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Field Research Study Abroad
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Comparative Analysis of Water Quality Based on Benthic Macroinvertebrates

Introduction:

While observing Springfield, we noticed a stream running by which feeds into the Check Hall River. Realizing this stream was contaminated with grey water from the Springfield facilities, we began to inquire about the impact this pollution would have on the macroinvertebrtates dwelling in the Springfield stream versus those in the comparatively pristine Check Hall River.

Hypothesis:

The quantity and diversity of benthic macroinvertebrates in the Check Hall River will be greater than that found in the Springfield stream do to the absence of direct effects of grey water.

Methods:

To begin our study, first six sites were chosen: three in the Check Hall River above the confluence with the Springfield stream and three in the Springfield stream above the conflence with the Check Hall River. At each site, a series of tests were conducted to help determine water quality and macroinvertebrate populations. Involved were: HACH pH kit, a standard flow meter placed in the riffle for three minutes to test velocity, a kick net and D net to capture invertebrates traveling through riffles as rocks and gravel were turned by hand for five minutes, and a thermometer to measure water and outside temperature at each site. An equation was used to interpret stream velocity from the number of counts recorded on the flow meter:

$$\text{Distance in meters} = \frac{\text{\# counts} * 26,873}{999999}$$

$$\text{Speed in cm/sec} = \frac{\text{dist. in meters} * 100}{\text{time in seconds}}$$

To determine water qualtiy, Beck's index for classification as modified by Kimmel and Sharpe (1975) was used. This is based on dividing macroinvertebrates into three classes. Each class is assigned a numerical value to be substituted into the Biotic Index(BI) (see Fig. 1). In addition, a voucher collection of all species reported on was placed in the laboratory at ATRC, Springfield, Dominica, West Indies.

Results and Discussion:

We attempted to choose sites with similar physical characteristics. Sites 1 and 2 were slightly more basic, with pH's of 8.0, which could be due to the grey water (see Tables 1 and 2). According to the Biotic Index, sites 1,2,3, and 6 fell into the moderate pollution category with BI's of five and six . The Springfield stream sites had slightly lower BI values than most of the sites on the Check Hall River. Site 6 had a lower diversity of macroinvertebrates than sites 4 and 5, possibly because of a slower stream flow. Sites 4 and 5 BI values indicate a clean stream with a lack of habitat diversity (see Figure 1). Invertebrates in the Class II category are characterized as moderately tollerant to pollution, and more of these were found in the Check Hall River. Other factors that could have attributed to the differences in results for the two areas are that the Springfield stream was very silty, decreasing the visiblity, and subjected to more canopy cover, which has been suggested to lower the density of species found in samples.

Future research:

Ideas for futher study on this topic include: testing downstream of where the Springfield stream and the Check Hall River intersect, chemical testing to determine amount of pollution, and determining if the amount of canopy cover truly affects the density of macroinvertebrates present. The results from this study could also be applied in a comparison with other streams in Dominica.

Works Cited

Chu, H.F. and Laurence K. Cutkomp. 1992. How to know the immature insects. Wm. C. Brown Communications, Inc, Dubuque, Iowa.

Lee, Richard. 1980. Forest Hydrology. Columbia University Press, New York. pp. 258-259.

Terry, Mark. 23 March 1992. "The Diversity and Distribution of Benthic Communities in the Check Hall River: Dominica, West Indies". State University of New York College of Environmental Science and Forestry, Syracuse, New York.

Figure 1

Biotic Index

$$BI = 2n(\text{Class I}) + n(\text{Class II})$$

where n is the number of different orders of a given class found in the stream.

Class	Numerical Value
I	2
II	1
III	0

Classification	
Clean	$BI \geq 10$
Moderate pollution	$1 \leq BI \leq 6$
Gross pollution	$BI = 0$

Note: $7 \leq BI \leq 9$ is rarely encountered and generally indicates a clean stream with lack of habitat diversity.

BI Site Information:

Springfield stream:
Site 1 = 2(2) +1=5
Site 2 = 2(2) + 2=6
Site 3 = 2(2) + 2=6

Check Hall River:
Site 4 = 2(2) + 3=7
Site 5 = 2(2) + 3=7
Site 6 = 2(2) + 2=6

Figure 1

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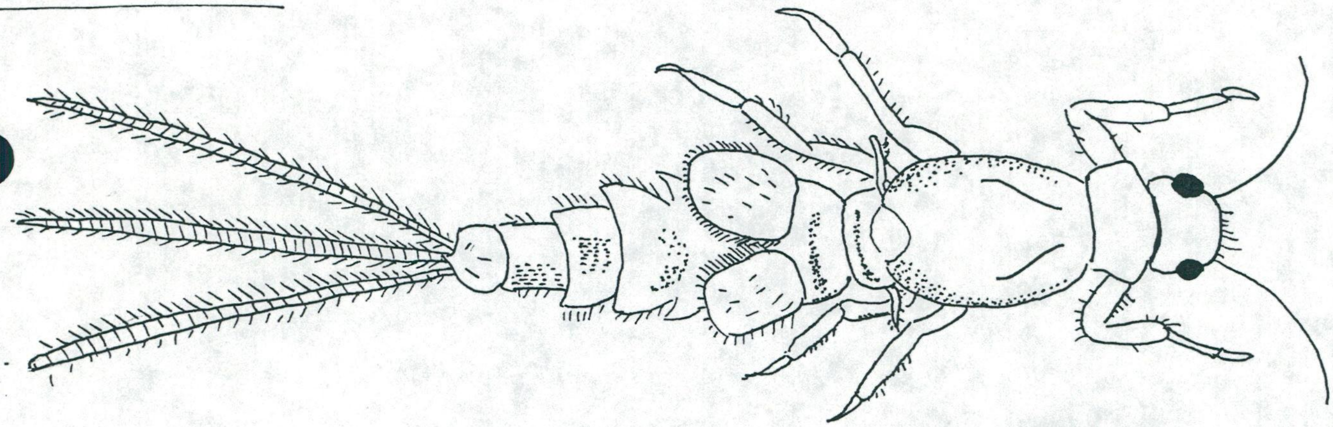
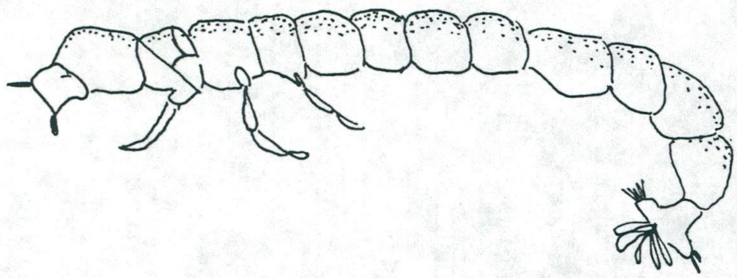
Site 5 = 2(2) + 3=7
Site 6 = 2(2) + 2=6

CLASS I



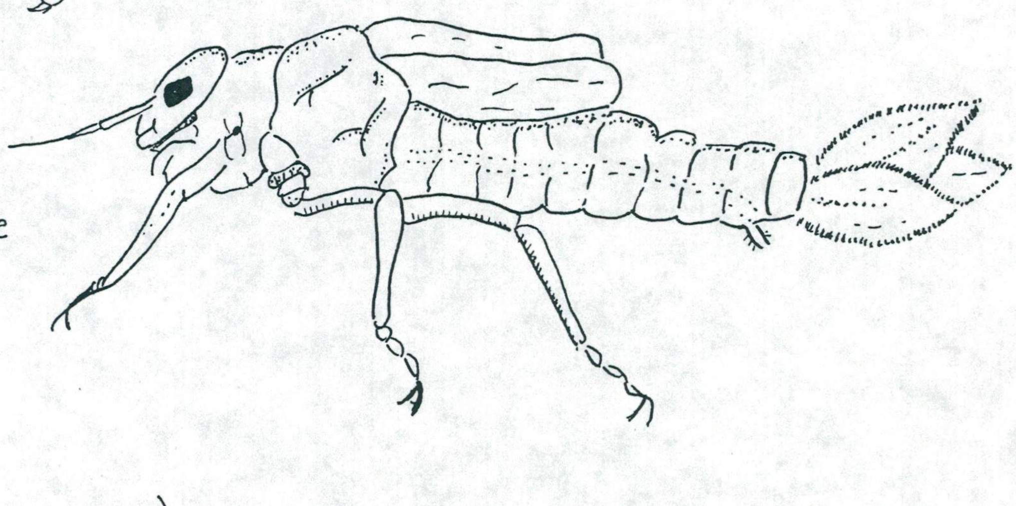
Order: Ephemeroptera
Family: Caenidae
MAYFLY



Order: Trichoptera
Family: Philopotamidae
CASE-BUILDING CADDISFLY

CLASS II

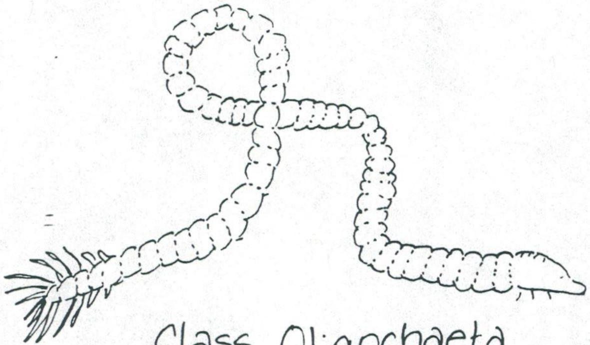
Order: Trichoptera
Family: Hydropsychidae
CADDISFLY



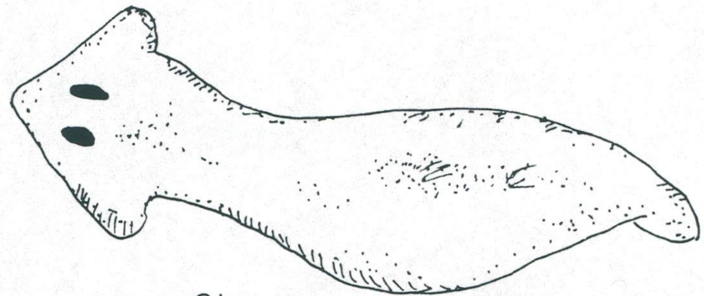
Order: Odonata
Family: Coenagrionidae
DAMSELFLY LARVA

Order: Coleoptera
Family: Elmidae
RIFFLE BEETLE LARVA

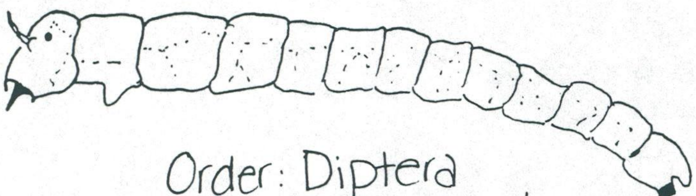
CLASS III



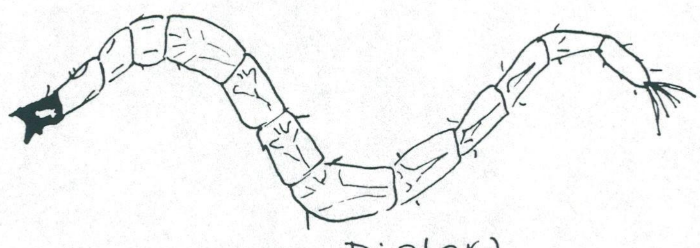
Class Oligochaeta
Segmented worm



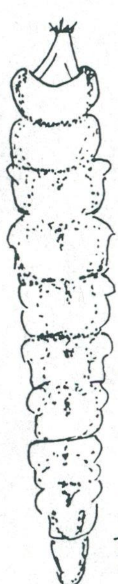
Class: Turbellaria
Planaria



Order: Diptera
Family: Chironomidae
Midge Larva



Order: Diptera
Family: Ceratopogonidae
Biting midge Larva



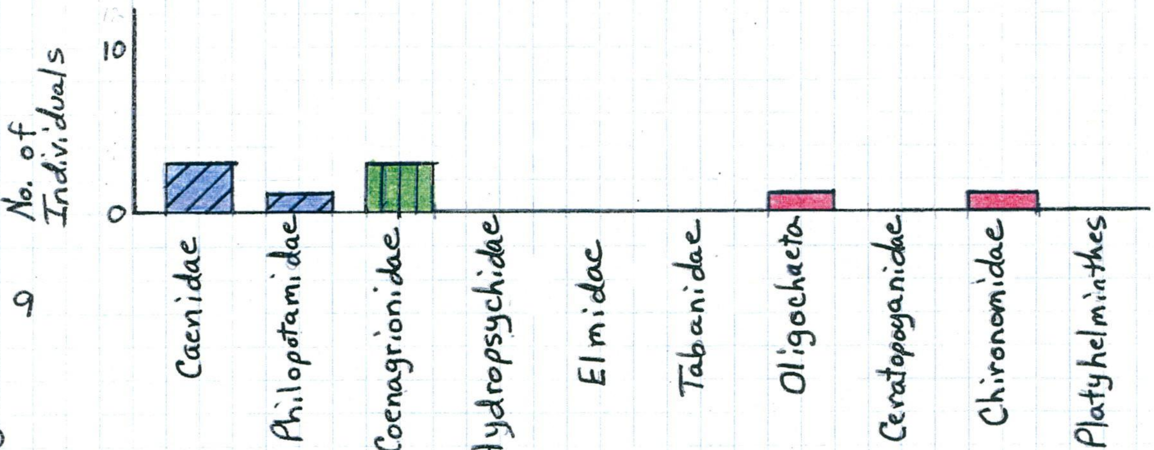
Order: Diptera
Family: Tabanidae
Horse Fly Larva

Table 1
Sites 1, 2 & 3 on Springfield Stream

Class I =
Class II =
Class III =

pH: >7.5<8.0
Air Temp: 80°F
Water Temp: 78°F
Stream Velocity: 68.2 cm/sec

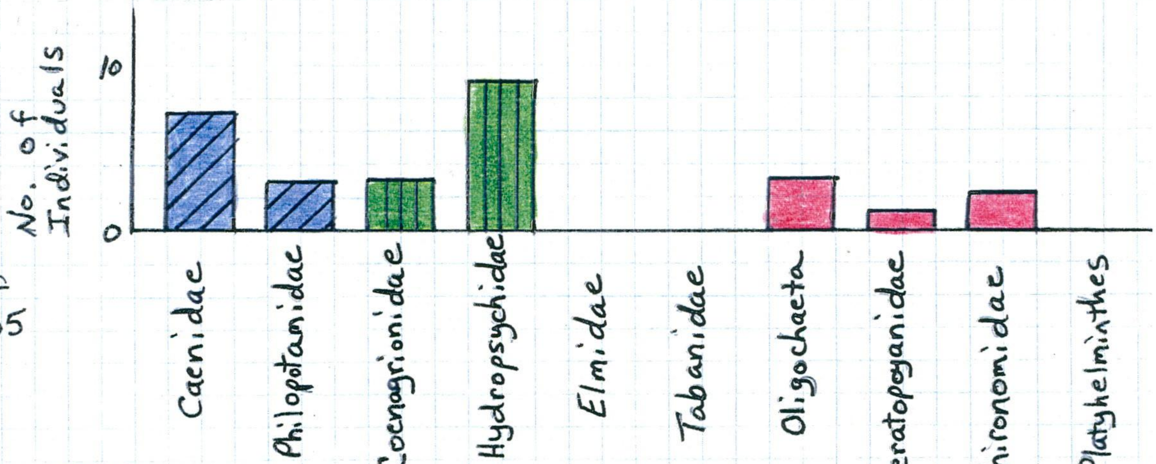
Site #1



Total No. of Individuals: 9

pH 8.0
Air Temp: 80°F
Water Temp: 78°F
Stream Velocity: 36.62 cm/sec

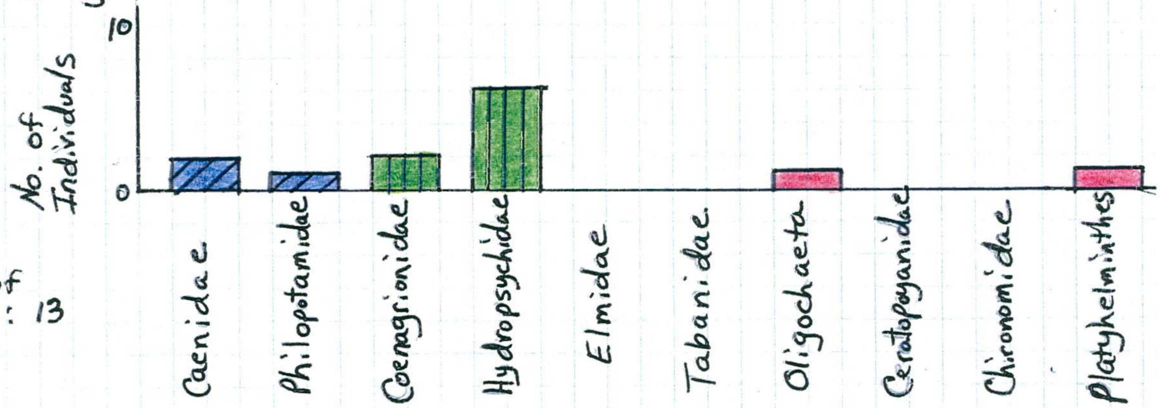
Site #2



Total No. of Individuals: 35

pH: 8.0
Air Temp: 77°F
Water Temp: 76°F
Stream Velocity: 41.10 cm/sec

Site #3



Total No. of Individuals: 13

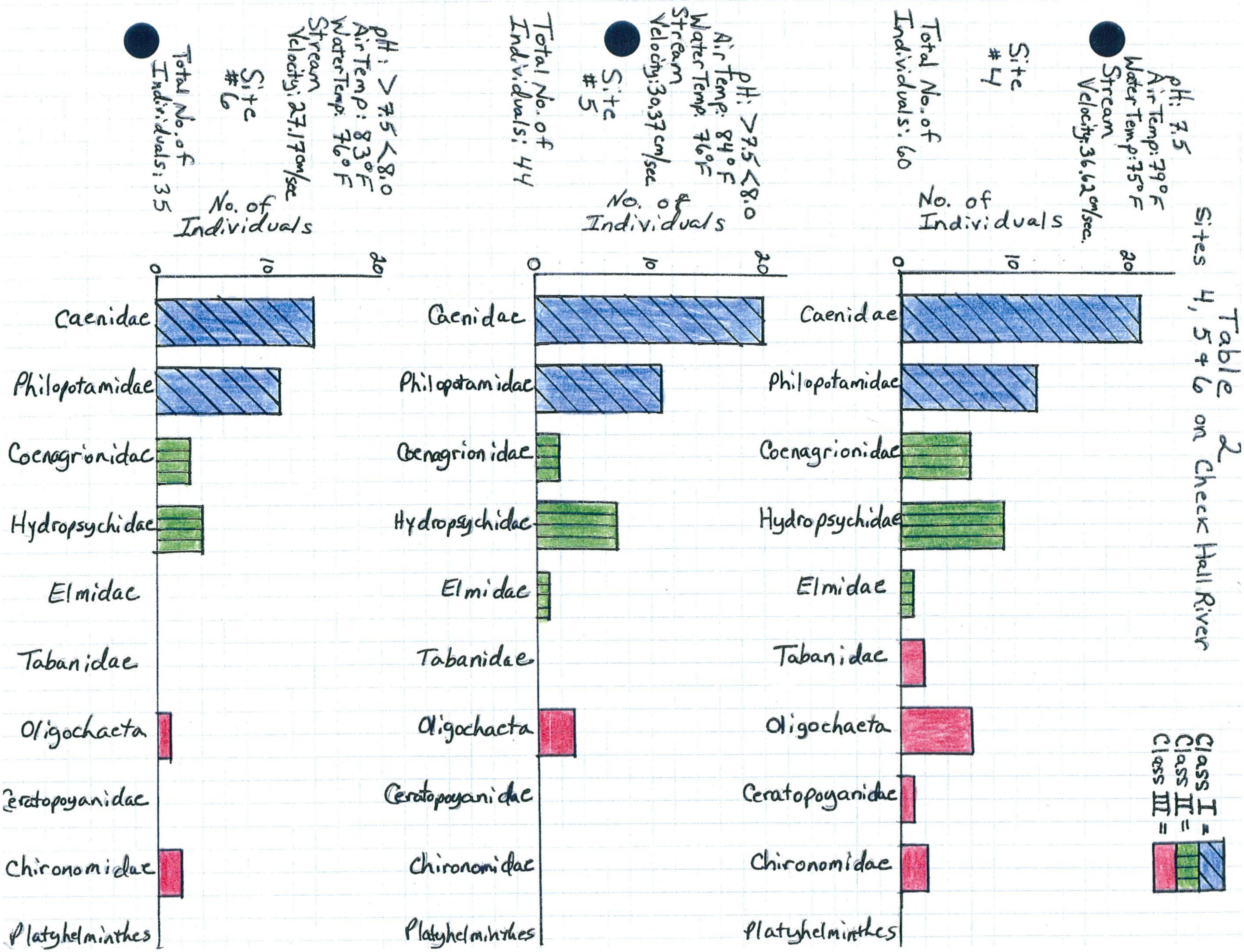


Table 2
Sites 4, 5+6 on Check Hall River
Site #4
pH: 7.5
Air Temp: 79°F
Water Temp: 75°F
Stream Velocity: 36.62 cm/sec.
Total No. of Individuals: 60
Site #5
pH: >7.5 <8.0
Air Temp: 84°F
Water Temp: 76°F
Stream Velocity: 30.37 cm/sec
Total No. of Individuals: 44
Site #6
pH: >7.5 <8.0
Air Temp: 83°F
Water Temp: 76°F
Stream Velocity: 27.17 cm/sec
Total No. of Individuals: 35
No. of Individuals
0
10
20
Caenidae
Philopotamidae
Coenagrionidae
Hydropsychidae
Elmidae
Tabanidae
Oligochaeta
Ceratopoganidae
Chironomidae
Platyhelminthes
Class I =
Class II =
Class III =