SURVEY OF ADULT TRICHOPTERA (INSECTA) OF SEVERAL TRIBUTARIES OF SULPHUR FORK CREEK AND RED RIVER, ROBERTSON COUNTY, TENNESSEE

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SURVEY OF ADULT TRICHOPTERA (INSECTA) OF SEVERAL TRIBUTARIES OF SULPHUR FORK CREEK AND RED RIVER, ROBERTSON COUNTY, TENNESSEE

A Thesis

Presented for the

Master of Science

Degree

Austin Peay State University

Ken J. Davenport

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To the Graduate Council:

I am submitting herewith a thesis written by Ken J. Davenport entitled "Survey of Adult Trichoptera (Insecta) of Several Tributaries of Sulphur Fork Creek and Red River, Robertson County, Tennessee." I have examined the final copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Biology.

Dr. Steven W. Hamilton, Major Professor

We have read this thesis and
recommend its acceptance:

Dr. David H. Snyder, Second Professor

Dr. Carol Baskauf, Third Professor

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DEDICATION

This thesis is dedicated to Dr. and Mrs. Fabricant,

the parents of my childhood friends.

The standards of excellence that they set

for their children have been a source of

inspiration for me over the years.

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ABSTRACT

Adult caddisflies (Insecta: Trichoptera) were sampled from three streams in Robertson County, Tennessee between May 1999 and April 2001. Eight sites on Brush Creek, three sites on Miller Creek, and one site on Buzzard Creek were sampled yielding a total of 55 samples. Sixty-three species representing 33 genera and 13 families, were found among the 3178 individuals identified. The families Leptoceridae and Hydropsychidae were the most speciose, with 16 and 12 species respectively. The most numerous species encountered were *Hydroptila gunda*, *Chimarra obscura*, and *Oecetis inconspicua,* with over 300 individuals each. Two state records, *Chimarra feria* and *Hydroptila perdita*, bring the total number of caddisflies species reported from Tennessee to 389. Seasonal flight patterns of the caddisflies identified suggest that most species in the study area are either univoltine or multivoltine, with overlapping cohorts. The only species with discontinuous flight patterns and life histories suggesting semivoltinism were *Pycnopsyche guttifer*, *Chimarra feria*, and *Chimarra aterrima*. Patterns of longitudinal distribution along Brush Creek suggest that some species prefer a particular stream reach, but most were collected from more than one reach.

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SECTION 1: INTRODUCTION

The Trichoptera, commonly known as caddisflies, are an order of holometabolous insects. Eggs are laid in or near water, and the larval and pupal stages are usually aquatic (Ross, 1944). Like their sister group, the order Lepidoptera, trichopteran larvae produce labial silk. Silk is used to build fixed retreats or portable cases, food collecting structures, anchoring lines, and pupal cases (Williams and Feltmate, 1992). This adaptation has allowed caddisflies to diversify (there are about 10,000 species worldwide) and play a vital role in aquatic ecosystems (Williams and Feltmate, 1992). Caddisflies, mayflies (order Ephemeroptera), and stoneflies (order Plecoptera) are relatively sensitive to water pollution (Lenat, 1993). Because of this, and the relative ease with which species can be identified, caddisflies are considered excellent bioindicators of water quality (Merritt and Cummins, 1996).

The order Trichoptera (G. "trichos" = hair, "pteron" = wing) can be divided into three suborders based largely on larval case-making behavior (Wiggins, 1996). The suborder Annulipalpia, or fixed-retreat makers, contains the families Hydropsychidae, Philopotamidae, Polycentropodidae, and Psychomyiidae.* The suborder Integripalpia, or portable-case makers, contains the families Brachycentridae, Helicopsychidae, Leptoceridae, Limnephilidae, Phryganeidae, and Uneonidae.* The suborder Spicipalpia, or closed-cocoon makers, contains the families Glossosomatidae, Hydroptilidae, and Rhyacophilidae.* The higher-level taxonomy of the order Trichoptera is a subject of current debate. Several authorities (Ross, 1956; Weaver and Morse, 1986; Wiggins and Wichard, 1989) propose alternative phylogenetic groupings based largely on larval and adult morphology.

*The families listed for each of these suborders are only those identified in this study.

Relevant Studies

Several caddisfly surveys have been conducted in the Interior Plateau region of Tennessee and Kentucky. Edwards (1966) published an annotated list of caddisflies from Middle and West Tennessee. His collections included sites on Red River and tributaries of Sulphur Fork Creek and Red River in Robertson and Montgomery counties.

Etnier and Schuster (1979) and Etnier et al. (1999) provided checklists of caddisflies of Tennessee. These papers reported 298 and 383 species, respectively, the latter being the most reported from any state or province in North America. Wiggins et al. (2001) add four species, bringing the total for Tennessee to 387.

A distributional list of caddisflies from Kentucky (Resh, 1975) included reports on the Trichoptera of that region. Resh reported 175 species, representing 15 families and 53 genera, with "most species belonging to the families Hydropsychidae, Hydroptilidae, and Leptoceridae."

Floyd and Schuster (1990) surveyed adult caddisflies from the Buck Creek system in Pulaski County, south-central Kentucky. They reported 15 families, 37 genera, and 79 species. They observed three distinct patterns of flight periods: 1) continuous emergence, 2) short periods of synchronous emergence and, 3) two or more periods of emergence.

Beiser et al. (1999) surveyed adult and larval caddisflies of the Drake's Creek drainage area in Allen, Simpson, and Warren counties in Kentucky (Simpson County is contiguous with Robertson County, Tennessee). They reported eight families, 15 genera, and 31 species from the 865 specimens collected. Ninety-five percent of these specimens were from the families Hydropsychidae and Leptoceridae. Most were collected in the late

summer, 1 August to 1 September, and they suggested that microhabitat availability seemed to account for the distribution and abundance of taxa.

Houp (1999) surveyed adult and larval caddisflies from reference streams across Kentucky. He reported 20 new state records, raising the total known Trichoptera fauna from Kentucky to 226 species.

To my knowledge, no trichopteran surveys of Brush, Miller, or Buzzard creeks of Robertson County, Tennessee, have been conducted.

Objectives

Objectives of this study include the following: 1) determine the species of caddisflies that inhabit Brush Creek; 2) determine the longitudinal distribution of caddisfly species along Brush Creek; 3) sample one site each from Buzzard and Miller creeks for comparison with a similar site on Brush Creek; and 4) determine seasonal occurrences of adult caddisflies from all three streams.

SECTION 2: STUDY AREA

The Sulphur Fork Creek watershed is part of the Western Pennyroyal Karst subregion (71e) of the Interior Plateau ecoregion (71) as shown in the map and narrative by Griffith et al. (1997). Physiographic characteristics of this section include gently rolling, weakly dissected plains, karst sinkholes and depressions, and few permanent streams with mostly gravel and bedrock substrates. The geology of this section is characterized by Mississippian limestone and Quaternary cherty clay solution residuum. The soil orders are alfisols and ultisols, with Pembroke, Crider, Baxter, Mountview, and Dickson being most common. The potential natural vegetation consists of oak-hickory forests and bluestem prairies. The land is primarily used for crops and pastures, with areas of mixed and deciduous forests (Griffith et al., 1997).

Brush Creek is a third-order tributary of Sulphur Fork Creek in Robertson County, Tennessee (Figure 1). It is approximately 14.5 km long from its headwaters to its confluence with Sulphur Fork Creek, and drains approximately 41 km^2 of land in southwest Robertson County (Figure 2). The surrounding area is primarily farmland, and virtually all of Brush Creek is separated from cropland and pastures by narrow riparian zones. Substrate of the upper reaches is mixed gravel and bedrock, and of the lower reaches primarily bedrock with scattered boulders and gravel.

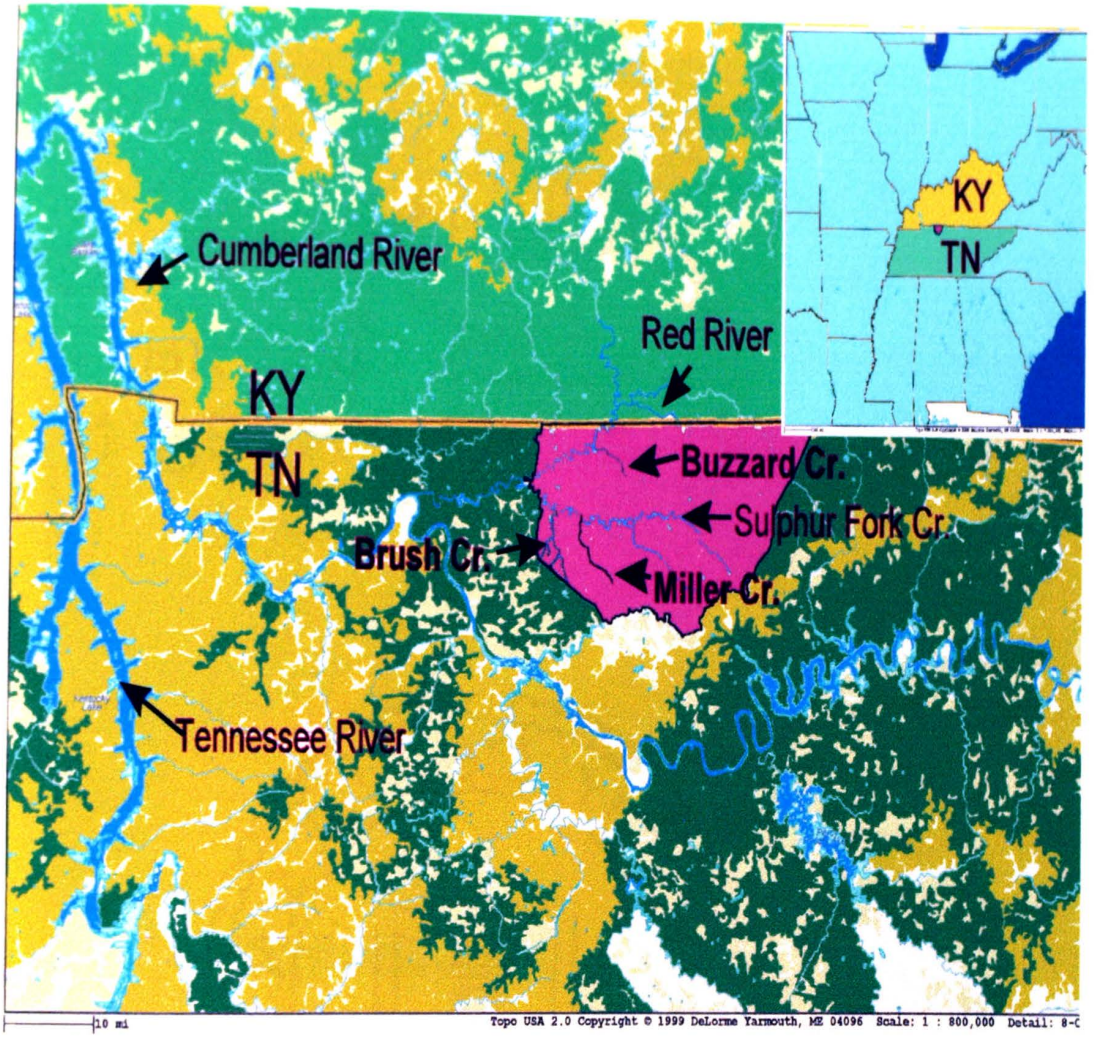

Figure 1. Location of Robertson County, Tennessee.

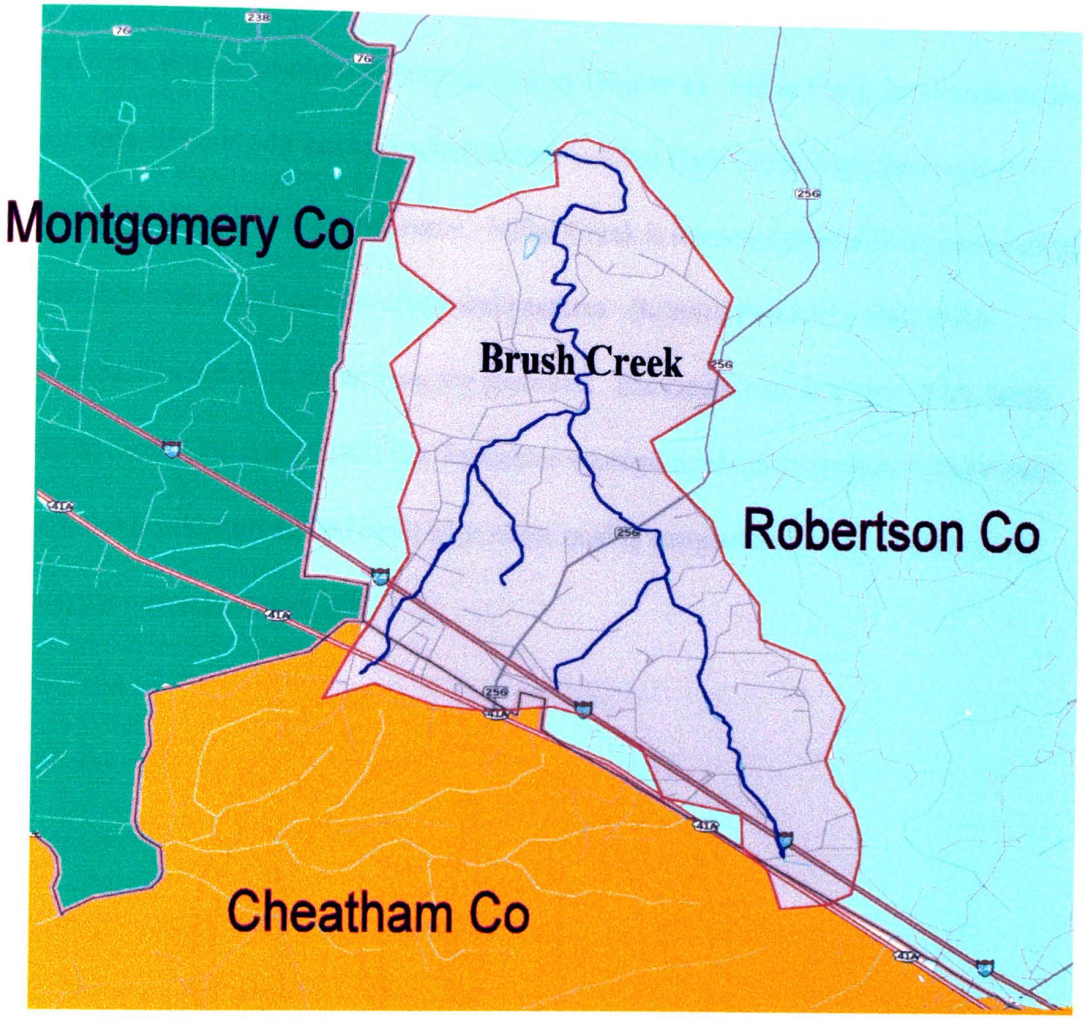

Figure 2. Drainage area of Brush Creek in southwestern Robertson County, Tennessee.

The other streams investigated in this study were Miller Creek, a tributary of Sulphur Fork Creek in south central Robertson, County (Figure 1), and Buzzard Creek, a tributary of Red River in northwestern Robertson County (Figure 1). Miller Creek is a fourth-order stream approximately 13 km long which enters Sulphur Fork Creek from the south, 9.7 km east of the Brush Creek confluence. Miller Creek is impacted primarily by surrounding agricultural lands including row crops and pastures. Buzzard Creek is a third-order stream which enters Red River from the southeast. Buzzard Creek is about 16 km north of Miller Creek. Buzzard Creek is a Tennessee ecoregion reference stream, which means it is relatively undisturbed and has a high water quality compared to other streams in the area (Arnwine and Denton, 2001).

SECTION 3: SAMPLING SITES

A total of 12 sites were sampled (Table 1 and Figure 3) from among Brush, Buzzard, and Miller creeks. Eight sites on Brush Creek were sampled (Table 1, Figure 3). Sites 1 through 7 on Brush Creek were selected for longitudinal distribution, site 7 being the most upstream site and site 1 being the most downstream site (a pond at the headwaters of the stream) and site 1 being the most downstream site. An eighth site, henceforth denoted as WF, was located on the West Fork of Brush Creek, a tributary which entered Brush Creek between sites 2 and 3. Sites 7, 6, and 5 were located in the first order reach of the stream; sites 4, 3, and WF the second order reaches; and sites 2 and 1 in the third order reach. In order to facilitate accessibility, and since proximity to a road does not bias the light trap sampling (S. W. Hamilton, pers. comm.), sites are within 120m of a bridge for all three creeks except site 2 on Brush Creek, which is 0.4 km from a bridge. Three sites along Miller Creek were sampled (Table 1, Figure 3). Site 1, the most downstream site, was in a fourth order reach; site 3 was in a second order reach nearer the headwaters of Miller Creek, and site 2 was in a third order reach between sites 1 and 3. One site in lower Buzzard Creek (a third order stream at that point) was sampled (Table 1, Figure 3). Site 1 from Miller Creek, and the only site from Buzzard Creek were comparable to site 1 on Brush Creek with regard to location along the stream and size and slope of the channel.

Table 1. Information regarding collection sites on Brush, Buzzard, and Miller creeks, Robertson County, Tennessee. Total number of samples from each site is indicated.

site	nearest road	lat/long	order	substrate	# samples
Brush Cr					
1	Ed Ross	36◦ 30.835' N/ 87◦ 5.569' W	3rd	bedrock w/boulders	5
2	Ed Ross	36◦ 30.681' N/ 87◦ 5.592' W	3rd	bedrock w/boulders	2
3	Stroudsville	36◦ 28.834' N/ 87◦ 5.364' W	2nd	bedrock w/ large rocks	2
WF	Stroudsville	36◦ 28.834' N/ 87◦ 6.098' W	2nd	bedrock w/ large rocks	4
4	Maxey	36◦ 28.240' N/ 87◦ 4.961' W	2nd	bedrock w/ large rocks	4
5	Wandaland	36◦ 27.032' N/ 87◦ 4.298' W	1st	bedrock w/ med. rocks	4
6	Gause	36◦ 25.956' N/ 87 3.943' W	1st	med. rocks & gravel	5
7	H. Harris	36◦ 25.392' N/ 87◦ 3.633' W	1st	pond/ small rocks	5
Miller Cr					
1	Carr	36◦ 30.445' N/ 87◦ 2.130' W	4th	bedrock w/boulders	4
2	Turnersville	36◦ 29.177' N/ 87◦ 2.339' W	3rd	bedrock w/ med.rocks	2
3	Sandy Springs	36◦ 26.843' N/ 87◦ 0.432' W	2nd	med. rocks & gravel	2
Buzzard Cr	Buzzard Creek	36◦ 36.320' N/ 86◦ 58.975' W	3rd	bedrock w/boulders	4

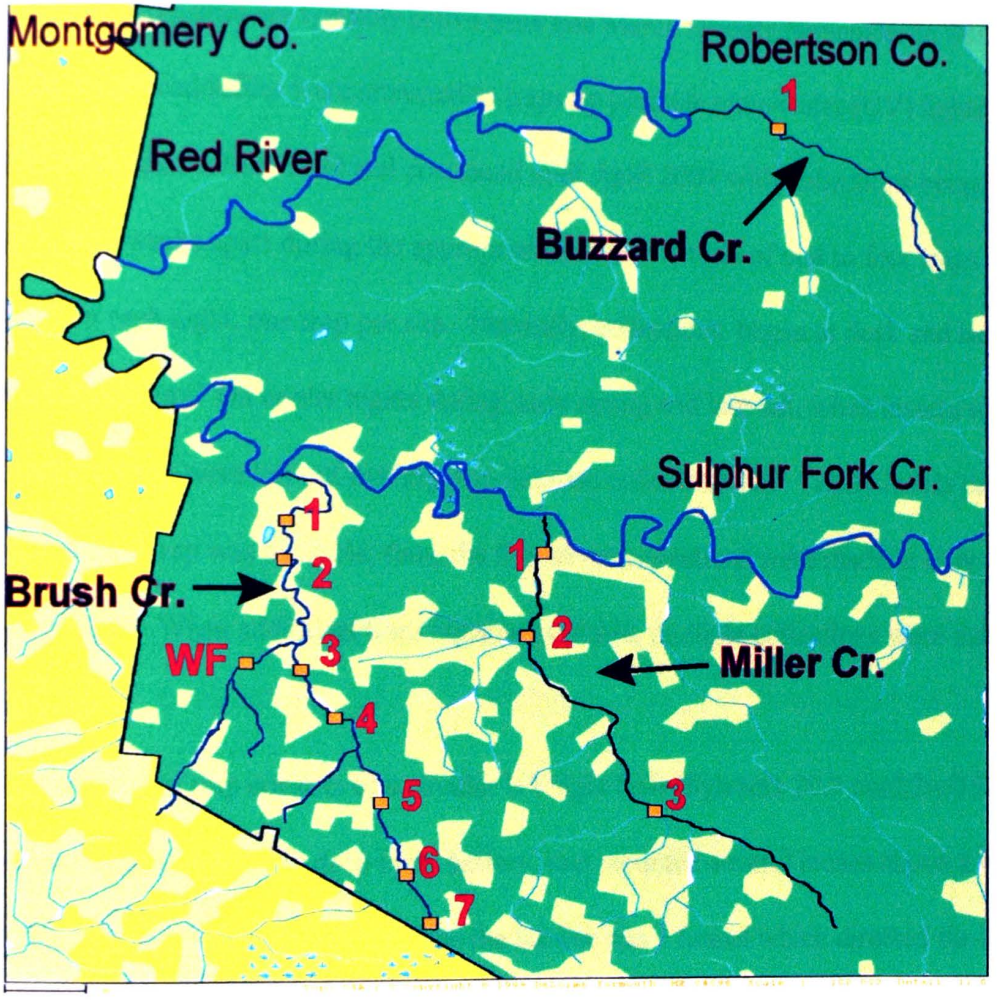

Figure 3. Sampling sites along Brush, Miller, and Buzzard creeks in Robertson County, Tennessee.

SECTION 4: METHODS AND MATERIALS

Collecting Techniques

Adult caddisflies are typically active from late March to early November in this region. Adult caddisflies were attracted to traps by portable ultra-violet (UV) lights. Collecting began in May 1999 and continued until April 2001 with collections being made two to four weeks apart during the appropriate season. A total of one to four traps were set out on each night, one trap per site. Normally, collections began at dusk and lasted for 1.5 to 2 hours. On cooler nights during early spring and late fall, when insects were less active, traps were left out overnight to increase collection time. Early in this project only one light trap was available; thus, the first seven collections were made at only one site per night. When additional traps became available, multiple collections were made on most nights.

One type of trap consists of a circular UV light bulb (Sylvania 20.3 cm/22w/350BL), powered by a standard 12v deep cycle battery, and mounted several inches above a white 10L bucket (BioQuip # 2851M). Inside the bucket was a funnel which directed the insects into a 450 mL jar containing 80% isopropanol. Another trap consisted of a 6v (4 D-size rechargeable batteries) Eveready multi-function light with a 6w UV light bulb resting on a white 30.48 cm x 45.72 cm x 5.08 cm tray with a thin layer of 80% isopropanol on the bottom. After collecting, the contents of the tray were emptied into a 450 ml jar and topped off with 80% isopropanol.

Field data includes location, date, duration of collection, ambient temperature, and relative humidity (determined using a sling psychrometer). Wind speed, cloud cover, and

Field data includes location, date, duration of collection, ambient temperature, and relative humidity (determined using a sling psychrometer). Wind speed, cloud cover, and brightness of the moon were determined qualitatively and recorded. Temperature, humidity, and moonlight can all have significant effects on the flight activity of caddisflies and their attraction to UV lights (S. W. Hamilton, pers. comm.).

Identification

Samples were brought to the laboratory and the caddisflies sorted from the other insects. While sorting specimens to family and genus levels, females and males were separated. Males were then identified to species under dissecting and compound microscopes with the use of keys by Armitage (1991), Armitage and Hamilton (1990), Betten (1934, 1950), Blickle and Morse (1979), Chapin (1978), Gordon (1974), Holzenthal (1982), Lago and Harris (1987), Morse (1972), Moulton and Stewart (1996), Resh (1974), Ross (1944), Schmid (1980), Weaver (1988), and Wojtowicz (1982). Females were identified to genus or species (depending on availability of a reliable key) when they appeared to be the only representative of a genus or species taken at a given collection site.

Whereas wing venation, thoracic features, palpi, and leg spurs are used for identification to family and genus, the male genitalia are most useful for species determination. Prior to species identification, abdomens of specimens to be identified were removed from the body and cleared of soft tissue in vials containing a heated caustic NaOH solution.. Some specimens were sent to appropriate authorities for verification. I

made all other identifications, and Dr. Steven Hamilton verified them. Most identified specimens will be retained as vouchers in the Austin Peay State University aquatic insect collection. These will be preserved in 80% isopropanol, in 3 dram patent lip vials with neoprene stoppers, with appropriate locality and identification labels. Selected specimens have been deposited in the University of Tennessee-Knoxville collection, curated by Dr. David Etnier.

Analysis

Comparisons of faunas from three streams (Brush, Buzzard, and Miller creeks) and from three reaches within one stream (Brush Creek) were done using Jaccard's index. Jaccard's index, a measure of community similarity is calculated as:

$$\textit{Jaccard's Coefficient} = \frac{c}{s_1 + s_2 - c}$$

where s_1 is the number of taxa from one site, s_2 is the number of taxa from another site, and c is the number of taxa common to both sites. This index measures presence vs. absence of taxa, with rare and common taxa being treated the same.

When referring to seasonal occurrence, I distinguish between continuous and discontinuous flight periods of caddisflies. Because absence from several consecutive samples seems a more reliable indicator of discontinuous occurrence than absence from a given period of time, I somewhat arbitrarily have defined, for the purpose of this study, four or more consecutive absences as indicative of discontinuous occurrence.

SECTION 5: RESULTS

Samples

The term sample, as used in this text, refers to the results of a collection from a given site on a given date. The first sample was collected on 16 May 1999 and the last on 5 April 2001. Forty-three samples were taken from 12 sites on 22 dates over a two year period.

Thirty-one samples were taken from Brush Creek and one of its tributaries. Five samples were taken from each of sites 1, 6, and 7; four from each of sites WF, 4, and 5; and two from each of sites 2 and 3. Nine samples were taken from Miller Creek five from site 1, and two from each of sites 2 and 3. Six samples were taken from one site on Buzzard Creek.

Taxa

Sixty-three species, from 33 genera, and 13 families, were identified (Table A1). I estimate that well over 10,000 specimens (including males and females) were collected, 3178 of which (males) were identified. The families Leptoceridae and Hydropsychidae were the most speciose with 16 and 12 species, respectively. These two families accounted for 44% of all the species identified. Five families (Brachycentridae, Helicopsychidae, Rhyacophilidae, Psychomyiidae, and Uneonidae) were represented by a single species (*Micrasema charonis*, *Helicopsyche borealis*, *Rhyacophila fenestra*, *Lype diversa*, and *Neophylax concinnus*, respectively).

The most abundant species encountered was *Hydroptila gunda* with 711 males. *Chimarra obscura* and *Oecetis inconspicua* were relatively abundant with 396 and 332 individuals, respectively. Six other species, *Cheumatopsyche oxa*, *Hydropsyche depravata*, *Rhyacophila fenestra*, *Hydroptila consimilis*, *Ochrotrichia eliaga* and *Mystacides sepulchralis* were common with 175, 175, 168, 167, 112, and 98 males, respectively. Eight of the 63 species were represented by single male specimens.

The most widely encountered species was *Oecetis inconspicua,* having been captured at more sites than any other species (nine of the 12 sites). *Cheumatopsyche pettiti*, *Cheumatopsyche oxa*, and *Oecetis ditissa* were each captured at eight sites.

Two species, *Hydroptila perdita* and *Chimarra feria,* represent first distributional records for Tennessee. These new records increase the number of species reported for Tennessee in Etnier et al. (1998) and Wiggins et al. (2001) to 389. At least 19 species are new records for Robertson County.

Seasonal Occurrence

Thirty-nine of the 63 species were collected continuously over a period of time (Tables 2, 3, and 4). Only one species, *Cheumatopsyche pettiti*, was collected continuously over a seven month period (early April through mid-October). Three species, *Cheumatopsyche oxa*, *Lype diversa*, and *Hydropsyche depravata*, were collected from early April through early September. Three other species, *Ceratopsyche sparna*, *Oecetis ditissa*, and *Oecetis inconspicua,* were collected from mid May through mid to late October. Seven species, *Nectopsyche exquisita*, *Protoptila palina*, *Hydropsyche*

betteni, *Chimarra obscura*, *Oecetis persimilis*, *Helicopsyche borealis*, and *Polycentropus centralis* were collected from mid May through September. *Micrasema charonis* was only collected during April. *Glossosoma nigrior* was collected from early April through mid May. *Rhyacophila fenestra* was collected from early May through late June. *Hydroptila consimilis* was only collected in May. *Hydropsyche frisoni* and *Hydroptila waubesiana* were collected from early August through early September. *Cheumatopsyche campyla* was collected from late June through mid August. *Hydroptila gunda* was collected from early June through mid September. *Hydropsyche orris*, *Ceraclea cancellata*, *Ceraclea transversa*, and *Mystacides sepulchralis* were collected from mid May through mid August. *Setodes epicampes* and *Trianodes ignitus* were collected from late June through early and late September, respectively. *Ceraclea tarsipunctata*, *Trianodes marginatus*, *Diplectrona modesta*, and *Polycentropus crassicornis* were collected from mid May through late June. *Polycentropus confusus* was collected from mid April through mid September. *Orthotrichia aegerfasciella* was collected from mid May through early September. *Hydroptila perdita* was collected from mid July through early October.

Nearly all species identified from the families Limnephilidae (*Ironoquia punctatissima*, *Pycnopsyche rossi*, and *Pycnopsyche lepida*), Phryganeidae (*Agrypnia vestita*, *Phryganea sayi*, and *Ptilostomis postica*), and Uneonidae (*Neophylax concinnus*) were collected only during September and/or October. The only exception was *Pycnopsyche guttifer*, which was also collected during mid-May.

Five species were collected discontinuously throughout the season (early April through late October). *Hydroptila armata* was collected during April and again throughout August. *Chimarra aterrima* was collected in April and May and again in September. *Chimarra feria* was collected in mid-May, again in early August through early October. *Polycentropus cinereus* was collected from mid-April to mid-May and again in early September. *Pycnopsyche guttifer* was collected in mid-May and again from late September through late October. Nineteen species appeared in only one sample.

Table 2: Seasonal occurrence of the suborder Annulipalpia. Collections were taken from Brush, Buzzard, and Miller creeks, Robertson County, Tennessee between May 16, 1999 and April 8, 2001. An 'X' means the species was collected on that date, whereas an 'O' means a sample was taken but that species was not collected. Shaded areas indicate a discontinuous flight period.

Taxa	Apr	May	Jun	Jul	Aug	Sep	Oct
Ceratopsyche cheilonis	x						
Ceratopsyche sparna		x	x	x	O	x O x	x x	O x
Cheumatopsyche campyla			x	x	x O x		
Cheumatopsyche ela					x		
Cheumatopsyche oxa	x x	x O x	x	x	x	x x O	x
Cheumatopsyche pettiti	x x	O O x	x	x	x	x x x	x	x	x
Diplectrona modesta		x	O	x			
Hydropsyche betteni		x	O	O	O	x x x	x	x
Hydropsyche depravata	x O	x O x	O	x	x	x x x	x
Hydropsyche frisoni					x x x	x
Hydropsyche orris		x	O	x	O	O x
Potamyia flava					x
Chimarra aterrima	x O	x O x				x	x
Chimarra feria		x			x O	O	O	x
Chimarra obscura		x	O	O	x	x O x	x	x
Chimarra socia		x
Dolophilodes distinctus		x
Cymellus fraternus				x
Nyctiophylax affinis						x
Polycentropus carolinenesis							x
Polycentropus centralis		x O x	O	x	x	x O O	O	x
Polycentropus cinereus	x	x O x					x
Polycentropus confusus	x	x O x	O	O	x	O x O	x	x
Polycentropus crassicornis		x O	O	x
Lype diversa	x O	O x O	O	O	x	O x O	x

Table 3: Seasonal occurrence of the suborder Spicipalpia. Collections were taken from Brush, Buzzard, and Miller creeks, Robertson County, Tennessee between May 16, 1999 and April 8, 2001. An 'X' means the species was collected on that date, whereas an 'O' means a sample was taken but that species was not collected. Shaded areas indicate a discontinuous flight period.

Taxa	Apr	May	Jun	Jul	Aug	Sep	Oct
Glossosoma nigrior	x O	OOx					
Protoptila palina		x	O O	x	OOO	x	
Hydroptila armata	x x				xO	x	
Hydroptila consimilis		xOx					
Hydroptila gunda			x O	x	xxx	x	x
Hydroptila perdita				x	OOO	x	O x
Hydroptila waubesiana					xOO	x	
Hydroptila waskesia						x	
Ochrotrichia eliaga		x					
Orthotrichia aegerfasciella		x	O O	x	OOO	x	
Rhyacophila fenestra		xOx	O x				

Table 4: Seasonal occurrence of the suborder Integripalpia. Collections were taken from Brush, Buzzard, and Miller creeks, Robertson County, Tennessee between May 16, 1999 and April 8, 2001. An 'X' means the species was collected on that date, whereas an 'O' means a sample was taken but that species was not collected. Shaded areas indicate a discontinuous flight period.

Taxa	Apr	May	Jun	Jul	Aug	Sep	Oct
Micrasema charonis	x x						
Helicopsyche borealis		x	O	x	xOO	x	O x
Ceraclea ancyla		x					
Ceraclea cancellata		x x	O x	x	O x		
Ceraclea nepha		x					
Ceraclea tarsipunctata		x x	x				
Ceraclea transversa		x	O x	x	x x		
Leptocerus americanus		x					
Mystacides sepulchralis		x x	O x	x	x x		
Nectopsyche exquisita		x	O x	x	xOO	O	x
Oecetis cinerascens		x	O x	x	xOO	x	
Oecetis ditissa		x x	O O	x	OxO	x	OO x
Oecetis inconspicua		x x	O x	x	xxO	x	OO x x
Oecetis persimilis		x	O O	O	xOO	x	
Setodes epicampes			x	O	Oxx	x	
Trianodes ignitus			x	O	OxO	O	x
Trianodes marginatus		x	x x				
Trianodes tardus		x					
Ironoquia punctatissima							x
Pycnopsyche guttifer		x					x xxx
Pycnopsyche lepida						x	x x x x
Pycnopsyche rossi							x
Agrypnia vestita						x	OO x
Phryganea sayi							x
Ptilostomis postica							x
Neophylax concinnus							x x

Brush Creek Fauna

Fifty-seven species, 29 genera, and 13 families were identified from Brush Creek (table A2). I estimate that more than 7000 individuals were collected from Brush Creek, 1499 of them males. The family Leptoceridae was the most speciose, with 16 species from 7 genera. The Hydropsychidae had 10 species from four genera, and the Hydroptilidae had seven species from three genera. The families Philopotamidae and Polycentropodidae had five species each, from two genera and one genus, respectively. The Limnephilidae had four species from two genera, the Phryganeidae had three species from three genera, and the Glossosomatidae had two species from two genera. The remaining families, Brachycentridae, Helicopsychidae, Psychomyiidae, Rhyacophilidae, and Uneonidae, had one species each.

The most common species in the Brush Creek samples was *Oecetis inconspicua* with 206 individuals. Other common species were *Rhyacophila fenestra* and *Hydroptila consimilis* with 167 individuals each, *Hydropsyche depravata* with 118 individuals, *Ochrotrichia eliaga* with 112 individuals, and *Mystacides sepulchralis* with 97 individuals.

The 32 samples from Brush Creek averaged 47 males each, but three samples had unusually high numbers. An emergence event of one or more species coincident with sampling and/or sampling under ideal environmental conditions may have been responsible for the three large samples, which together accounted for 1005 individuals, 67% of the total. Removing these three samples and averaging the 29 remaining samples gives an average of 17 males per sample.

Longitudinal Distribution on Brush Creek

Of the 57 species collected from the eight sites on Brush Creek, 19 were collected from a single site, 10 other species were collected from two of the eight sites, nine other species were collected from three sites, seven species from four sites, five species were collected from five of the eight sites, and the remaining five species were collected from six of the eight sites (Tables 5, 6, and 7). The most widespread species at Brush Creek were *Polycentropus centralis* and *Cheumatopsyche pettiti,* each collected at seven of the eight Brush Creek sites (Table 5). Of the 19 species collected from only one site, 12 are represented by a single specimen, six by multiple specimens (each collected in a single sample), and one (*Polycentropus crassicornis)* was collected on two different dates.

Forty-one species were collected from first order reaches, 34 from the second order reaches, and 36 from third order reaches (Table A9). Eight species were collected exclusively from third order reaches, nine exclusively from second order reaches, and six exclusively from first order reaches. Site 1 yielded the most species (27) and site 4 the fewest (14). An average of 20 species were collected from each site.

Of the 38 species collected from multiple sites, eight were collected only from adjacent sites (Tables 5, 6, and 7). *Cheumatopsyche pettiti* was collected at all sites from 1through 6 plus the West Fork site, *Hydropsyche frisoni* was collected from sites 1 and 2, *Hydroptila gunda* was collected at all sites from 1 through 4, *Ochrotrichia eliaga* was collected from sites 5 and WF, *Chimarra feria* was collected from sites 3, 4, 5, and WF, *Diplectrona modesta* was collected from sites 5 and 6, *Agrypnia vestita* was collected from sites 3, 4, and WF, and *Lype diversa* was collected from sites 5 and 6.

Table 5. Longitudinal distribution of the suborder Spicipalpia along Brush Creek, Robertson County, Tennessee. A shaded area indicates collections from adjacent sites.

Taxa	Brush 1	Brush 2	Brush 3	Brush 4	Brush WF	Brush 5	Brush 6	Brush 7	totals
Glossosoma nigrior								1	1
Protoptila palina						1			1
Hydroptila armata	1				1				2
Hydroptila consimilis					165		2		167
Hydroptila gunda	14	33	9	2					58
Hydroptila perdita			4						4
Hydroptila waubesiana		1							1
Ochrotrichia eliaga					2	110			112
Orthotrichia aegerfasciella	1								1
Rhyacophila fenestra	2			4	34	115	11	1	167
Totals	18	34	13	6	202	226	13	2	514
# of species- suborder	4	2	2	2	4	3	2	2	10
# of species- order	27	22	19	15	18	24	18	18	57

Table 6. Longitudinal distribution of the suborder Annulipalpia along Brush Creek, Robertson County, Tennessee. A shaded area indicates collections from adjacent sites.

Taxa	Brush 1	Brush 2	Brush 3	Brush 4	Brush WF	Brush 5	Brush 6	Brush 7	totals
Ceratopsyche cheilonis	1								1
Ceratopsyche sparna	15	5	1		1	7	1		30
Cheumatopsyche campyla		9						1	10
Cheumatopsyche oxa	7	10		2		7	1	2	29
Cheumatopsyche pettiti	17	14	3	3	6	6	3		52
Diplectrona modesta						2	1		3
Hydropsyche betteni	1	44	1		1	27		1	75
Hydropsyche depravata		104		4		8	2		118
Hydropsyche frisoni	1	7							8
Hydropsyche orris		1						2	3
Chimarra aterrima	6		1				2		9
Chimarra feria			2	3	9	10			24
Chimarra obscura		3	3		1	3			10
Chimarra socia					1				1
Dolophilodes distinctus						2			2
Polycentropus carolinenesis			3						3
Polycentropus centralis	2	1	3		2	46	5	4	63
Polycentropus cinereus	1								1
Polycentropus confusus	2		1		10	17	1		31
Polycentropus crassicornis							3		3
Lype diversa						1	1		2
Totals	53	198	18	12	31	136	20	10	478
# of species- suborder	13	10	9	4	8	12	10	5	21
# of species- order	27	22	19	15	18	24	18	18	57

Table 7. Longitudinal distribution of the suborder Integripalpia along Brush Creek, Robertson County, Tennessee. A shaded area indicates collections from adjacent sites.

Taxa	Brush 1	Brush 2	Brush 3	Brush 4	Brush WF	Brush 5	Brush 6	Brush 7	totals
Micrasema charonis	4			3			1		8
Helicopsyche borealis	1	1					2		4
Ceraclea ancylus	4								4
Ceraclea cancellata	1					4		5	10
Ceraclea nepha	1							1	2
Ceraclea tarsipunctata	1					3		24	28
Ceraclea transversa	2	10		2		2			16
Leptocerus americanus								2	2
Mystacides sepulchralis		1			1	93		2	97
Nectopsyche exquisita		4						3	7
Oecetis cinerascens		4			1	1			6
Oecetis ditissa	2	2	1	1		10		1	17
Oecetis inconspicua	40	77		19		54	3	13	206
Oecetis persimilis	2	3				1			6
Setodes epicampes		4						1	5
Trianodes ignitus			1	1			2		4
Trianodes marginatus	1	1	2			1		9	14
Trianodes tardus								3	3
Ironoquia punctatissima					1				1
Pycnopsyche guttifer	10		1	1	8		10		30
Pycnopsyche lepida	1		12		3		10		26
Pycnopsyche rossi			1						1
Agrypnia vestita			5	1	1				7
Phryganea sayi			1						1
Ptilostomis postica				1					1
Neophylax concinnus				1					
totals	70	107	24	29	15	169	28	64	506
# of species- suborder	13	10	8	9	6	9	6	11	26
# of species- order	27	22	19	14	18	24	18	18	57

Comparison of First, Second, and Third Order Reaches of Brush Creek

Sites 5, 6, and 7 represent first order reaches; sites 3, 4, and WF represent second order reaches; and sites 1 and 2 represent third order reaches of Brush Creek. Seven samples from third order reaches yielded 480 individuals from 36 species, 10 samples from second order reaches yielded 350 individuals from 34 species, and 14 samples from first order reaches yielded 668 individuals from 41 species (Tables 8 and A3).

The second order reaches had the highest number of unique species with nine, followed by the first order reaches with eight, and the third order reaches with six (Table A3). The first and second order reaches of Brush Creek had two species in common, the second and third order reaches had four species in common, and the first and third order reaches shared nine species. The first, second, and third order reaches had eighteen species in common.

Comparison of Brush, Buzzard and Miller Creeks

The following comparison is of only the most downstream site of each stream. Site 1 on Brush Creek was sampled five times; once each in April, May, June, August, and October (Table 8). Twenty-seven species, 14 genera, and nine families were identified, and 141 males collected. The most numerous species was *Oecetis inconspicua* (40 individuals). The most frequently encountered species was *Cheumatopsyche pettiti*, collected from four of the five samples.

Miller Creek was sampled four times; twice in April, and once each in July and August. Twenty-five species, 16 genera, and nine families were identified, among 1235 males collected. The most numerous species was *Hydroptila gunda* (603 individuals). The most frequently encountered species were *Cheumatopsyche pettiti* and *Cheumatopsyche oxa*, each occurring in three of the four samples.

Buzzard Creek was sampled four times; once each in April, May, August, and September. Nineteen species, 15 genera, and nine families were identified among 240 males collected. The most numerous species was *Cheumatopsyche oxa* (119 individuals).

The most frequently encountered species were *Cheumatopsyche oxa* and *Hydropsyche depravata* each represented in all four samples.

Site 1 of Miller Creek had the highest number of unique species with nine, followed by site 1 of Brush Creek with eight, and Buzzard Creek with four (Table 8). Site 1 from Brush and Miller creeks had six species in common, Brush and Buzzard, four, and Miller and Buzzard, three. The three sites had nine species in common.

SECTION 6: DISCUSSION

Samples

Nearly all specimens collected were examined in the laboratory. The only exception was a portion of the sample (roughly two-thirds) obtained on 18 May 2000 from site 5 on Brush Creek. This sample was unusually large (8000 or more individuals) and so was divided into two jars, one of which spoiled. Of the remaining individuals (about 2500), an estimated 90% were from the family Hydroptilidae, the microcaddisflies. Because of the large number, only a small percentage of hydroptilids were examined. Following removal of other large caddisflies, I randomly withdrew about 5% of all the hydroptilids from this sample for identification. All specimens examined were identified to species, excepting one female *Agapetus*.

Several samples yielded no caddisfly adults. Most of these, taken during November and March, were the result of post- and preseasonal collecting, when evening temperatures were too low for flight activity. These sampling attempts were important for determining the beginning and ending dates of the season when adult caddisflies are typically active in this region. Based on the results of this study, it seems that the earliest time of nocturnal flight activity for caddisflies is around late March for certain species and the latest time of activity is the last days of October for certain species. Unusually warm or cool temperatures may have significant affects on these earliest and latest dates of activity. Other samples which yielded no caddisflies were collected on especially cool evenings during mid-season. In order to assess whether the trichopteran fauna of Brush Creek had been thoroughly sampled, a curve plotting cumulative number of species

Creek had been thoroughly sampled, a curve plotting cumulative number of species collected against number of samples was constructed (Figure 4). The steepness of the beginning of the curve is indicative of a greater number of additional species being added to the total in the initial samples. The flattening out of the curve toward its end is indicative of fewer additional species in later samples. The last five samples taken added no species to the total, and the last 15 (45% of samples) added only 2 species (4% of total species) to the total. I conclude that the trichopteran fauna of Brush Creek is well represented in these collections, and few additional species would have been found with additional light trapping effort.

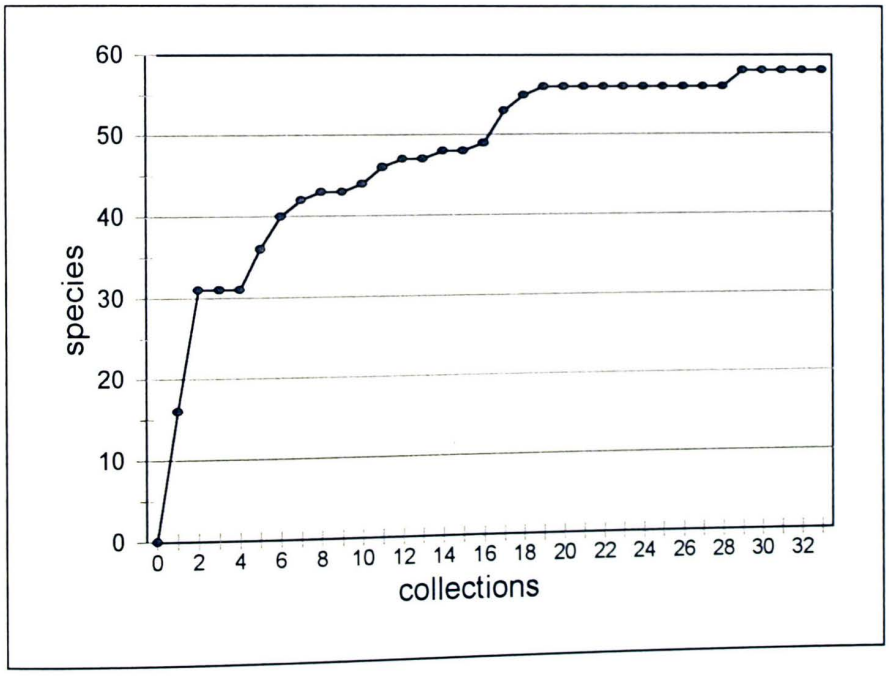

Figure 4. Species-sample curve for trichopteran fauna of Brush Creek, Robertson County, Tennessee.

Taxa

Based on previous studies in the region the moderately rich caddisfly fauna found was not unexpected. The southeastern United States has one of the most diverse aquatic faunas in the world (Folkerts, 1997). Tennessee not only has the most species of caddisflies of any state or province in North America (383 in Etnier et al., 1999), but, even for the Southeast has a high diversity of other speciose aquatic groups such as fish, mussels, and crayfish.

The diversity found by this study is consistent with studies in Kentucky by Resh (1975), Floyd and Schuster (1990), Beiser et al. (1999), and Houp (1999). Most previously unreported species collected from this area probably reflect the paucity of past surveys rather than something unique or unusual about the area. Many of my records for Robertson County fill in gaps from previous surveys.

Hydroptila perdita, a new state record, has been reported by Resh (1975) from several counties near Frankfort, Kentucky and also from Alabama so its discovery in Tennessee is not surprising. The other new state record, *Chimarra feria*, represents a range extension to the east of its previously known range which extended from the Great Lakes region south through Illinois and west of the Mississippi River into Texas (Lago and Harris, 1987).

Several species from this investigation were heretofore reported only from areas east of Robertson County. These western range extensions are not surprising, because of what we know from the concentrated collecting efforts in East Tennessee by Dr. Etnier and his students at the University of Tennessee, Knoxville and by investigators working in Great Smoky Mountain National Park.

Seasonal Occurrence

Small samples are of little use in determining seasonal activity patterns. Although the presence of a particular species on a certain date is significant, its absence from samples on other dates may not be, the species may have been present, but not collected. Or, as Carl Sagan has put it, "absence of evidence is not evidence of absence." Only after intensive documentation of a species' presence or absence during a particular part of the year can seasonal occurrence be reliably inferred. These data simply suggest patterns, that may or may not be supported by other studies. Most taxa from this study have been documented by other workers with regard to seasonal occurrence. The results presented here are generally supportive of previous studies (Floyd and Schuster, 1990).

Sampling bias must be considered before determining patterns such as seasonal occurrence or habitat preference. For example, in this study five samples were taken in August versus one sample taken in July. Two samples were taken in June versus four taken in May. Number of specimens per sample must also be considered. If one individual was collected in April and at no other time, it may be due to either a seasonal activity pattern, or to sampling bias. But, if numerous individuals were collected from each of five samples in April and May and at no other time of the year, a pattern of spring emergence is clearly suggested.

Some species, such as *Cheumatopsyche pettiti*, were present in virtually every sample throughout the season. Others showed large gaps (seven or more weeks) between samples. In chart form though it became apparent that sampling bias was the likely to cause for many of these gaps. The largest and most frequent gaps occurred between mid-

May and mid-July, when only two samples were taken. Two samples, one taken in mid-May and another in mid-July, showed unusually high diversity whereas the two samples in between (early and late June) were relatively meager. After filling in this 'mid-summer gap' several larger gaps became apparent. Because absence from several consecutive samples seems a more reliable indicator of discontinuous occurrence than absence from a given period of time, I somewhat arbitrarily have defined, for the purpose of this study, four or more consecutive absences as indicative of discontinuous occurrence.

Most caddisfly species in the study area are apparently either univoltine, or multivoltine with overlapping cohorts. Of the five species with discontinuous occurrences, three (*Pycnopsyche guttifer, Chimarra feria,* and *Chimarra aterrima*) are probably semivoltine, and two *(Polycentropus cinereus* and *Hydroptila armata*) are likely univoltine (and were probably present, but not collected during the summer season; Tables 2 and 3). Floyd and Schuster (1990) reported these latter two species as being present throughout the majority of the season in Kentucky. Floyd and Schuster (1990) also reported that *Pycnopsyche guttifer* and *Pycnopsyche lepida* "represented 2 possible semivoltine species." Although *Pycnopsyche lepida* was not collected by me during the spring it is possible that it was present then as adult.

Fluctuations in ambient temperature could affect on the occurrence of individuals throughout the season. Several factors, such as temperature, relative humidity, wind speed, moonlight intensity, and rainfall may also affect the flight activity and/or attraction to UV light of adult caddisflies. Figure 5 shows ambient temperature, number of individuals collected, and the number of species collected throughout the season.

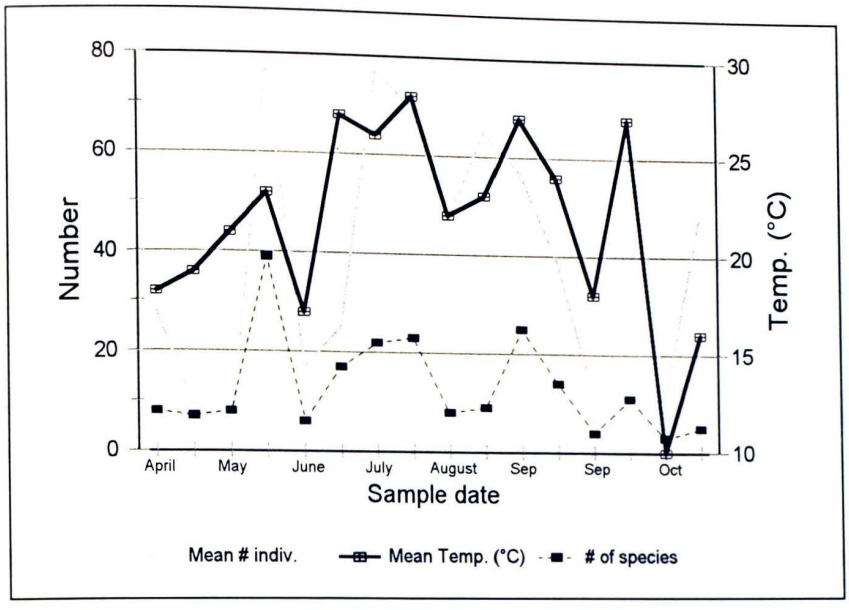

Figure 5. Ambient temperature (heavy solid line), vs. average number of individuals (solid line), and number of species (broken line) throughout the collecting season season.

Brush Creek Fauna

Beiser et al. (1999) identified 865 adult caddisflies collected from the Drake's Creek drainage of Allen, Simpson, and Warren counties, Kentucky between 1 November 1982 and 15 October 1983. They reported 31 species, from 15 genera, and eight families, with 95% of all specimens being from either the Leptoceridae or Hydropsychidae.

Floyd and Morse (1993) identified 3980 larval and adult caddisflies collected from Wildcat Creek, Pickens County, South Carolina by students and researchers at Clemson University over a 33 year period. They reported 62 species representing 17 families, and proposed that this level of diversity of caddisflies (along with that of other aquatic insect groups) is great enough for Wildcat Creek to be considered an area reference stream.

Floyd et al. (1995) examined 9315 specimens of adult caddisflies from Upper Three Runs Creek, Aiken County, South Carolina. Samples of caddisflies using light traps were made biweekly over a two year period. They reported 93 species of caddisflies representing 14 families, with the Leptoceridae and Hydroptilidae being the most speciose. Based on this and other samples of aquatic insects, the authors concluded that this creek "supports one of the richest known aquatic insect, and especially caddisfly, faunas of any stream in North America."

Floyd and Schuster (1990) reported 79 species of caddisflies representing 15 families from a sample obtained from the Buck Creek system, Pulaski County, Kentucky. Based on past surveys of mussels and fishes, this stream "showed the potential to support a diverse Trichopteran fauna." Adults were collected biweekly from late April through late October 1988. Leptoceridae and Hydroptilidae were the most speciose.

By comparison, my survey of Brush Creek yielded 57 species representing 29 genera and 13 families, with 1499 specimens being identified. My study consisted of 32 samples over a two year period for an average of two samples per month between late March and early November. The Leptoceridae and Hydropsychidae were the most speciose.

The diversity of caddisflies that I took from Brush Creek is certainly comparable to that of the above studies, several of which were conducted in streams considered to be of high water quality. The importance of faunistic surveys, especially of those diverse taxa with the potential to serve as bioindicators, cannot be overestimated. Indeed, the main intent of this project was to provide baseline data in an area that has already shown effects of agricultural practices.

Longitudinal Distribution on Brush Creek

Based on a study of longitudinal patterns of benthic insect communities, Ward (1992) states that some of the differences between sites are more dependent on substrate type and current velocity than on relative location of the site along the river. Referring specifically to rheocrenes (spring-fed brooks) Ward (1992) writes, "in the absence of adverse chemical conditions, temperature, flow, and substrate appear to be the primary factors structuring the biotic communities of springs."

Habitat preference based on longitudinal distribution patterns cannot be inferred for the 18 species that were collected from a single site (Tables 5, 6, and 7). Twelve of these species were represented by only one specimen. All individuals of each of the other six species were collected on the same night, suggesting sampling bias might account for their absence from other samples. But, if several individuals of one species are collected from only one site, during multiple samplings, an inference of habitat preference seems more appropriate.

Eight species were collected only from adjacent sites along the stream and habitat preference may help explain these results.

Comparison of First, Second, and Third Order Reaches of Brush Creek

Table A3 shows a varying degree of similarity among the samples of the three reaches from Brush Creek. Jaccard's index applied to the faunas of these three reaches reveals the greatest similarity between samples from the first and third order regions and lowest similarity between samples from the first and second order reaches (Table 8).

I expected communities from adjacent reaches to be most similar. The somewhat low level of similarity between the faunas of the second order reaches with both the first and third order reaches (0.41 and 0.43, respectively) is not surprising. The relatively higher level of similarity between the faunas of the first and third order reaches (0.6) is somewhat surprising, simply because of the distance between the two sites.

Table 8. Number of species and pairwise comparison of Jaccard's index applied to the caddisfly faunas of each of three stream order reaches on Brush Creek, Robertson County, Tennessee.

Stream Order	3rd	2nd	1st
# Species	36	34	41
Jaccard's Index			
3rd order		0.43	0.6
2nd order	0.43		0.41
1st order	0.6	0.41	

Sampling bias may explain the lower similarity values associated with the second order reaches of Brush Creek. Table 4 shows eight species from the suborder Integripalpia which were collected only from late August through October. Many of the samples taken during this part of the season were from sites in the second order region. Tables 7 and A3 show that six of these eight species were collected only from sites in the second order region. Thus the uniqueness of these six species to sites in the second order region may be due to a higher number of samples being taken late in the season from those sites and not anything unique or unusual about those sites.

Aquatic macroinvertebrate communities sampled from seven sites along a springbrook in the Smoky Mountains by Stoneburner (1977), were compared using Sorensen's index, a community similarity index similar to Jaccard's. The index values for that study ranged

from 0.40 - 0.69, with both extremes representing communities from adjacent sites. If the values in Table 8 are converted to Sorensen's index, the range becomes 0.45 - 0.52, which is comparable to Stoneburner's results.

Comparison of Brush, Buzzard and Miller Creeks

Brush Creek was chosen for this study because it was one of the few streams in the Sulphur Fork Creek Watershed that had not been investigated with regard to water quality. Buzzard and Miller creeks were used as reference streams. Miller Creek is considered to be somewhat impacted by surrounding agricultural practices, whereas Buzzard Creek is relatively unimpacted. Both these streams are sites of ongoing water quality related investigations being conducted by workers at Austin Peay State University.

I sampled Brush Creek along its entire length, but only one site from Brush Creek was chosen for comparison with sites from two other streams, on Buzzard and Miller creeks. The site on Brush Creek chosen for this comparison was # 1, because it seemed most comparable to the downstream sites on Buzzard and Miller creeks that were to be sampled.

Jaccard's index applied to the samples from these three sites reveals a low degree of similarity (approximately 0.33) among the samples of the three streams (Tables A4 and 9). However, the three values, representing all possible pairwise comparisons of the three streams, are very close. Thus, the Brush and Buzzard creek samples show the highest degree of similarity, but only slightly more so than the samples from Miller and Buzzard creeks, which show the lowest degree of similarity.

The values in Table 9 are not dissimilar enough for an assessment of the quality of the water in Brush Creek relative to Buzzard and Miller creeks. I expected the faunas from the three sites to share more species than they did. Because of their proximity, I also expected the sites from Brush and Miller creeks to have greater community similarity with each other than either would with Buzzard Creek.

Table 9. Number of species and pairwise comparison of Jaccard's index applied to the caddisfly faunas of site 1 from each of Brush, Miller, and Buzzard creeks, Robertson County, Tennessee.

Stream	Brush	Miller	Buzzard
# Species	27	25	19
Jaccard's Index			
Brush		0.33	0.35
Miller	0.33		0.29
Buzzard	0.35	0.29	

In a study by Hamilton et al. (in press), benthic macroinvertebrate communities were sampled from several springs in Land Between The Lakes, Kentucky and Tennessee. They analyzed their data using Jaccard's similarity index and reported a high value of 0.44 (for the two most similar sites). They also suggested a correlation between community similarity and proximity, lending support to my assumption (i.e., Brush and Miller creeks would show the highest similarity) but not to the actual results of my analysis of the caddisfly faunas.

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APPENDIX

Raw data of the trichopteran fauna sampled from Brush, Miller, and Buzzard creeks,Robertson County, Tennessee between May 1999 and April 2001.

Table A1: List of caddisflies collected from Brush, Buzzard, and Miller creeks in Robertson County, Tennessee between May 16, 1999 and April 8, 2001.

	TAXA			#
1	Brachycentridae	*Micrasema*	*charonis*	56
2	Glossosomatidae	*Agapetus*	*sp*	2
3	Glossosomatidae	*Glossosoma*	*nigrior*	10
4	Glossosomatidae	*Protoptila*	*palina*	3
5	Helicopsychidae	*Helicopsyche*	*borealis*	18
6	Hydropsychidae	*Ceratopsyche*	*cheilonis*	1
7	Hydropsychidae	*Ceratopsyche*	*sparna*	31
8	Hydropsychidae	*Cheumatopsyche*	*campyla*	22
9	Hydropsychidae	*Cheumatopsyche*	*ela*	1
10	Hydropsychidae	*Cheumatopsyche*	*oxa*	175
11	Hydropsychidae	*Cheumatopsyche*	*pettiti*	66
12	Hydropsychidae	*Diplectrona*	*modesta*	3
13	Hydropsychidae	*Hydropsyche*	*betteni*	83
14	Hydropsychidae	*Hydropsyche*	*depravata*	175
15	Hydropsychidae	*Hydropsyche*	*frisoni*	14
16	Hydropsychidae	*Hydropsyche*	*orris*	4
17	Hydropsychidae	*Potamyia*	*flava*	4
18	Hydroptilidae	*Hydroptila*	*armata*	8
19	Hydroptilidae	*Hydroptila*	*consimilis*	167
20	Hydroptilidae	*Hydroptila*	*gunda*	711
21	Hydroptilidae	*Hydroptila*	*perdita*	4
22	Hydroptilidae	*Hydroptila*	*waubesiana*	2
23	Hydroptilidae	*Hydroptila*	*waskesia*	10
24	Hydroptilidae	*Ochrotrichia*	*eliaga*	112
25	Hydroptilidae	*Orthotrichia*	*aegerfasciella*	2
26	Leptoceridae	*Ceraclea*	*ancylus*	4
27	Leptoceridae	*Ceraclea*	*cancellata*	42
28	Leptoceridae	*Ceraclea*	*nepha*	2
29	Leptoceridae	*Ceraclea*	*tarsipunctata*	28
30	Leptoceridae	*Ceraclea*	*transversa*	21
31	Leptoceridae	*Leptocerus*	*americanus*	2
32	Leptoceridae	*Mystacides*	*sepulchralis*	98
33	Leptoceridae	*Nectopsyche*	*exquisita*	32
34	Leptoceridae	*Oecetis*	*cinerascens*	7
35	Leptoceridae	*Oecetis*	*ditissa*	21
36	Leptoceridae	*Oecetis*	*inconspicua*	332
37	Leptoceridae	*Oecetis*	*persimilis*	8
38	Leptoceridae	*Setodes*	*epicampes*	34

Table A1 cont.

39 Leptoceridae	*Trianodes*	*ignitus*	5
40 Leptoceridae	*Trianodes*	*marginatus*	14
41 Leptoceridae	*Trianodes*	*tardus*	3
42 Limneplilidae	*Ironoquia*	*punctatissima*	1
43 Limneplilidae	*Pycnopsyche*	*rossi*	1
44 Limneplilidae	*Pycnopsyche*	*guttifer*	37
45 Limneplilidae	*Pycnopsyche*	*lepida*	38
46 Philopotamidae	*Chimarra*	*aterrima*	18
47 Philopotamidae	*Chimarra*	*feria*	24
48 Philopotamidae	*Chimarra*	*obscura*	396
49 Philopotamidae	*Chimarra*	*socia*	1
50 Philopotamidae	*Dolophilodes*	*distinctus*	2
51 Phryganeidae	*Agrypnia*	*vestita*	8
52 Phryganeidae	*Phryganea*	*sayi*	1
53 Phryganeidae	*Ptilostomis*	*postica*	1
54 Polycentropodidae	*Cyrnellus*	*fraternus*	1
55 Polycentropodidae	*Nyctiophylax*	*affinis*	3
56 Polycentropodidae	*Polycentropus*	*carolinensis*	3
57 Polycentropodidae	*Polycentropus*	*centralis*	63
58 Polycentropodidae	*Polycentropus*	*cinereus*	13
59 Polycentropodidae	*Polycentropus*	*confusus*	34
60 Polycentropodidae	*Polycentropus*	*crassicornis*	3
61 Psychomyiidae	*Lype*	*diversa*	25
62 Rhyacophilidae	*Rhyacophila*	*fenestra*	168
63 Ueneonidae	*Neophylax*	*concinnus*	2
Total			3178

Table A2: Caddisfly fauna of Brush Creek, Robertson County, Tennessee. Collections were taken between May 16, 1999 and April 8, 2001.

TAXA			#
1 Brachycentridae	*Micrasema*	*charonis*	8
2 Glossosomatidae	*Glossosoma*	*nigrior*	1
3 Glossosomatidae	*Protoptila*	*palina*	1
4 Helicopsychidae	*Helicopsyche*	*borealis*	4
5 Hydropsychidae	*Ceratopsyche*	*cheilonis*	1
6 Hydropsychidae	*Ceratopsyche*	*sparna*	30
7 Hydropsychidae	*Cheumatopsyche*	*campyla*	10
8 Hydropsychidae	*Cheumatopsyche*	*oxa*	29
9 Hydropsychidae	*Cheumatopsyche*	*pettiti*	52
10 Hydropsychidae	*Diplectrona*	*modesta*	3
11 Hydropsychidae	*Hydropsyche*	*betteni*	75
12 Hydropsychidae	*Hydropsyche*	*depravata*	118
13 Hydropsychidae	*Hydropsyche*	*frisoni*	8
14 Hydropsychidae	*Hydropsyche*	*orris*	3
15 Hydroptilidae	*Hydroptila*	*armata*	2
16 Hydroptilidae	*Hydroptila*	*consimilis*	167
17 Hydroptilidae	*Hydroptila*	*gunda*	58
18 Hydroptilidae	*Hydroptila*	*perdita*	4
19 Hydroptilidae	*Hydroptila*	*waubesiana*	1
20 Hydroptilidae	*Ochrotrichia*	*eliaga*	112
21 Hydroptilidae	*Orthotrichia*	*aegerfasciella*	1
22 Leptoceridae	*Ceraclea*	*ancylus*	4
23 Leptoceridae	*Ceraclea*	*cancellata*	10
24 Leptoceridae	*Ceraclea*	*nepha*	2
25 Leptoceridae	*Ceraclea*	*tarsipunctata*	28
26 Leptoceridae	*Ceraclea*	*transversa*	16
27 Leptoceridae	*Leptocerus*	*americanus*	2
28 Leptoceridae	*Mystacides*	*sepulchralis*	97
29 Leptoceridae	*Nectopsyche*	*exquisita*	7
30 Leptoceridae	*Oecetis*	*cinerascens*	6
31 Leptoceridae	*Oecetis*	*ditissa*	17
32 Leptoceridae	*Oecetis*	*inconspicua*	206
33 Leptoceridae	*Oecetis*	*persimilis*	6
34 Leptoceridae	*Setodes*	*epicampes*	5
35 Leptoceridae	*Trianodes*	*ignitus*	4
36 Leptoceridae	*Trianodes*	*marginatus*	14
37 Leptoceridae	*Trianodes*	*tardus*	3
38 Limnephilidae	*Ironoquia*	*punctatissima*	1

Table A2 cont.

39 Limneplilidae	*Pycnopsyche*	*rossi*	1
40 Limneplilidae	*Pycnopsyche*	*guttifer*	30
41 Limneplilidae	*Pycnopsyche*	*lepida*	26
42 Philopotamidae	*Chimarra*	*aterrima*	9
43 Philopotamidae	*Chimarra*	*feria*	24
44 Philopotamidae	*Chimarra*	*obscura*	10
45 Philopotamidae	*Chimarra*	*socia*	1
46 Philopotamidae	*Dolophilodes*	*distinctus*	2
47 Phryganeidae	*Agrypnia*	*vestita*	7
48 Phryganeidae	*Phryganea*	*sayi*	1
49 Phryganeidae	*Ptilostomis*	*postica*	1
50 Polycentropodidae	*Polycentropus*	*carolinensis*	3
51 Polycentropodidae	*Polycentropus*	*centralis*	63
52 Polycentropodidae	*Polycentropus*	*cinereus*	1
53 Polycentropodidae	*Polycentropus*	*confusus*	31
54 Polycentropodidae	*Polycentropus*	*crassicornis*	3
55 Psychomyiidae	*Lype*	*diversa*	2
56 Rhyacophilidae	*Rhyacophila*	*fenestra*	167
57 Ueneonidae	*Neophylax*	*concinnus*	1
Total			1499

Table A3 Comparison of caddisfly fauna of 1st, 2nd, and 3rd order reaches of Brush Creek, Robertson County, Tennessee. Sites #1-7 on Brush Creek are abbreviated as Br 1 - Br 7 and the site on the West Fork Branch of Brush Creek as Br WF. Lightly shaded areas indicate taxa common to two or more sites. Darkly shaded areas indicate taxa unique to a site. Numbers indicate number of individuals.

Taxa	Br 1	Br 2	Br 3	Br 4	Br WF	Br 5	Br 6	Br 7	Total
	3rd order		2nd order			1st order			
Glossosoma nigrior								1	1
Protoptila palina						1			1
Hydroptila armata	1				1				2
Hydroptila consimilis					165		2		167
Hydroptila gunda	14	33	9	2					58
Hydroptila perdita			4						4
Hydroptila waubesiana		1							1
Ochrotrichia eliaga					2	110			112
Orthotrichia aegerfasciella	1								1
Rhyacophila fenestra	2			4	34	115	11	1	167
Ceratopsyche cheilonis	1								1
Ceratopsyche sparna	15	5	1		1	7	1		30
Cheumatopsyche campyla		9						1	10
Cheumatopsyche oxa	7	10		2		7	1	2	29
Cheumatopsyche pettiti	17	14	3	3	6	6	3		52
Diplectrona modesta						2	1		3
Hydropsyche betteni	1	44	1		1	27		1	75
Hydropsyche depravata		104		4		8	2		118
Hydropsyche frisoni	1	7							8
Hydropsyche orris		1						2	3
Chimarra aterrima	6		1				2		9
Chimarra feria			2	3	9	10			24
Chimarra obscura		3	3		1	3			10
Chimarra socia					1				1
Dolophilodes distinctus						2			2
Polycentropus carolinensis			3						3
Polycentropus centralis	2	1	3		2	46	5	4	63
Polycentropus cinereus	1								1
Polycentropus confusus	2		1		10	17	1		31
Polycentropus crassicornis							3		3
Lype diversa						1	1		2
Micrasema charonis	4			3			1		8
Helicopsyche borealis	1	1					2		4
Ceraclea ancylus	4								4
Ceraclea cancellata	1					4		5	10
Ceraclea nepha	1							1	2
Ceraclea tarsipunctata	1					3		24	28
Ceraclea transversa	2	10		2		2			16

Table A3 cont.

Leptocerus americanus								2	2
Mystacides sepulchralis		1			1	93		2	97
Nectopsyche exquisita		4						3	7
Oecetis cinerascens		4			1	1			6
Oecetis ditissa	2	2	1	1		10		1	17
Oecetis inconspicua	40	77		19		54	3	13	206
Oecetis persimilis	2	3				1			6
Setodes epicampes		4						1	5
Trianodes ignitus			1	1			2		4
Trianodes marginatus	1	1	2			1		9	14
Trianodes tardus								3	3
Ironoquia punctatissima					1				1
Pycnopsyche guttifer	10		1	1	8		10		30
Pycnopsyche lepida	1		12		3		10		26
Pycnopsyche rossi			1						1
Agrypnia vestita			5	1	1				7
Phryganea sayi			1						1
Ptilostomis postica				1					1
Neophylax concinnus				1					1
# of Individuals	141	339	55	47	248	531	61	76	384

Table A4. Comparison of caddisfly faunas from most downstream sites of Brush (Bru), Miller (Mil), and Buzzard (Buz) creeks, Robertson County, Tennessee. Lightly shaded areas indicate taxa common to two or more sites. Darkly shaded areas indicate taxa unique to a site. Numbers indicate number of individuals.

TAXA	Bru	Bru	Bru	Bru	Bru	Mil	Mil	Mil	Mil	Buz	Buz	Buz	Buz	Total
Micrasema charonis	4					4					14			22
Glossosoma nigrior											9			9
Protoptila palina								3						3
Helicopsyche borealis		1						7						8
Ceratopsyche cheilonis	1													1
Ceratopsyche sparna			14		1									15
Cheumatopsyche campyla								6	6					12
Cheumatopsyche ela									1					1
Cheumatopsyche oxa	4		3			2	2	13		17	81	2	19	143
Cheumatopsyche pettiti	8	1	7	1			1	5	3	2	1			29
Hydropsyche betteni				1					2					3
Hydropsyche depravata								2	7	2	4	1	36	52
Hydropsyche frisoni				1					1	1				3
Hydropsyche orris								1						1
Potamyia flava								4						4
Hydroptila armata				1		4	2							7
Hydroptila gunda			7	7				600	3					617
Orthotrichia aegerfasciella		1						1						2
Ceraclea ancylus		4												4
Ceraclea cancellata		1						30					2	33
Ceraclea nepha		1												1
Ceraclea tarsipunctata		1												1
Ceraclea transversa		1		1				5						7
Mystacides sepulchralis													1	1
Nectopsyche exquisita								20						20
Oecetis cinerascens								1						1
Oecetis ditissa		1		1						2				4
Oecetis inconspicua		1		4	35			106		2				148
Oecetis persimilis		2								2				4
Setodes epicampes									7	1			2	10
Trianodes ignitus													1	1
Trianodes marginatus					1									1
Pycnopsyche guttifer					10									10
Pycnopsyche lepida					1					5				6

Table A4 cont.

Chimarra aterrima		6								9				15
Chimarra obscura								338	35					373
Cyrnellus fraternus								1						1
Nyctiophylax affinis										1				1
Polycentropus centralis		2												2
Polycentropus cinereus		1					2					2		5
Polycentropus confusus		2								1			1	4
Lype diversa								2		13	3		4	22
Rhyacophila fenestra		2										1		3
Total	17	28	31	17	48	10	7	1145	65	58	112	6	66	1610

VITA

Kenneth James Davenport was born in Brick, New Jersey on March 18, 1964 where he lived with his family until 1986. He graduated from Brick High School in June 1982. After living in Phoenix, Arizona for two years he moved to Alaska where he attended the University of Alaska, Anchorage, in 1990. Originally a psychology major, he switched to biology after becoming interested in writings of E. O. Wilson and Richard Dawkins. He received his bachelor's degree in Biology in May 1995. Twice he had his name published in the National Dean's List while at UAA. He worked as a stocker, garden supply salesperson, and landscaper while attending UAA. After moving to Tennessee in 1996, he began attending Austin Peay State University in January 1998, taking one class per semester for three semesters.. In May 1999, he was appointed as a research assistant for the Center for Field Biology under Dr. Steven Hamilton, serving for two years in that capacity. To acquire some teaching experience as a prelude to a possible career as a college professor, he taught freshmen biology labs as an adjunct professor for two semesters at Austin Peay. He received his Master of Science degree in Biology from Austin Peay State University in May 2002. He has been accepted into a Ph.D. program in zoology at Michigan State University, where he will enroll in the summer of 2002.