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SUMMER EPHEMEROPTERA, PLECOPTERA AND TRICHOPTERA OF
SOUTHWESTERN OF 15 DRAINAGES IN GREAT SMOKY MOUNTAINS NATIONAL
PARK

By

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For

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Abstract.-Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (in total, EPT) were inventoried during May and June 2003 and early July 2004 at 15 stream reaches from the southwestern Great Smoky Mountains National Park (GRSM). Adults and immatures were collected using ultraviolet light traps, sweepnetting, and handpicking. At least 168 species were collected, distributed as 52 mayfly, 38 stonefly, and 78 caddisfly species. A species accumulation curve suggests that EPT richness in the area has not been nearly exhausted. A cluster analysis of current data suggested that stream reaches often held distinctive assemblages. Three new regional records included *Ameletus tertius* (NC), *Epeorus fragilis* (NC), and *Leucrocuta walshi* (TN), all mayflies. Other new state records included *Isonychia georgiae* (TN) and *Siphonurus typicus* (NC). Overall, 11 new GRSM records are reported. Comparison to a previous Abrams Creek EPT study found similar species richness, but the current study found more Heptageniidae, Ephemerellidae, and Baetidae mayfly species, but many fewer species of Hydroptilidae and Leptoceridae caddisflies. Among stoneflies, the current study found many fewer Perlidae species. More work in drainages above Lake Fontana will undoubtedly yield new summer records for mayflies and caddisflies.

The National Park Service has been conducting an All Taxa Biodiversity Inventory (ATBI) in the Great Smoky Mountains National Park (GRSM) since 1997 (Sharkey 2001). Discover Life in America (DLIA) and Friends of the Smoky Mountains National Park, non-profit organizations, have provided financial and logistical support for dozens of scientists working to document the presence, distribution, and biology of GRSM species.

It was thought that insects in the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) (hereafter referred to as EPT) were well documented in GRSM. However, DeWalt and Heinold (2005), working in the western Abrams Creek drainage, recorded 39 EPT species not previously reported from GRSM, eight of which were new TN state records. Most of these new records were found in larger, low elevation streams. They stated that the greatest potential for adding new records appeared to be in mayflies and caddisflies.

Other areas in GRSM that appear to be under studied occur east of Abrams Creek in into North Carolina (NC). This southwestern end of GRSM is remote and constitutes one of the largest roadless areas in GRSM, if not the entire eastern United States. Much of the region occurs north of Lake Fontana, making accessibility difficult for scientists. The building of a proposed highway, the so-called North Shore Road, has loomed as a threat to this area for over 50 years and would run along the northern boundary of Lake Fontana. This threat makes it imperative to document species and communities there.

My objective was to inventory the EPT of 15 stream reaches spanning the distance from the mouth of Shop Creek in Blount County, Tennessee (TN) to Deep Creek near Bryson City, Swain County, NC. Particular effort was made to inventory several streams tributary to Lake Fontana.

MATERIALS AND METHODS

These 15 reaches (Table 1, Fig. 1) were accessed by foot and by using boats on three occasions to access northshore streams. Most sites were inventoried on multiple occasions using

multiple methods (Table 1). Ultraviolet (UV) light trapping employed a Bioquip™, 12-v light and battery. Effort was standardized by time (approximately one hour beginning sunset) and reflective sheet size (1 m²). Trays of 80% EtOH were positioned below the sheet to capture falling insects. Mayfly subimagoes (a subadult with hair-covered wings that molts to an imago) were captured from the sheet and reared to imagoes. Males of Perlidae and Perlodidae stonefly species were captured and their intromittent organ extruded to facilitate species identification. Remoteness of access meant that we could not control for variability of weather on all occasions. Sweepnetting of riparian vegetation for adults and handpicking in streams for nymphs, larvae and pupae continued until now new species were detected. Geographic coordinate data were captured using a Garmin™ 12XL global positioning system at each site.

Samples were sorted in their entirety and specimens identified to species when possible. Often only the males of species could be identified, but where descriptions for females existed or where it seemed that color pattern, size, or wing venation was consistent with males of known identity, they too were determined. When necessary, specimens were sent to specialists for confirmation. All specimens are housed in the INHS insect collection and entered into our INHS insect collection database. Internet accessible records will become available by late 2004 at <http://ctap.inhs.uiuc.edu/insect/search.inhs.asp>.

Construction of a species accumulation curve was accomplished by ordering data for all reaches in a west to east gradient, beginning with Shop Creek, and adding new species found in each reach to the richness of the previous site. The totals were presented by order to demonstrate order-specific patterns. This is not a typical accumulation curve with species increasing with additional samples. Because EPT taxa require so many methods of capture to obtain a reasonable estimate of richness, all methods were combined to produce the curve.

Differences between EPT communities found at each reach were studied by construction of a presence/absence-by-reach matrix. Taxa not known at the specific level were discarded unless they were the only representative of the genus across all reaches. From this, Sørensen's

(1948) quotient of similarity was calculated for each pairwise combination. A distance measure resulted by subtracting similarity from one. This dissimilarity measure was then used in an unweighted pair group method (UPGMA) cluster analysis after Sneath and Sokal (1973). A dendrogram was constructed from the UPGMA results.

RESULTS

At least 168 EPT species were captured with mayflies, stoneflies, and caddisflies contributing 52, 38, and 78 species, respectively. The distribution of species among mayflies was heavily dominated by Heptageniidae with 23 species in six genera. Ephemerellidae provided another 10 species in four genera. Plecoptera were dominated by 10 species of Perlodidae among six genera, while Chloroperlidae provided seven species in four genera. Among the Trichoptera, Hydropsychidae was the dominant family with 11 species. Three other families, Leptoceridae, Polycentropodidae, and Rhyacophilidae, provided nine species each.

Four stream reaches, Shop, Tabcat, Deep, and Eagle creeks (Campground, CG 89), were especially species rich when compared to other reaches (Table 2 and Fig. 2). At nearly all sites, caddisflies contributed more species than mayflies and stoneflies combined. A species accumulation curve (Fig. 3) demonstrated that the number of EPT species had not yet reached saturation. Reaches that provided large ($\geq 10\%$) jumps in richness included Tabcat and Twentymile at CG 93, and Deep creeks and Proctor Branch. These stream reaches varied in altitude, degree of canopy cover, aspect to the sun, stream gradient, and stream width. However, Fig. 3 strongly suggests that many more EPT species are available during the summer in this part of GRSM.

The UPGMA cluster analysis produced several clusters of stream reaches. One grouping, Tabcat, Proctor, Shop, and Twentymile CG 93 clustered at an average dissimilarity of 0.52, meaning that, on average, each site shared about half their taxa with the others (Fig. 4). Another cluster occurred for Eagle Creek at CG 89, Hammer, and Twentymile CG 92, having only slightly less species overlap. The next strongest clusters supported only about 25% overlap in

species. John's Cove overlapped little with the other sites. It experienced the lowest collecting effort of any reach examined, so its relationship is somewhat spurious. Overall, the cluster analysis suggests that many of these sites have great turnover in EPT community composition and that EPT fauna are not evenly distributed in the region.

SIGNIFICANT RECORDS

Ephemeroptera (Mayflies)

Ameletidae

***Ameletus tertius* McDunnough.**- Two nymphs from Deep Creek. Zloty (1996) revised the genus to include 30 valid species and reported *A. tertius* as being from southeastern Canada, Maine, Vermont, and New York. This find, from the mountains of western NC, is the first record for the southern Appalachians and is a new GRSM and NC record. Specimens were identified by Michael Meyer of Purdue University.

Caenidae

***Caenis* sp. undetermined.**-The specific identity of this taxon is unknown, but it was first reported in GRSM as *Caenis* nr. *maccafferti* Provonsha by DeWalt and Heinold (2005) in 2001. We now have nymphs from Shop Creek and Abrams Creek Campground and one reared adult of each sex from the latter location. The nymphs key to *C. tardata* McDunnough, having the operculate second gill uniformly brown and hind tarsal fimbriate spurs numbering 12 (although they occur in two rows of nine and three). However, the Y-ridge diverges in the anterior half of the operculate gill, not in the posterior as in *C. tardata*. Adults key to near *C. maccafferti*, with forewing vein ICuA1 forked from CuA2 just distad of the CuA1-CuP crossvein; abdominal terga 1-10 shaded blackish brown and terga nine and 10 lacking triads of black dots; eggs with single polar cap. However, adults lack the fleshy protuberance characteristic of *C. maccafferti* (Provonsha 1990). These new specimens have been sent to Arwin Provonsha for review.

***Hexagenia limbata* (Serville).**-Three specimens from Deep and Shop creeks. McCafferty (1994) stated that this the most widespread of burrowing mayflies, being found coast-to-coast in

the United States. It has been reported from both NC (Pescador et al. 1999) and TN (Long and Kondratieff 1996). A new GRSM record.

Heptageniidae

***Epeorus fragilis* (Morgan).**-A single female subimago from Deep Creek. A male imago was collected from a nearby drainage in the GRSM (INHS 9961. NC: Haywood Co., Trib. Hemphill Creek, 5 km WNW Jonathan, 35.5764 N, -83.0729 W, 31 May 2003, R. E. DeWalt), confirming its presence regionally. Not known from GRSM, NC, or TN. Known from West Virginia (Faulkner and Tarter 1977), Virginia (Kondratieff and Voshell 1983), and New York (Jacobus and McCafferty 2001b).

***Nixe spinosa* (Traver).**-A single specimen from Deep Creek. It is known from NC (Pescador et al. 1999, Unzicker and Carlson 1982), but had not been reported from TN until DeWalt and Heinold (2005) did so from several locations in the Abrams Creek drainage of GRSM. Regionally, it is rarely collected.

***Rhithrogena fasciata* Traver.**-Large population at Eagle Creek CG 90. Traver (1933) listed it from several western NC sites, including Waynesville in Haywood County, adjacent to GRSM. Reported from South Carolina (SC) and Georgia (GA) (NatureServe.org) and it is currently under review in all three states for imperilment status. NatureServe also discusses the possibility that this species may not be valid. This is a new GRSM record.

***Stenacron pallidum* (Traver).**-Sixteen specimens from four locations in TN and NC. Lewis (1974) reported it as restricted to the NC mountains. Subsequently reported from SC (Morse et al. 1989) and TN (DeWalt and Heinold 2005) in GRSM.

***Stenonema carlsoni* Lewis.**-One specimen from Hazel Creek. Morse et al. (1989) reported it from NC (Morse et al. 1989) and from the Ravensford area of the Cherokee Indian Reservation (unpublished data). Long and Kondratieff (1996) provided no records for TN. This is a new GRSM record.

***Leucrocuta walshi* (McDunnough).**-A single male from Shop Creek. Distributed in Ohio and

northeastward in to Canada (Randolph and McCafferty 1998). This specimen is being confirmed by members of the McCafferty Laboratory. This would be a new regional record if confirmed.

Isonychiidae

***Isonychia geogiae* McDunnough.**-Specimens from Tabcat Creek and Proctor Branch.

Kondratieff and Voshell (1984) provided locations in GA, NC, and Virginia (VA) for piedmont and mountain streams. Also known from SC (Pescador et al. 1999). A new GRSM and TN state record.

Neophemeridae

***Neophemera purpurea* (Traver).** One nymph from Deep Creek. Known from GA, NC, SC, TN, and VA (Bae and McCafferty 1998). It was discussed here due to its apparent rarity.

Siphonuridae

***Siphonurus typicus* (Eaton).**-One specimen from Deep Creek. DeWalt and Heinold (2005) reported a single male from Abrams Creek at Cades Cove Campground. Known from scattered locations in the Midwest, the northeastern states and Canada (Provonsha and McCafferty 1982, Randolph and McCafferty 1998), and New York (Jacobus and McCafferty 2001b). This is a new NC state record.

Plecoptera

Perlodidae

***Oconoperla innubila* (Needham & Claassen).**-Male and female from Proctor Branch. Stark and Stewart (1982) erected the genus and described a new species *O. weaveri*. Stark (1985) later removed *Yugus innubilus* (Needham and Claassen) to *Oconoperla*, and synonymized *O. weaveri* with it. A rare species from NC, SC, and TN from a total of seven locations, including Clingman's Dome, GRSM (Stark 1985, Stewart and Stark 1982).

Trichoptera

Glossomatidae

***Agapetus iridis* Ross.**-Three males from Hammer Branch. Unzicker et al. (1982) reported it

from mountain and piedmont ecoregions. Known from two counties in TN (Etnier et al. 1998).

A new GRSM record.

Leptoceridae

***Ceraclea diluta* (Hagen)**.-Several specimens from Deep Creek. Reported from the NC coastal plain by Unzicker et al. (1982) and several east-central counties of TN (Etnier, et al. 1998). A new GRSM record.

***Triaenodes taenius* Ross**.-A single male from Tabcat Creek. Described from near GRSM doorstep (Ross 1938). Known from Abrams Creek drainage (DeWalt and Heinold 2005) and from the Ravensford area (Morse, unpublished data). Etnier et al. (1998) provided one Cooke Co. record adjacent to GRSM.

Molannidae

***Molanna ulmerina* Navas**.-Nine specimens from Shop Creek. DeWalt and Heinold (2005) reported it from low elevation Abrams Creek reaches of GRSM. Known from east-central TN location (Etnier et al. 1998).

Polycentropodidae

***Nyctiophylax denningi* Morse**.-Thirteen males and six females from Shop and Tabcat creeks. Armitage and Hamilton (1990) listed it from AL, GA, MS, SC, and TN (the latter also by Etnier et al. 1998). A GRSM record.

Rhyacophilidae

Sericostomatidae

***Agarodes tetron* (Ross) or *grisea* Banks**.-One female from Deep Creek. Ross and Scott (1974) provided a key to *Agarodes*, but could not separate females of these species. *Agarodes tetron* has been reported from unspecified TN locations adjacent to GRSM (Etnier et al. 1998) and from Ravensford (Morse, unpublished data). A GRSM record.

DISCUSSION

This inventory produced a total of 168 EPT species, four more than was found by DeWalt and Heinold (2005) in their examination of the Abrams Creek drainage in GRSM. Sørensen's quotient of similarity between these two data sets demonstrated a 61% overlap in species composition. Initial thought might consider this value low for adjacent watersheds, but Abrams Creek is unique since it runs through the only calcium rich bedrock area in GRSM and has a significant part of its middle drainage as open pasture. Drainages in the current study were heavily wooded throughout.

This study produced many more mayfly species, especially in the families Heptageniidae, Ephemerellidae, and Baetidae. Among the latter two families, additional handpicking of nymphs may have helped increased richness. Among stoneflies, Perlidae were not as rich as in Abrams Creek, the majority being lost in the genus *Perlesta*. Additionally, caddisflies richness was much less than for Abrams Creek, with major losses among the Hydroptilidae and Leptoceridae. The lack of a large, warm, placid stream, like Abrams Creek, is probably the cause of the deficiency in these two families.

The current study accumulated three significant regional records for the mayflies *Ameletus tertius* (NC), *Epeorus fragilis* (NC), and *Leucrocuta walshi* (TN). Additional state records included *Siphonurus typicus* (NC) and *Isonychia georgiae* (TN). New GRSM records include seven mayfly and four caddisfly species as well.

Species accumulation curves and turnover in species between these two studies suggests that many more EPT species can be added to GRSM and state lists. There are still many drainages north of Lake Fontana that have been poorly studied. More work should be conducted there.

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FIGURE LEGENDS

Fig. 1. Streams reaches sampled for Ephemeroptera, Plecoptera, and Trichoptera in southwestern Great Smoky Mountains National Park.

Fig. 2. Ephemeroptera, Plecoptera, and Trichoptera species richness (EPT) from 15 sites in southwestern Great Smoky Mountains National Park, TN and NC.

Fig. 3. Cumulative Ephemeroptera, Plecoptera, and Trichoptera species richness (EPT) from 15 sites in southwestern Great Smoky Mountains National Park, TN and NC. Asterisks indicate reaches increasing in richness by $\geq 10\%$.

Fig. 4. Unweighted pair-group method average dissimilarity dendrogram of Ephemeroptera, Plecoptera, and Trichoptera assemblages in 15 sites in southwestern Great Smoky Mountains National Park, TN and NC.

Table 1. Location information, approximate stream width, elevation, dates of collection, and methods used at 15 stream sites in southwestern Great Smoky Mountains National Park in May and June 2003 and July 2004. Stream sites oriented from west to east.

Site	Creek	Lat.	Long.	Width (m)	Elevation (m)	Dates	Methods
Blount County, Tennessee							
1	Shop Cr.	35.5308	83.9878	4	268	6/1, 6/9	sweep, handpicking, UV light
2	Tabcat Cr.	35.5196	83.9793	5	299	5/21, 5/22, 6/8	sweep, handpicking, UV light
3	Seeps Cattail Br.	35.5149	83.9763	0.5	311	5/21, 5/22	sweep, handpicking
4	Cattail Br.	35.5149	83.9763	2	311	5/21, 5/22	sweep, handpicking
Swain County, North Carolina							
5	Twentymile Cr. CG 93	35.4730	83.8524	6	579	5/21, 7/2	handpicking, UV light
6	John's Cove	35.4725	83.8515	2	579	5/22	sweep
7	Proctor Br.	35.4856	83.8368	2	768	5/22, 6/5, 7/3	sweep, handpicking, UV light
8	Twentymile Cr. CG 92	35.4968	83.8337	3	713	6/5, 7/3	sweep, handpicking, UV light
9	Gunna Cr.	35.4880	83.7718	6	1109	6/3	sweep, handpicking, UV light
10	Eagle Cr. CG 90	35.4981	83.7664	12	533	5/28, 7/4	sweep, handpicking, UV light
11	Eagle Cr. CG 89	35.4935	83.7674	8	585	5/28, 6/10	sweep, handpicking, UV light
12	Eakanetlee Cr.	35.5512	83.7322	10	585	5/28, 6/10	sweep, handpicking, UV light
13	Hazel Cr.	35.4744	83.7245	10	531	5/29, 6/11	sweep, UV light
14	Hammer Br.	35.4739	83.4311	2	585	5/24	sweep, handpicking, UV light
15	Deep Cr.	35.4730	83.4300	10	594	5/24, 5/31, 6/12	sweep, handpicking, UV light

Table 2. Ephemeroptera, Plecoptera, and Trichoptera taxa taken from stream in southwestern Great Smoky Mountains National Park, May and June 2003. Sites organized from west to east along southern Park boundary. Site numbers refer to stream reaches in Table 1.

Site # →	Order/Family/Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
Ephemeroptera																	
Ameletidae																	
	<i>Ameletus tertius</i>															2	2
Baetidae																	
	<i>Acerpenna macdunnoughi</i>	1				1					4	5	3				13
	<i>Acentrella ampla</i>	1	1														2
	<i>Acentrella</i> sp.											8					8
	<i>Baetis brunneicolor</i>	3															3
	<i>Baetis flavistriga</i>	1	1														2
	<i>Baetis tricaudatus</i>										4						4
	<i>Baetis</i> sp.		1										1	3		12	17
	<i>Centroptilum</i> sp.	1															1
Caenidae																	
	<i>Caenis</i> sp.	27															27
Ephemerellidae																	
	<i>Drunella cornutella</i>	1	7			19					3	38	23	10		22	123
	<i>Drunella tuberculata</i>		2														2
	<i>Ephemerella catawba</i>			3			1										1
	<i>Ephemerella dorothea</i>	6	8		12	1			1	1				1			30
	<i>Ephemerella excrucians</i>									1							1
	<i>Ephemerella hispida</i>															1	1
	<i>Ephemerella</i> sp.		3			1						10	1	18		27	60
	<i>Serratella deficiens</i>	1	4														5
	<i>Serratella serrata</i>					11											11
	<i>Serratella</i> sp.	1															1
	<i>Timpanoga simplex</i>					3											3
Ephemeridae																	
	<i>Ephemera varia</i>															2	2
	<i>Ephemera guttulata</i>		2			3									3		8
	<i>Hexagenia limbata</i>	1														2	3
Heptageniidae																	
	<i>Epeorus dispar</i>		3					9	4			6	1			18	41
	<i>Epeorus fragilis</i>															1	1
	<i>Epeorus subpallidus</i>					1											1
	<i>Epeorus vitreus</i>		1														1
	<i>Epeorus</i> sp.															20	20
	<i>Leurocuta aphrodite</i>	43	26								20						89
	<i>Leurocuta junio</i>										21					15	36
	<i>Leurocuta minerva</i>		3														3
	<i>Leurocuta thetis</i>					7		4	4								15
	<i>Leurocuta walshi</i>	1															1
	<i>Leurocuta</i> sp.	12	15														27
	<i>Nixe spinosa</i>															1	1
	<i>Maccaffertium carlsoni</i>													1			1
	<i>Maccaffertium ithaca</i>	2												2		2	6
	<i>Maccaffertium mexicanum</i>		1														1
	<i>Maccaffertium meririvulanum</i>							2									2
	<i>Maccaffertium modestum</i>	1	7									2					10
	<i>Maccaffertium pudicum</i>	2	4								4		1			1	12
	<i>Maccaffertium terminatum</i>				3	7			1	1				6			18
	<i>Maccaffertium vicarium</i>												1				1
	<i>Maccaffertium</i> sp.	1													1		2
	<i>Rhithrogena amica</i>											1				1	2
	<i>Rhithrogena fasciata</i>										20						20
	<i>Rhithrogena</i> sp.											3					3
	<i>Stenacron carolina</i>								2								2
	<i>Stenacron interpunctatum</i>	4	6									2	1			1	14
	<i>Stenacron pallidum</i>	1	6			4		5									16

Table 2. Continued.

Site #—>	Order/Family/Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
	Isonychiidae																0
	<i>Isonychia georgiae</i>		1					4									5
	<i>Isonychia bicolor</i>										1	1				1	3
	Leptophlebiidae																0
	<i>Habrophlebia vibrans</i>	4		16								3	4		3		30
	<i>Habrophlebiodes americana</i>	7	3	9	1							2		1			23
	<i>Habrophlebiodes</i> sp.	3	2			1											6
	<i>Paraleptophlebia assimilis</i>		1					2				3			1		7
	<i>Paraleptophlebia guttata</i>		1	1				1	1								4
	<i>Paraleptophlebia mollis</i>															4	4
	<i>Paraleptophlebia</i> sp.					1				2					1		4
	Neophemeridae																0
	<i>Neophemera purpurea</i>															1	1
	Siphonuridae																0
	<i>Siphonurus typicus</i>															1	1
	Chloroperlidae																0
	<i>Alloperla atlantica</i>															12	12
	<i>Alloperla nanina</i>							2									2
	<i>Alloperla usa</i>					1			3								4
	<i>Alloperla</i> sp.		3			1		3									7
	<i>Haploperla brevis</i>							1				1				1	3
	<i>Suwallia marginata</i>								1								1
	<i>Sweltsa lateralis</i>									2							2
	<i>Sweltsa mediana</i>											5			1	3	9
	<i>Sweltsa</i> sp.	1	2				1	2		2				1			9
	Leuctridae																0
	<i>Leuctra carolinensis</i>							13							3		16
	<i>Leuctra ferruginea</i>	14	19														33
	<i>Leuctra mitchellensis</i>									18							18
	<i>Leuctra sibleyi</i>							1									1
	<i>Leuctra</i> sp.	13			3			2		12		1	1	1		3	36
	Nemouridae																0
	<i>Amphinemura nigritta</i>		1	1				1		4		1					8
	<i>Amphinemura wui</i>						2	23				5	1		10		41
	<i>Amphinemura</i> sp.	1			1			2	1		1	10	1			1	18
	<i>Soyedina</i> sp.			2													2
	Peltoperlidae																0
	<i>Tallaperla anna</i>							6	2								8
	<i>Tallaperla cornelia</i>							16		3							19
	<i>Tallaperla elisa</i>											1					1
	<i>Tallaperla laurie</i>		3	17	1			1				2					24
	<i>Tallaperla maria</i>	1		2												2	5
	<i>Tallaperla</i> sp.															2	2
	<i>Viehopera ada</i>							6				1					7
	Perlidae																0
	<i>Acroneuria abnormis</i>	6	16			8		1	7		5	10	6	1			60
	<i>Acroneuria filicis</i>					1											1
	<i>Agnetina capitata</i>		1														1
	<i>Eccopectura xanthenes</i>	1				3			3				1				8
	<i>Neoperla occipitalis</i>	26															26
	<i>Neoperla</i> sp.	3	6														9
	<i>Perlesta frisoni</i>					1		1	4			1		2			9
	Perlodidae																0
	<i>Cultus decusus</i>											2					2
	<i>Diploperla duplicata</i>		6	1								2				1	10
	<i>Isoperla dicala</i>											1		1		5	7
	<i>Isoperla distincta</i>									1							1
	<i>Isoperla holochlora</i>	4	5					4	1			3	1		2		20
	<i>Isoperla orata</i>											2		1			3
	<i>Isoperla</i> sp. M8		3			1			3							11	18
	<i>Isoperla</i> sp.											36					36

Table 2. Continued.

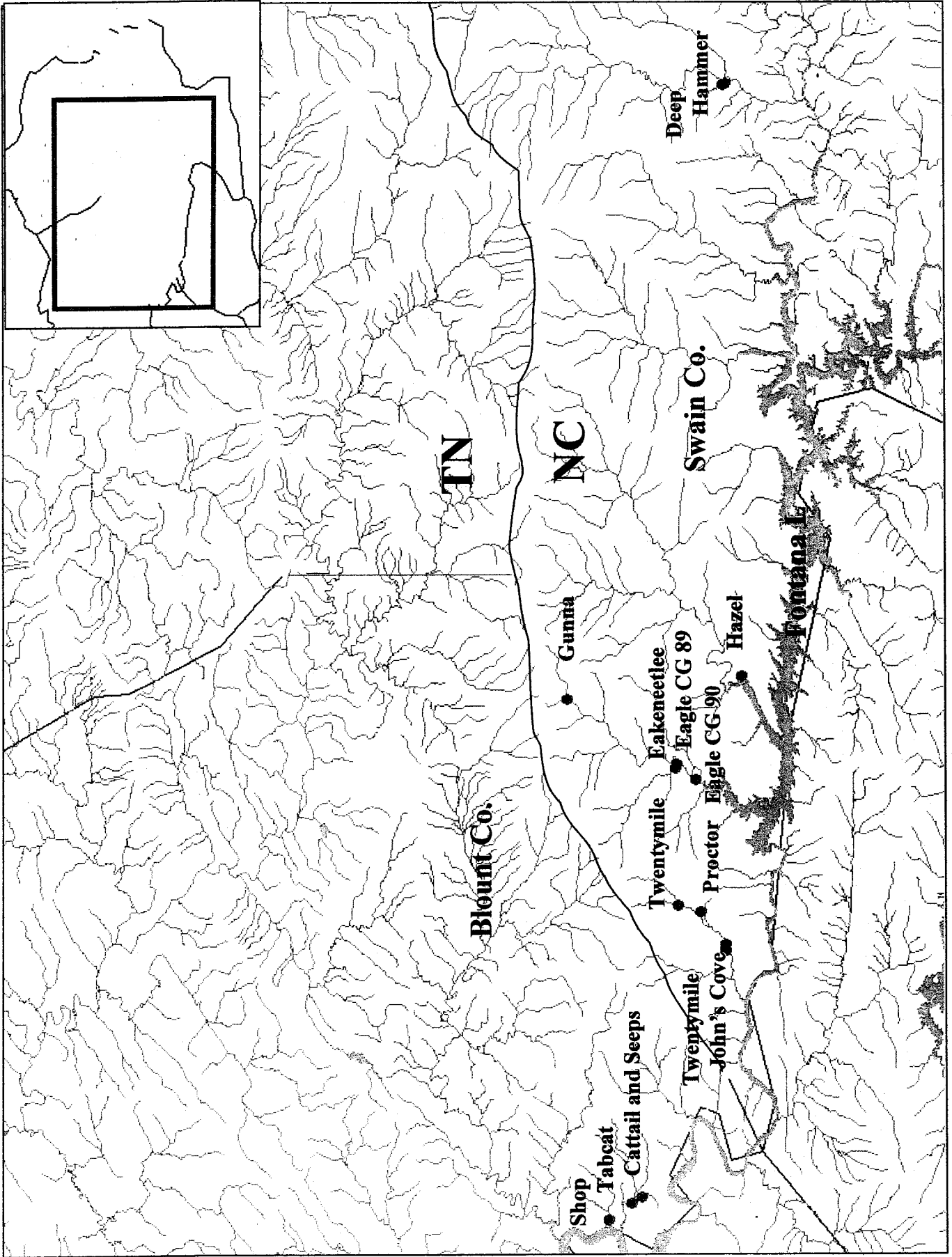
Site # →	Order/Family/Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
	Oconoperla innubila							2									2
	Remenus bilobatus	1	5	1	3	1		1		1		1	1				15
	Yugus arinus											1			2		3
	Pteronarcyidae																0
	Pteronarcys scotti					1											1
	Pteronarcys sp.	1	3									1				1	6
	Taeniopterygidae																0
	Bolotoperla rossi											1					1
	Trichoptera																0
	Brachycentridae																0
	Brachycentrus sp.					1											1
	Micrasema charonis											1				1	2
	Micrasema rickeri															8	8
	Micrasema wataga		1														1
	Micrasema sp.									1						5	6
	Dipseudopsidae																0
	Phylocentropus carolinus												1				1
	Phylocentropus lucidus								1	1		1	1				4
	Glossosomatidae																0
	Agapetus pinatus										4	3				6	13
	Agapetus iridis								1						3		4
	Agapetus sp.	1	1								76	17	2		1	33	131
	Glossosoma nigror		1		1												2
	Glossosoma sp.	11	3			8			3		1			2			28
	Goeridae																0
	Goera calcarata	7									6			2		7	22
	Helicopsyichidae																0
	Helicopsyche borealis		2								8						10
	Hydropsychidae																0
	Arctopsyche irrorata								1								1
	Ceratopsyche macleodi												4				4
	Ceratopsyche morosa														1		1
	Ceratopsyche slossonae					12					2	6				2	22
	Ceratopsyche sparna	23	9						1		17	8	11	10	30	110	219
	Ceratopsyche sp.												2				2
	Cheumatopsyche harwoodi	18	2								3	42	10	14		94	183
	Cheumatopsyche analis	4															4
	Cheumatopsyche sp.	8	23														31
	Diplectrona metaqui	1	1	3													5
	Diplectrona modesta	6	21		4	40		3	42	2	3	14	21			1	157
	Hydropsyche betteni	3	4														7
	Hydropsyche betteni or depravata	7														1	8
	Hydropsyche sp.												1				1
	Parapsyche cardis							2	1						2		5
	Hydroptilidae																0
	Hydroptila oneili	3															3
	Hydroptila valhalla	1															1
	Hydroptila sp.		15									1				7	23
	Stactobiella delira					6											6
	Stactobiella martynovi															3	3
	Stactobiella sp.														7	11	18
	Lepidostomatidae																0
	Lepidostoma lydia											1					1
	Lepidostoma ontario															1	1
	Lepidostoma pictile														5	2	7
	Lepidostoma tibiale										19						19
	Lepidostoma sp.		3	1		4					1						9
	Theliopsyche grisea	1															1

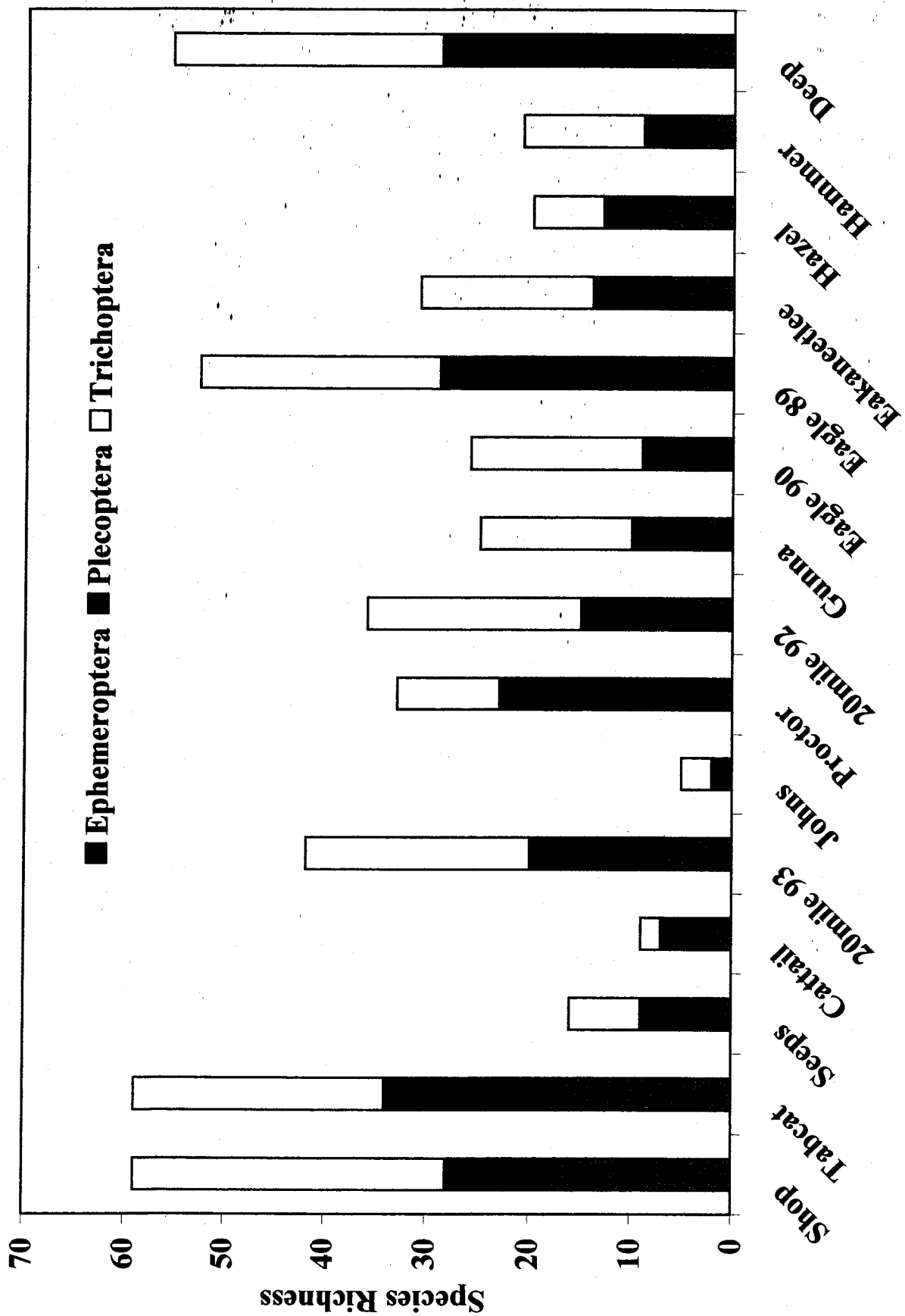
Table 2. Continued.

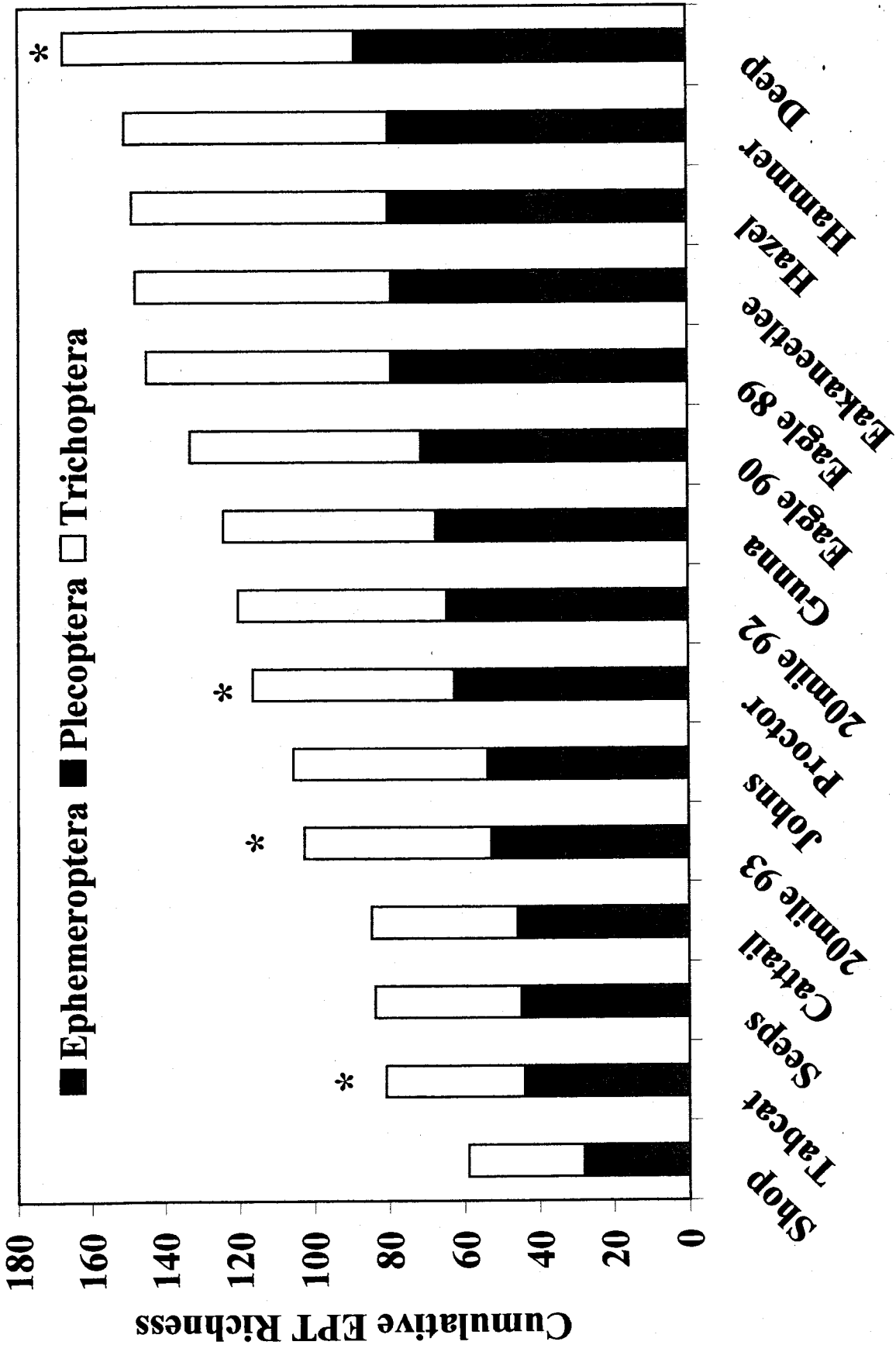
Site # →	Order/Family/Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
	Leptoceridae																0
	<i>Ceraclea diluta</i>															5	5
	<i>Ceraclea flava</i>										1						1
	<i>Ceraclea tarsipunctata</i>	1															1
	<i>Ceraclea transversa</i>	122	35			1					1	3					162
	<i>Nectopsyche exquisita</i>	2															2
	<i>Oecetis avara</i>										10						10
	<i>Oecetis inconspicua</i>	8	1			3							1			1	14
	<i>Oecetis persimilis</i>										23						23
	<i>Oecetis</i> sp.	1															1
	<i>Triaenodes taenius</i>		1														1
	Limnephilidae																0
	<i>Hydatophylax argus</i>															7	7
	<i>Pseudostenophylax uniformis</i>					1		27	11	103							142
	<i>Pycnopsyche flavata</i>									2							2
	<i>Pycnopsyche gentilis</i>			2				2				1					5
	<i>Pycnopsyche</i> sp.	2	1			2			1				1				7
	Molannidae																0
	<i>Molanna musetta</i>	3															3
	<i>Molanna ulmerina</i>	9															9
	<i>Molanna</i> sp.											1					1
	Odontoceridae																0
	<i>Psilotreta amera</i>								1								1
	<i>Psilotreta</i> sp.			1													1
	Philopotamidae																0
	<i>Chimarra aterrima</i>			3													3
	<i>Dolophilodes distinctus</i>					11		1				1				1	14
	<i>Dolophilodes major</i>					1											1
	<i>Dolophilodes</i> sp.		2						4			3				4	13
	<i>Wormaldia moesta</i>														1		1
	<i>Wormaldia</i> sp.	1	2	1						1							5
	Phryganeidae		1														1
	<i>Ptilostomis ocellifera</i>					1			1								2
	Polycentropodidae																0
	<i>Neureclipsis</i> sp.	1															1
	<i>Nyctiophylax affinis</i>	2															2
	<i>Nyctiophylax celta</i>										5						5
	<i>Nyctiophylax denningi</i>	6	12														18
	<i>Nyctiophylax moestus</i>	3															3
	<i>Nyctiophylax nephophilus</i>					5			5			3	3				16
	<i>Nyctiophylax</i> sp.	5										1		1		3	10
	<i>Polycentropus cinereus</i>	6	3			1			4								14
	<i>Polycentropus confusus</i>	42	2								1					2	47
	<i>Polycentropus maculatus</i>					1											1
	<i>Polycentropus</i> sp.	31	1			1					32	1					66
	Psychomyiidae																0
	<i>Lype diversa</i>	7	1	1		8		1	10	3	1	6	2		2		42
	<i>Psychomyia flavida</i>	3	6			8				1		62	14			2	96
	Rhyacophilidae																0
	<i>Rhyacophila amicis</i>															5	5
	<i>Rhyacophila atrata</i>												3				3
	<i>Rhyacophila carolina</i>	1				3	1		2	1	1	1			5	5	20
	<i>Rhyacophila carpenteri</i>							2		1						1	4
	<i>Rhyacophila fuscula</i>					3			2			10	11	2	2	22	52
	<i>Rhyacophila glaberrima</i>								1						1		2
	<i>Rhyacophila nigrita</i>						1	11		4		1	3				20
	<i>Rhyacophila teddyi</i>											3				1	4
	<i>Rhyacophila torva</i>	1							2	1		1			1		6
	<i>Rhyacophila</i> sp.							1		1						1	3

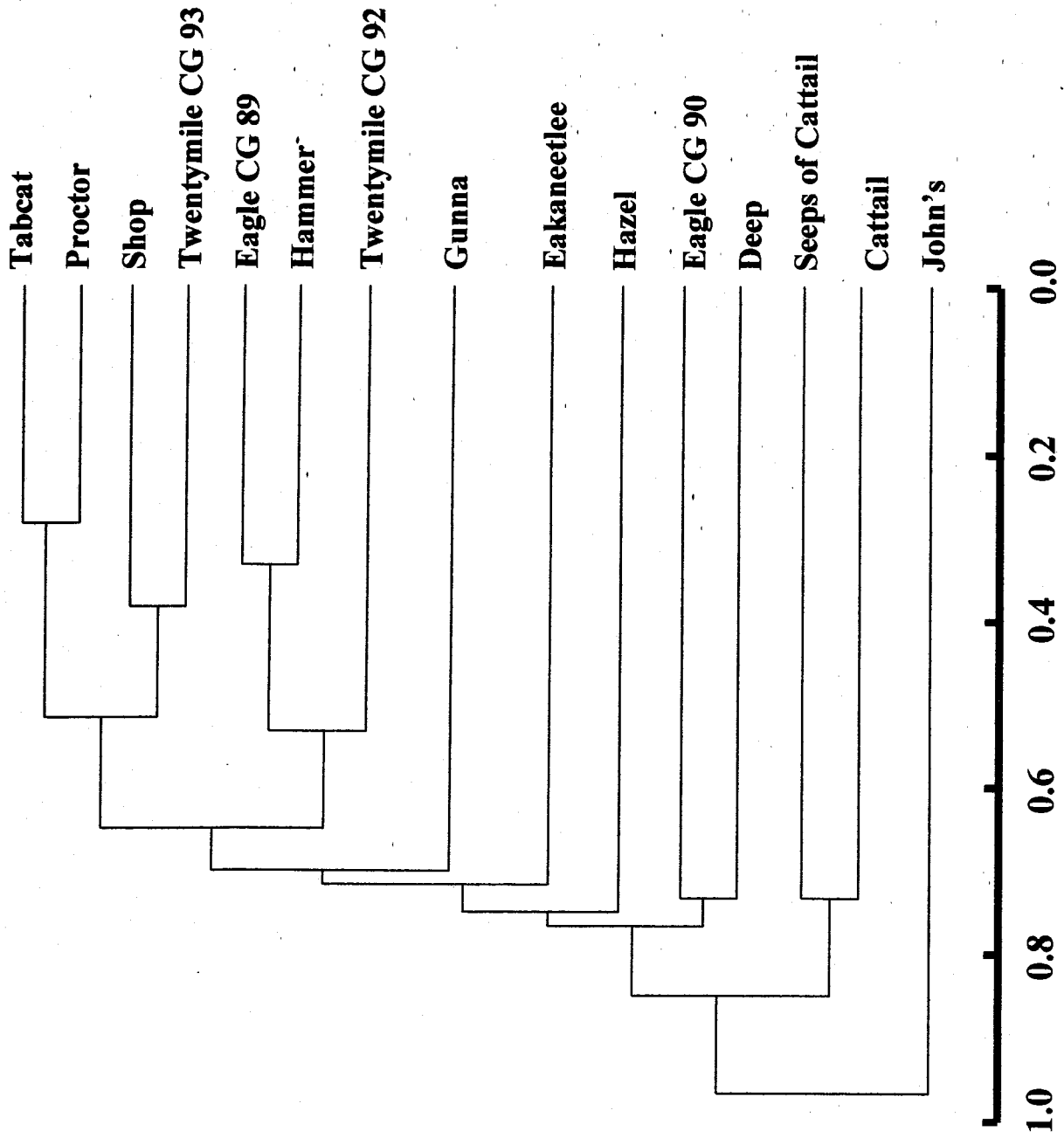
Table 2. Continued.

Site # →	Order/Family/Genus	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
	Sericostomatidae																0
	Agarodes grisea or tetron															1	1
	Fattigia pele						2	2		1		3					8
	Uenoidae																0
	Neophylax consimilis	4															4
	Neophylax mitchelli					9		2	3	7							21
	Neophylax oligius											2		1			3
	Neophylax ornatus		1			4			5	1							11
	Neophylax sp.		1														1
	Total Count	556	349	74	45	234	31	197	172	215	338	413	187	133	144	590	3198
	Ephemeroptera	18	21	3	3	12	0	7	6	4	7	10	8	7	4	19	54
	Plecoptera	10	13	6	4	8	2	16	9	6	2	19	6	6	5	10	38
	Trichoptera	31	25	7	2	22	3	10	21	15	17	24	17	7	12	27	78
	Total EPT	59	59	16	9	42	5	33	36	25	26	53	31	20	21	56	170









UPGMA Average Dissimilarity