LIFE CYCLE AND COMMUNITY STRUCTURE OF CADDISFLIES (INSECTA:TRICHOPTERA) IN THE NAVASOTA RIVER, TEXAS.

An Undergraduate Research Scholars Thesis

by

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ABSTRACT

Life Cycle and Community Structure of Caddisflies (Insecta:Trichoptera) in the Navasota River, Texas. (May 2015)

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There is a lack of research focused upon the structure and function of low elevation, turbid lotic ecosystems such as the Navasota River, located in south-central Texas. The understanding of these ecosystems can be important to management of freshwater resources. Aquatic invertebrate communities and their ecological functions to the Navasota River and similar ecosystems are poorly studied. The purpose of this study was to gain a better understanding of the life cycle and community structure of caddisflies (Insecta: Trichoptera) in the Navasota River, near where it joins the Brazos River. Four replicate samples were collected approximately once every month from a riffle. One species of the genus *Cheumatopsyche* is the dominant caddisfly in the river accounting for over 90% of all caddisflies collected. Based upon larval collections, emergency of adults appears to occur during the months of January and February. Data collection was hampered by extremely high water conditions during part of the year, resulting in gaps in the data.

CHAPTER I

INTRODUCTION

Rivers have been dammed and diverted for flood control and hydropower generation, and used for navigation for centuries (Benke and Cusing 2011). They are also a vital part in human communities by being used as a source of water for agriculture, industry, and human consumption. Although lotic systems play an important role in society, there is a complete lack of knowledge about their ecosystems. This lack of basic ecological data severely hampers decision makers involving management of freshwater resources (Baumgardner and Bowles 2005). An important component of the ecosystem of a lotic system is the aquatic invertebrate community. In this study, we focus on trying to gain a better understanding of the community structure and life cycle of the caddisfly.

Caddisflies (Insecta: Trichoptera) are one of the most common aquatic invertebrates found in lotic ecosystems throughout the world, including numerous running water ecosystems throughout Texas (Wiggins 1996). The majority of a caddisfly's life is spent in water. Once the adult caddisflies emerge then mate, the female lays her eggs in a freshwater stream or river. The larvae go through 6-7 growth stages before pupating and emerging from the water as adult caddisflies (Kondratieff et al. 1997). These larvae are an important food source for other insects and fishes, and their presence can signal the health of a lotic system (Rhame and Stewart 1976). Few comprehensive studies have been conducted \ on the life-history of caddisflies, especially in rivers throughout the southeastern United States. Understanding the seasonal fluctuations and growth patterns of caddisflies in Texas rivers is an important step in determining their life history and understanding community structure in lotic systems (Cloud 1974). Life histories affect the ecosystem around them which in turn can affect freshwater and natural resources (Huryn et al. 2000).

CHAPTER II

METHODS

Aquatic Invertebrate Collection

Beginning in August 2013, samples of macroinvertebrates were conducted approximately monthly from the Navasota River at a location approximately 30 km south of College Station. Four replicate samples were taken from a shallow riffle using a Hess sampler with a mesh size of 250 µm. A garden hand weeder was used to disrupt the substrate, and a laboratory glass cleaning brush was used to dislodge insects from large rocks and debris. For transportation back to the laboratory, collected insects were preserved in a 500 mL Nalgene bottle filled with 75% ethyl alcohol.

Sorting the Samples

Aquatic macroinvertebrates were separated from collected sediment and debris using an AM dissecting microscope. The specimens were then sorted by species into 4 dram glass vials clearly labeled with the collection date, location, sample number, and replicate number. Larval caddisflies of the genus *Chematopsyche* were segregated from all other specimens. Head capsule width was measured in millimeters using an AM dissecting microscope with ocular micrometer. Each measurement was recorded in a Microsoft Excel spreadsheet organized by date and replicate number. All data upon which this study is based is housed at the Texas A&M University Insect Collection.

Analysis of the data

The larval head capsule data was used to infer the life cycle of this species within the Navasota River. The averages of the total number of caddisflies and the head capsule measures were calculated for each month as well as an overall nine month average. The averages for each month were compared to the nine month average in an unpaired t-test to determine if any differences were statistically significant. These average head capsule widths were plotted on a line graph to give a visual representation of the pattern of growth, development, and emergency of the species.

CHAPTER III

RESULTS

Number of *Cheumatopsyche*

Cheumatopsyche was found in every sample taken with a mean of 513 for the 9 sampled months. The greatest number of caddisflies were found in the months of September (718), April (950), and July (739). The months with the smallest number of caddisflies were February (361), January (129), and October (114). August (600), March (588), and June (422) all had similar caddisfly numbers and did not notably differ from the 9-month average.

Table 1: The number of each head capsule measures per month of the year.

Head Capsule Width	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July
0.05	48	98	38	No Data	No Data	3	0	69	108	No Data	121	130
0.1	105	134	27	No Data	No Data	5	0	184	202	No Data	178	325
0.2	198	156	21	No Data	No Data	11	31	229	339	No Data	58	118
0.3	166	281	19	No Data	No Data	11	77	51	249	No Data	27	100
0.4	69	17	5	No Data	No Data	19	103	18	34	No Data	15	25
0.5	13	4	0	No Data	No Data	28	135	6	14	No Data	11	25
0.6	0	0	0	No Data	No Data	2	15	1	0	No Data	11	15
0.7	1	0	0	No Data	No Data	0	0	0	0	No Data	0	0

Head Capsule Width of *Cheumatopsyche*

The average head capsule width over the 9 months sampled was 0.24 mm. Months January (0.40 mm) and February (0.41 mm) both have average head capsule widths significantly larger than the 9-month average (p=0.0089). Although both October (0.16 mm) and June (0.15 mm) have notably smaller average head capsule widths than the average, the different is not statistically significant (p=0.1982). August, September, March, April, and July all had head capsule width averages well within .07 mm of the average.

The largest head capsule width recorded was 0.70 mm found in August. January had many large caddisflies with 2 individuals with 0.60 mm head capsule width and 28 individuals with 0.50 mm. February had 7 caddisflies with 0.60 mm head capsule widths and 90 with 0.50 mm. These are the largest numbers of large head capsule widths for the whole year. The smallest head capsule width measured was 0.05, and the months with the highest number of this head capsule width was April (108) and June (121). Both of these months also had over a hundred caddisflies measured with 0.1 head capsule width.

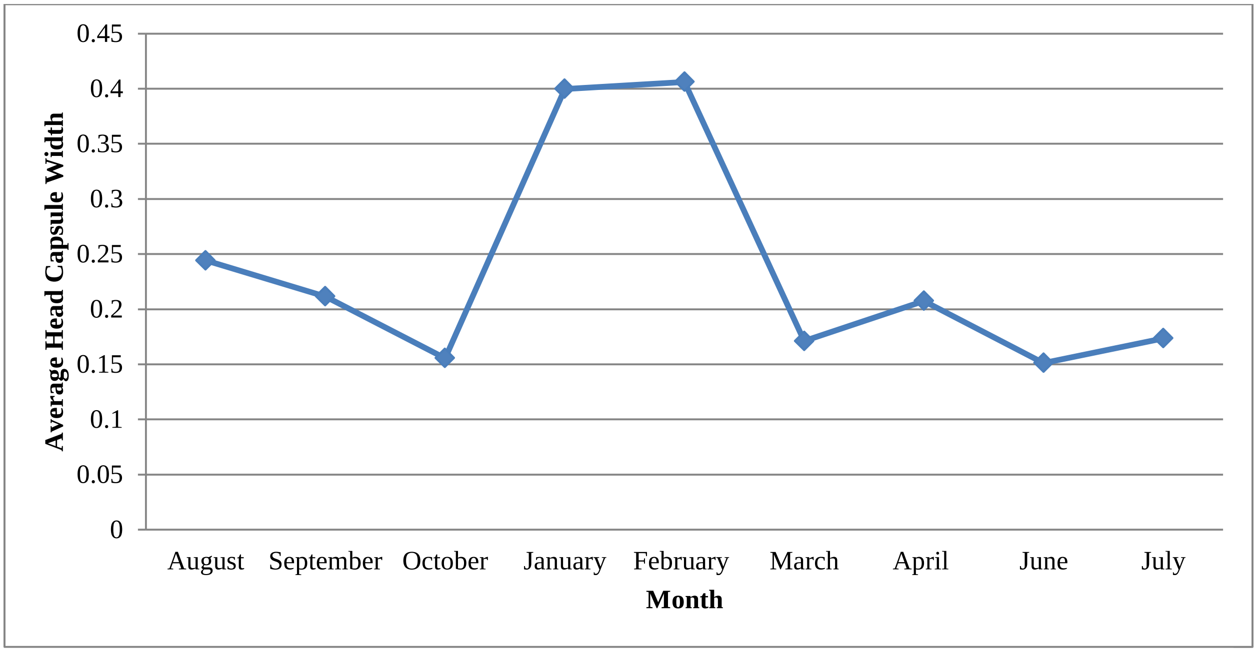

Figure 1: The average head capsule widths for each month sampled. November, December, and May not included because no data was obtained during those months.

CHAPTER IV

DISCUSSION

No samples were taken in the months of November and December because of extremely high water levels at the Navasota River (Figure 1) due to heavy rains. . No sample was taken in the month of May due to other commitments of the researchers.

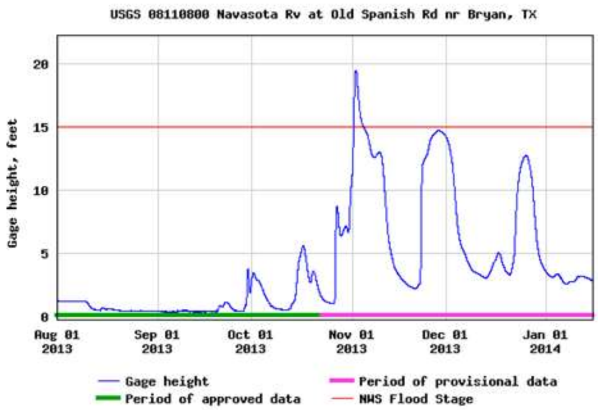

Figure 1: The height of water in the Navasota River at Old Spanish Rd. near the collection site. The gage height for November and December is at flood levels.

With the exception of January and February, there is limited variation in head capsule width throughout the year. This suggests that there is a single generation of *Cheumatopsyche* per year present in the Navasota River with most adult emergence in the months of January and February. There appears to be little growth throughout most of the year based upon the fact that head capsule width measurements vary little throughout all months of the year except January and February. Unfortunately, due to the lack of data in November and December, it is not possible to fully understand growth patterns. It appears that there may be extensive growth during these two months.

The small head capsule widths present in March and April support the hypothesi that adult emergence and reproduction is occurring during the months of January and February . Rhame and Stewart (1976) also noted emergence and mating of caddisflies during these months in the Brazos River (into which the Navasota River drains).   McCabe and Gotelli (2003) noted that there may be s diapause of the larvae during the early winter months. Although no data was collected during this study in the months of November and December, there does not appear to be any type of egg diapauses because larvae are present in the months that precede November and December. Larvae appear to grow slowly over the year, as is indicated by the little change in the average head capsule widths throughout the year.

For future studies, data needs to be taken from every single month. It is clear that the data from November and December is important to understanding the apparent rapid growth of caddisflies during this time. More years of research are essential for making solid conclusions on the life history of *Cheumatopsyche* in the Navasota River. This study provides the stepping stone to a more accurate understanding of the role that *Cheumatopsyche* plays in the aquatic invertebrate ecosystem and will broaden our knowledge of lotic systems.

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