Hughes 1978). At each collection event one bucket scoop of leaf litter through open spaces of water was acquired. Additionally, two sweeps were performed with D-nets through dense vegetation and partial leaf litter. More than one collection method enabled a greater possibility of encompassing the different types of aquatic invertebrates that may be found in these study areas. General weather conditions and time of day were recorded along with GPS Coordinates and date.

In order to identify the various aquatic invertebrates that were found in the study areas, the collected samples of water and vegetation were taken to the freshwater ecology lab at USA and sorted through using a pan, forceps, and bright light. Invertebrates were preserved using 95% ethyl-alcohol and viewed under a microscope to identify to class, order and family. Samples were grouped by the areas from which they were collected and identified by means of aquatic invertebrate keys. The correct identification of families found in both Site A and Site B were verified by Dr. John McCreadie, professor and entomologist in the University of South Alabama Biology Department. Additionally, the frequency of each family that were found in each sample of vegetation and water was accounted for by means of hand counting.

Results

Completion of this project yielded 16 different families from Site A, the Halls Mill Creek study area, and 18 different families from Site B, the Moore Creek study area. While there were some families that were found in both locations, there were also several families located in Site A that were not in Site B. Likewise, there were samples found in Site B that were not found in Site A. In both locations there was an overwhelming occurrence of Gammaridae, which was marked in frequency as "too many to count" (TMTC) at both sites. Site A yielded 59 collected samples. Site B had a total of 30 samples collected in the same manner as Site A. Comparison of Site A and Site B show that the families present in Site A (Halls Mill Creek) that were not also found in Site B include Daphniidae, Isotomidae, Caenidae, and Limnesiidae. Families found in Site B that were not in Site A include Tridactylidae, Glossiphoniidae, Veliidae, and Planariidae as shown in Figure 2. The absence of these families does not confirm that these families

are not located in the study area, but indicates that they were not found in the collected samples of water and vegetation that. A total of 89 samples were sorted through and identified to reach these results.

	SITE A RESULTS				SITE B RESULTS			
	Class	Order	Family	Frequency	Class	Order	Family	Frequency
	Insecta	Odonata	Libellulidae	1	Insecta	Odonata	Libellulidae	1
	Insecta	Odonata	Coenagrionidae	3	Malacostraca	Decapoda	Cambaridae	1
	Malacostraca	Decapoda	Palaemonidae	10	Insecta	Odonata	Coenagrionidae	6
	Malacostraca	Isopoda	Asellidae	10	Malacostraca	Amphipoda	Pontoporeiidae	1
	Insecta	Diptera	Ceratopogonidae	4	Insecta	Coleoptera	Elmidae	1
	Malacostraca	Amphipoda	Hyalellidae	2	Malacostraca	Decapoda	Palaemonidae	1
	Insecta	Diptera	Chironomidae	11	Turbellaria	Tricladida	Planariidae	2
	Arachnida	Prostigmata	Limnesiidae	1	Insecta	Hemiptera	Veliidae	2
	Insecta	Ephemeroptera	Baetidae	1	Clitellata	Rhynchobdellida	Glossiphoniidae	1
	Insecta	Coleoptera	Haliplidae	1	Malacostraca	Isopoda	Asellidae	1
	Insecta	Coleoptera	Hydrophilidae	1	Insecta	Orthoptera	Tridactylidae	1
	Insecta	Ephemeroptera	Caenidae	3	Insecta	Diptera	Tipulidae	1
	Collembola	Collembola	Isotomidae	3	Insecta	Odonata	Corduliidae	1
	Gastropoda	Hygrophila	Planorbidae	1	Insecta	Coleoptera	Hydrophilidae	1
	Branchiopoda	Cladocera	Daphniidae	2	Insecta	Coleoptera	Staphylinidae	4
	Gastropoda	Hygrophila	Physidae	5	Insecta	Diptera	Chironomidae	1
	Malacostraca	Amphipoda	Gammaridae	TMTC	Gastropoda	Hygrophila	Physidae	4
					Malacostraca	Amphipoda	Gammaridae	TMTC
TOTAL	6	11	17	59	5	11	18	30

Figure 2- Results of Class, Order, and Family from Site A and Site B

Discussion and Conclusions

This project showed a significant difference in the total number of specimens collected from each of the study areas. Despite the fact that both sites were collected from using the same methodology of 1 bucket scoop and 2 D-net sweeps, Site A yielded 59 collected specimens and Site B yielded 30 collected specimens. The 4 orders of aquatic invertebrates that were found in Site A and not Site B included Cladocera (Daphniidae), Collembola (Isotomidae), Ephemeroptera (Caenidae), and Prostigmata (Limnesiidae). The 4 orders that were found in Site B and not Site A included Orthoptera (Tridactylidae), Rhynchobdellida (Glossiphoniidae), Hemiptera (Veliidae), and Tricladida (Planariidae) as can be shown in Figure 3.

Upon seeing which families were found in one area and not another, a closer look was taken at the typical environments these organisms occur in or some of their basic
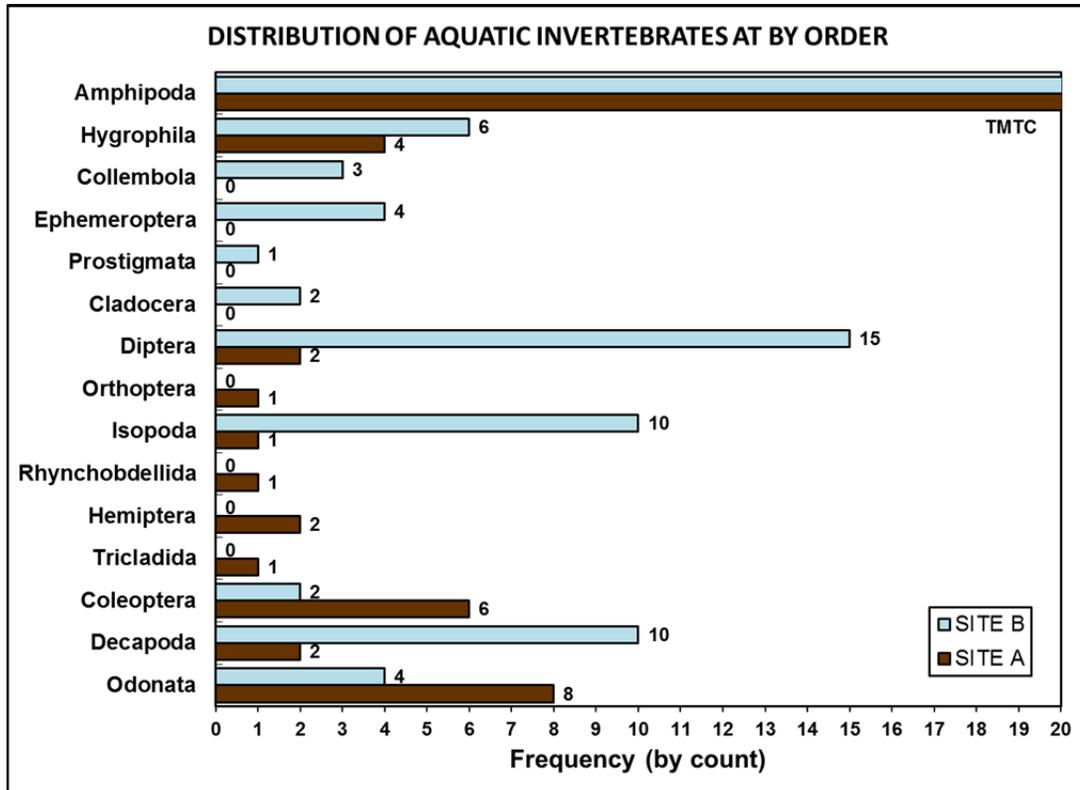
Figure 3- Graph showing the distribution of orders of aquatic invertebrates by order found at Site A and Site B

characteristics, in an attempt to explain why some species are located in one place and not another. The first Site A family looked at was Daphniidae. This organism is generally tolerant of poor water quality due to their ability to synthesize hemoglobin, but is "very sensitive to disturbances of the ionic composition of their environment" (Schumann 1996). Additionally, they have a wide tolerance to temperature. The next family, Isotomidae, can be found in a variety of environments including soil and freshwater pools. Some are carnivorous, "feeding on other springtails, nematodes, and other small arthropods" (BioKIDS 2014). These organisms contribute nutrients to soil "because they speed up the process of decay and deposit nutrient rich feces back into the earth" (BioKIDS 2014). Some organisms within the family Limnesiidae are considered planktonic due to being collected in open waters. Overall, there seems to be "poor

knowledge of water-mite ecology" (Hugo 2011). The last organism to discuss from Site A is from the family Caenidae. These small organisms are collector/gatherers or scrapers and tend to occur in streams in areas of slow current. They have a high tolerance value for poor water quality (Bouchard 2004).

Site B has 4 separate families of aquatic invertebrates that were not found in Site A. The first of these organisms is Tridactylidae. These organisms are typically found in moist, sandy soil near water, and feed largely on plant material (Allaby 2009). Glossiphoniidae is a type of leech that once engorged, detach and rest on a protected substate in the water, such as the leaf under a stump, that this sample was found in. Their entire lifecycle may last anywhere from 24 hours to several months depending upon host availability. Some populations "show preference for, or will exclusively occur on one particular host" (FAO 1996). The next organism, Veliidae, is semi-aquatic. They typically occur in quiet lotic and lentic waters dwelling on the water surface. They are predators and scavengers which feed on a variety of small crustaceans and other insects (Murray-Darling 2013). The last differing organism is the family Planariidae. These are flatworms that avoid light and are found under rocks and debris during the day. They are predators and scavengers and eat snails, worms, or soft insect larvae (Canadian 2007).

The presence of Daphniidae and Caenidae solely at Site A could be indicative that there is poorer water quality at this location. Additionally, the presence of a much higher number of Chironomidae at Site A could also represent poor water quality. These 3 families of organisms are all highly tolerant of poor water and harsh conditions. The absence of these organisms at Site B leads me to believe that there is greater "stream

health" at the Moore Creek study area. This means there not only appears to be greater species richness at Site B, but also cleaner water.

The data gained in this project has the potential to aid future studies on the Dog River Watershed's biodiversity by providing information on the current organisms found in areas of Halls Mill Creek and Moore Creek. The research done, while it did not definitively give levels of biodiversity in the watershed, was able to generally identify current species composition, richness, and a possible explanation on which area had greater "stream health". This research can aide future studies to compare what exists now and what may exist in the future. Identification of the presence of organisms is the first step in evaluating the biodiversity levels in the study areas. This information has the potential to help further understand the ecology of the Dog River Watershed and what can be done to maintain healthy levels of aquatic invertebrates.

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