

Carl Sandburg Home National Historic Site

Inventory of Aquatic Insects

In September 2010, the author was asked to conduct an inventory of the aquatic insects of Carl Sandburg Home National Historic Site (CARL) in Flat Rock, Henderson County, North Carolina. This survey was designed to assess the fauna of Ephemeroptera (mayflies), Odonata (damselflies and dragonflies), Plecoptera (stoneflies), Megaloptera (sialids, fishflies, hellgrammites and dobsonflies), and Trichoptera (caddisflies) in the park. We refer to these as the target species.

With the aid of CARL management and staff, we sampled 26 locations in the park, making more than 100 collections and observations of aquatic insects, and documenting more than 160 target species, including new park, state, and regional occurrence records. As a by-product of this effort, we also were able to record the presence in CARL of more than 250 non-target taxa, such as beetles, flies, ants, wasps, bees, lacewings, spiders, and others.

The data from this effort include a database of more than 3,200 specimen records containing taxonomic identifications of most target specimens, and geographic information on all sample locations. More than 12,000 specimens have been cataloged, curated, and will be consolidated into the CARL natural history collection at the park.

This report details the methods and results of the effort, and is presented in the hope that the data will be of use to the park and the National Park Service for management and conservation applications in the future.

Methods

The principal investigator (PI), with the assistance of CARL staff sampled the predominant orders of aquatic insects (Ephemeroptera, Plecoptera, Odonata, Mecoptera, and Trichoptera) using light and Malaise traps, sweeping, hand collecting, and rearing. All collecting localities were georeferenced using a global positioning system and by reference to topographic maps.

Malaise trap — Malaise traps are efficient, relatively unbiased samplers of flying insects that do not depend on any attractive agents or principles to obtain a sample, and therefore are of great



use in general flying insect biodiversity inventories. A Malaise trap (named for the inventor, Dr. Malaise) is a tent like device of fine mesh netting that is suspended in a frame of cords or other supports. One end of the trap usually is raised and supports a collecting jar of alcohol set below the upper end of the net/frame. Insects are collected into the sample jar due to their tendency to move upward toward light. Periodically, approximately weekly, the jar is emptied of its catch and replaced with a fresh jar of alcohol. The sample is labeled and then stored for further analysis. We made extensive use of Malaise traps

during this study because of their effectiveness and ease of use. Prior studies by the PI of a similar nature did not use these traps because of budget difficulties. We feel their use in the CARL study added immeasurably to the quality and comprehensiveness of our results.

Light trapping — Most flying insects are attracted to lights, and ultra-violet (UV) lights are very effective at attracting adults of aquatic insects. We used black light traps or black lights hung in front of sheets. The traps consist of a bucket with a funnel, above which the light is suspended. Insects land on or near the light or its supports, and then fall into the bucket below. These traps may have a light-sensitive trigger that turns the light on at dusk and off at daybreak, allowing unattended operation. This permitted us to leave several lights in different locations each night. The next day the traps were retrieved and the contents were preserved 70-75 percent ethanol. Using black lights at sheets involved hanging a UV light in front of a white sheet suspended from branches near water. We then picked off interesting specimens, and either kept them dry for pinning or put them into 70-75 percent ethyl alcohol in vials. This type of sampling required continual attendance at the light, usually for about 2 hours following darkness.

Hand sampling — During daylight, habitats were sampled by hand. If conditions were dry, sweep nets were used to capture adult specimens by swinging the nets through the vegetation over and near the water's edge. Most adults captured in this fashion were put into alcohol, although a limited number were kept dry for later pinning. Species of Odonata (dragonflies, damselflies) often were collected by nets and the specimens preserved in acetone, as explained below under *Specimen curation*. The aquatic stages were sampled by turning over rocks, sticks, and logs in the water or by using a D-frame net to sample root mats, undercut banks, debris, silt, sand, and other microhabitats in the water. These samples were examined on site for specimens, usually the immature stages of aquatic insects but also for those adults that have aquatic stages, mostly Hemiptera and Coleoptera, and for other groups of organisms, such as crustaceans and worms.

Identification — Specimens were sorted to the lowest possible taxonomic level. Trichoptera specimens were identified by the PI. David Etnier, University of Tennessee, Knoxville, identified some specimens and provided valuable comments on the identity of others. Immature specimens were identified using Brigham et al. (1982), Floyd (1995), Glover (1996), Glover and Floyd (2004), Parker (1998), Wiggins (1996), and many other sources. Adults were identified using a variety of sources. Recent revisions of certain genera have provided several useful references for adult caddisfly identification, including *Agapetus* (Etnier et al., 2010), *Agarodes* (Keth and Harris, 2008), *Neophylax* (Vineyard et al., 2005), *Psilotreta* (Parker and Wiggins, 1987), *Rhyacophila* (Prather and Morse, 2001; Prather et al., 1997; Stocks and Morse, 2005), *Triaenodes* (Manuel, 2010), and *Wormaldia* (Muñoz-Quesada and Holzenthal, 2008). Some specimens of Ephemeroptera and Plecoptera were sent to Dr. Boris C. Kondratieff of Colorado State University for identification.

Data entry — As specimens were identified they were entered into a biodiversity database developed by the PI. This is a Microsoft Access database that was designed to record specimen data. A copy of the completed database has been provided to the park.

When data were entered into the database each specimen record was assigned a unique SpecimenID (identifier), normally prefixed with the 4-letter park acronym, for example, CARL-59866234. For each record that represented specimens to be accessioned into the park's collection a National Park Service Accession and a Catalog number were assigned from a list of numbers provided by the park. Specimen CARL-59866234, for example, was assigned the Accession Number "CARL-481" and Catalog Number "CARL 113264."

Specimen curation — Each specimen record represents one or more specimens stored in a glass vial, on an insect pin, or in an envelope. The bulk of material is in 16-milliliter glass vials having screw caps with plastic cone liners and filled with 70-75 percent ethyl alcohol. Pinned specimens are normally on #2 insect pins that pass through the specimens on the right side of the meso- or metathorax. Small specimens of caddisflies, such as *Hydroptila*, *Agapetus*, *Lype*, and *Wormaldia*, and some Diptera and Hemiptera, are double-mounted on minuten pins. In these preparations, a very thin and short minuten pin is passed through the insect, and the minuten is pinned into a foam block. The foam block is then affixed to a standard sized insect pin (#3 or #4). Some small hard-bodied insects, particularly small beetles, are double-mounted on points. In these mounts, the insect is glued to a small paper triangle and the paper triangle, or point, is pinned to a standard size insect pin.

<i>Argia translata</i>		Hagen in Selys,	1 pair in
Dusky dancer		1865	tandem
Det: Carl Cook			
Kentucky, McCreary Co, BISO			
Big South Fork of the Cumberland River at Blue Heron, upstream from parking lot			
719066 East, 4060785 North		16S	NAD 1983
236 meters		Accession No.	BISO-180
26 July 2006		Catalog No.	BISO 50672
Coll: MGeraghty & CRParker		Spec ID	BISO-94811654
Big South Fork National River and Recreation Area			

Adults of Odonata and a few other insects are preserved in envelopes as shown above. When captured, odonate adults are placed in paper that is folded into triangles. Appropriate collection information is written on the triangles and then the triangles with the specimens are placed into acetone for 12–24 hours. The triangles are then removed from the acetone and allowed to dry. In the lab, the specimens are removed from the triangle, identified, and placed into a clear plastic envelope approximately 2.5 x 6 inches. A label is placed into the envelope with the specimens.

All specimens, whether in alcohol, on pins, or in envelopes are labeled with the following information: state:county, park acronym, locality, collection method, elevation, Universal Transverse Mercator (UTM) Zone, UTM coordinates, collection date, collector(s), SpecimenID, specimen identification with the name of the determiner and the year of determination, and the Park Service Accession and Collection numbers. On alcohol and envelope labels, the number and type of specimens are also included. Pinned labels are much smaller than alcohol labels, and therefore the data are printed with a small font size (4 points). When available, the gender is appended to the SpecimenID line as either a ♂ or ♀ symbol. Then, to conserve space in collection trays and reduce the chance of damage to the specimens, the label is cut into several strips, and the strips are pinned in order onto

the insect pin. All labels are printed on archival quality paper with archival quality ink using an ink jet printer.

Most specimens are deposited in the collection at CARL. Some specimens are deposited at the University of Tennessee, Knoxville, or at the Colorado State University Collection, Fort Collins.

Results

Complete data are provided in the Appendices. Appendix 1, Locations and Events, lists 26 sampling locations and 132 events¹. Another 30 sample events did not yield specimens and are not listed in Appendix 1. Appendix 2, Target Species Data, lists all specimens of Ephemeroptera, Odonata, Plecoptera, Megaloptera, and Trichoptera that were collected during the study. Appendix 3, Non-Target Taxa Data, includes more than 250 taxa that were collected incidentally to the main study. These represent taxa such as flies, ants, bees, wasps, beetles, moths and butterflies. Most of the non-target specimens were collected because most collections were made using indiscriminate bulk samplers, such as light traps and Malaise traps. Appendix 4, Species List, is a complete list of all identified species, including both target and non-target species. Appendix 5, Species of Interest, is a detailed summary of 114 target species from CARL that possess characteristics which make them potentially significant in terms of rarity, conservation, tolerance, or habitat requirements. A few additional records that represent rare or new species, or specimens that are omitted for other reasons are mentioned below.

Discussion

Carl Sandburg Home National Historic Site possesses an interesting array of aquatic insects that reflects its location in the Black Mountains of North Carolina. The fauna has species associated with moderate elevations (656-754 m) and cool water habitats in the Southeastern United States. *Rhyacophila mycta*, *Leuctra biloba*, and *Allocapnia aurora* are examples of CARL species that favor the higher elevations of the region. Widespread generalist species such as *Caenis punctata*, *Oxyethira pallida*, and *Enallagma signatum* are also found in CARL.

Some species may be of particular interest to park managers. Most of these are detailed in Appendix 5, Species of Interest, and we encourage managers to review this appendix when any questions about particular CARL aquatic species may arise. *Beraea gorteba* Ross, 1944 is perhaps the most significant species listed in Appendix 5. It is one of the rarest caddisflies in North America, known only from Georgia and now from North Carolina (see page 52 of Appendix 5).

Libellula auripennis Burmeister, 1839, the Golden-winged Skimmer, a dragonfly found in North Carolina and many other southern states, may be represented in CARL by 2 larvae collected in the cement pond at the house. However, since larvae of this species are difficult to determine, we choose to leave *L. auripennis* as a possible record without confirming its presence in CARL.

At least six Trichoptera species found during this study possibly are undescribed species. Three of these species are known only from CARL. The other three are known from locations outside CARL, including Great Smoky Mountains National Park and the Blue Ridge Parkway. These are not included in the count of species known from the park. Dr. Etnier will retain the specimens for further study, after which a decision will be made regarding their status.

¹ The map of sample locations was created early in the study, and as a result is inconsistent with some of the locations listed in Appendix 1. This is because when I retired, my license for ARCGIS expired and changes to the map could no longer be incorporated.

LAPSUS

There are seven pinned caddisflies from the Front Lake parking lot spring that were collected 26 July 2011 that cannot be found. The specimens were assigned Catalog Numbers: CARL 114356, CARL 114804, CARL 115053, CARL 115169, CARL 115188, CARL 115299, CARL 115316. They were identified only as Trichoptera.

Further, 44 lots of Odonata kept in envelopes and assigned Catalog Numbers cannot be located.

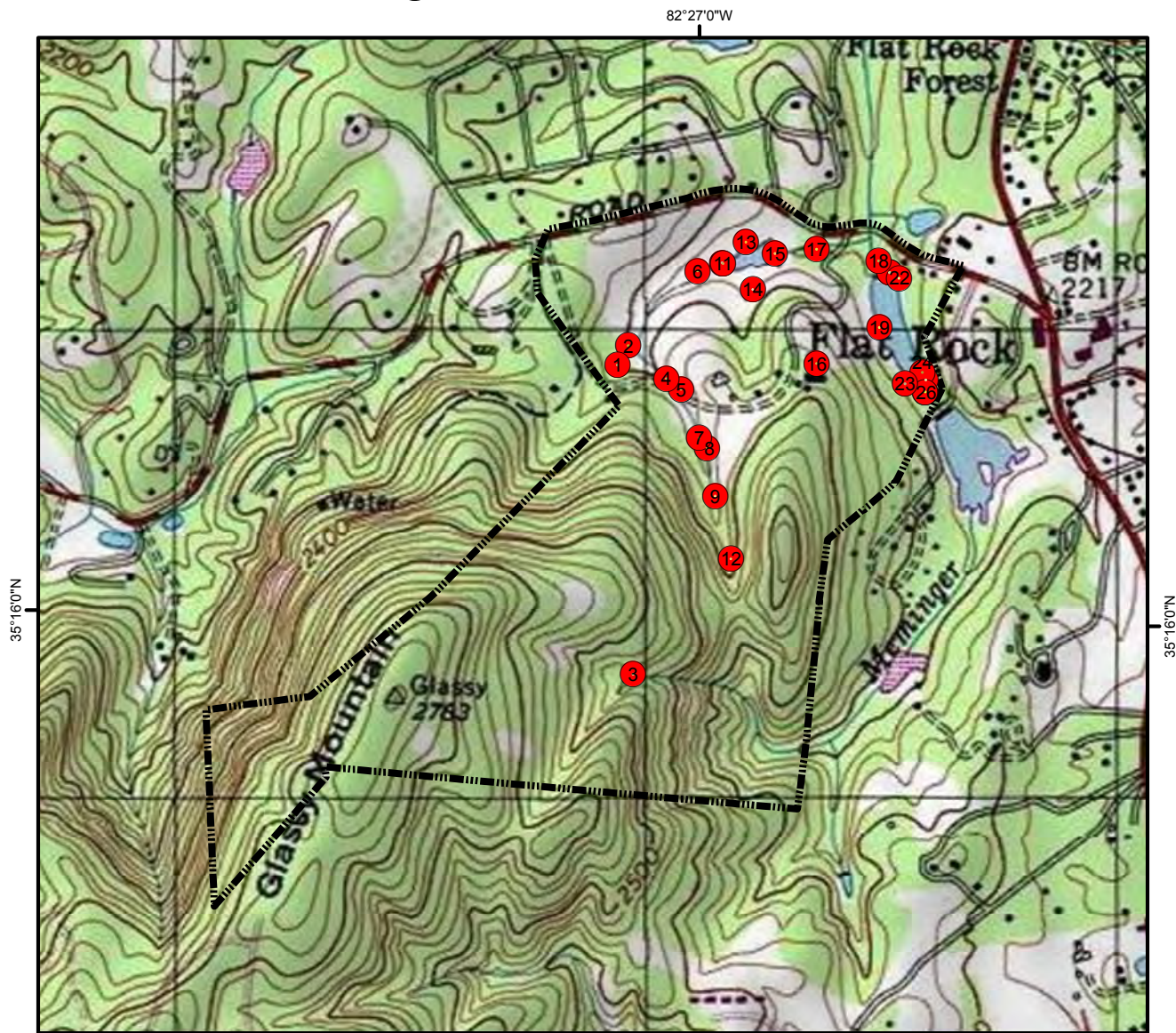
CatalogNumber	Taxon		
CARL 113078	Ischnura posita	CARL 115887	Ischnura posita
CARL 113085	Lestes australis	CARL 115888	Chromagrion conditum
CARL 113398	Argia fumipennis violacea	CARL 115890	Ischnura posita
CARL 113551	Argia fumipennis violacea	CARL 115891	Ischnura species
CARL 113872	Argia fumipennis violacea	CARL 115892	Ischnura species
CARL 114346	Argia fumipennis violacea	CARL 115893	Enallagma signatum
CARL 114358	Pachydiplax longipennis	CARL 115894	Ischnura hastata
CARL 114672	Ischnura posita	CARL 115895	Chromagrion conditum
CARL 114757	Ischnura posita	CARL 115896	Ischnura posita
CARL 114758	Chromagrion conditum	CARL 115897	Argia fumipennis violacea
CARL 114759	Ischnura posita	CARL 115899	Epitheca cynosura
CARL 114760	Chromagrion conditum	CARL 115902	Lestes australis
CARL 114761	Lestes australis	CARL 115903	Ischnura posita
CARL 114838	Argia fumipennis violacea	CARL 115909	Enallagma aspersum
CARL 114935	Ischnura posita	CARL 115910	Ischnura posita
CARL 114953	Sympetrum vicinum	CARL 115911	Ischnura hastata
CARL 115198	Enallagma geminatum	CARL 115912	Chromagrion conditum
CARL 115282	Ischnura posita	CARL 115913	Ischnura verticalis
CARL 115883	Ischnura species	CARL 115914	Enallagma geminatum
CARL 115885	Ischnura species	CARL 115915	Ischnura posita
CARL 115886	Enallagma species	CARL 115917	Ischnura posita
		CARL 115918	Argia fumipennis violacea

If these specimens cannot be found, they will be designated as lost.

Literature Cited

- Brigham, A. R., Brigham, W. U., and Gnilka, A., eds., 1982, The aquatic insects and oligochaetes of North and South Carolina, Mahomet, IL, Midwest Aquatic Enterprises, 837 p.
- Etnier, D. A., Parker, C. R., Baxter, J. T., Jr., and Long, T. M., 2010, A review of the genus *Agapetus* Curtis (Trichoptera: Glossosomatidae) in eastern and central North America, with description of 12 new species: *Insecta Mundi*, v. 149, 1-77 p.
- Floyd, M. A., 1995, Larvae of the caddisfly genus *Oecetis* (Trichoptera: Leptoceridae) in North America: *Bulletin of the Ohio Biological Survey New Series*, v. 10, viii + 85 p.
- Glover, J. B., 1996, Larvae of the caddisfly genera *Triaenodes* and *Ylodes* (Trichoptera: Leptoceridae) in North America: *Bulletin of the Ohio Biological Survey New Series*, v. 11, vii + 89 p.
- Glover, J. B., and Floyd, M. A., 2004, Larvae of the genus *Nectopsyche* (Trichoptera: Leptoceridae) in eastern North America, including a new species from North Carolina: *Journal of the North American Benthological Society*, v. 23, 526-541 p.
- Keth, A. C., and Harris, S. C., 2008, The North American genus *Agarodes* Banks (Trichoptera: Sericostomatidae), Columbus, Ohio, The Caddis Press, vi + 33 p.
- Manuel, K. L., 2010, The longhorn caddisfly genus *Triaenodes* (Trichoptera: Leptoceridae) in North America, Columbus, Ohio, The Caddis Press, v + 109 p.
- Muñoz-Quesada, F. J., and Holzenthal, R. W., 2008, Revision of the Nearctic species of the caddisfly genus *Wormaldia* McLachlan (Trichoptera: Philopotamidae): *Zootaxa*, v. 1838, 1-75 p.
- Parker, C. R., 1998, A review of *Goerita* (Trichoptera: Goeridae), with description of a new species: *Insecta Mundi*, v. 12, 227-238 p.
- Parker, C. R., and Wiggins, G. B., 1987, Revision of the caddisfly genus *Psilotreta* (Trichoptera: Odontoceridae): *Royal Ontario Museum Life Sciences Contributions*, v. 144, iv + 55 pp.
- Prather, A. L., and Morse, J. C., 2001, Eastern Nearctic *Rhyacophila* species, with revision of the *Rhyacophila invaria* Group (Trichoptera: Rhyacophilidae): *Transactions of the American Entomological Society*, v. 127, no. 1, p. 85-166.
- Prather, A. L., Syrett, A. L., and Morse, J. C., 1997, Females of *Rhyacophila* (Trichoptera: Rhyacophilidae) from the southeastern United States, in Holzenthal, R. W., and Flint, O. S., Jr., eds., *Proceedings of the 8th International Symposium on Trichoptera*, Volume 8: University of Minnesota, St. Paul, Ohio Biological Survey, Columbus, Ohio, 387-399 p.
- Stocks, I. C., and Morse, J. C., 2005, Erratum. Prather, A. L. and J. C. Morse. 2001. Eastern Nearctic *Rhyacophila* species, with revision of the *Rhyacophila invaria* Group (Trichoptera: Rhyacophilidae). *Transactions of the American Entomological Society* 127(1):85-166.
- Vineyard, R. N., Wiggins, G. B., Frania, H. E., and Scheffer, P. W., 2005, The caddisfly genus *Neophylax* (Trichoptera: Uenoidae): *ROM Contributions in Science*, v. 2, vi + 141 p.
- Wiggins, G. B., 1996, Larvae of the North American caddisfly genera (Trichoptera), Toronto, Ontario, University of Toronto Press, xiii + 457 p.

Carl Sandburg Home National Historic Site



Legend

● Sample Location  Boundary

SiteCode

- | | | |
|--|---|--|
| • 1 - CARL trib to Pasture Creek below entrance road | • 10 - CARL Duck Pond, along shore | • 20 - CARL Front Lake near parking lot |
| • 2 - CARL Pasture Creek West | • 11 - CARL Side Lake | • 21 - CARL Front Lake parking lot spring |
| • 3 - CARL Mountain Reservoir | • 12 - CARL Trout Pond spring | • 22 - CARL Front Lake spring near parking lot |
| • 4 - CARL Pasture Creek below Duck Pond | • 13 - CARL Side Lake North | • 23 - CARL Front Lake WEST |
| • 5 - CARL Duck Pond | • 14 - CARL trib to Side Lake above duck cage | • 24 - CARL Front Lake EAST |
| • 6 - CARL Pasture Cr inlet to Side Lake | • 15 - CARL Side Lake at dam | • 25 - CARL Front Lake at Inlet |
| • 7 - CARL Trout Pond effluent | • 16 - CARL cement pond in front of house | • 26 - CARL Front Lake inlet stream |
| • 8 - CARL Trout Pond drain | • 17 - CARL Pasture Creek below Side Lake | • 27 - CARL Front Lake ca. 20 m east of inlets |
| • 9 - CARL Trout Pond | • 18 - CARL Memminger Creek below Front Lake | |
| | • 19 - CARL Front Lake, along shore | |

The background map is the USA Topographic Basemap from ESRI's
ArcGIS Online Map Services, at
<http://www.esri.com/software/arcgis/arcgisonline/services/map-services>



Appendix 1. Locations and Events

Each location at which samples were collected is listed below. Every collection site is identified by the SiteCode given in the database. The column Location represents the state and county, followed by the SiteCode from the database. The column UTM's gives the coordinates in Universal Transmicator, Datum83, and UTM Zone 17 North. Column Lat/Lon gives the geographic coordinates in decimal degree format. The final column Elevation provides the elevation above sea level in meters (m).

Each location was sampled at least once, and several locations were sampled multiple times. Each sampling occasion is called an event and is distinguished from every other event at the same location by its date, the collection method used, and by the collector(s) who took the sample. Following each Location record events are listed by date, collection method, and by collector(s).

Carl Sandburg Home National Historic Site

Location	UTMs	Lat/Lon	Elevation
NC:Henderson Co., CARL cement pond in front of house	3904126N	35.27163°N	
	368380E	82.44713°W	694 m
Event 01: 26 May 2011, by hand, E. Alcantar & I. van Hoff			
Event 02: 7 Jun 2011, by hand, CRParker			
NC:Henderson Co., CARL Duck Pond	3904071N	35.2711°N	
	368091E	82.45029°W	665 m
Event 01: 30 May 2011, by hand, CRParker			
Event 02: 6-7 Jun 2011, black light trap, CRParker			
NC:Henderson Co., CARL Duck Pond, along shore	3904341N	35.27354°N	
	368178E	82.44938°W	665 m
Event 01: 30 Aug 2011, dip net, CRParker			
Event 02: 30 May 2012, sweeping, CRParker			
Event 03: 26 Jul 2012, observed, CRParker			
NC:Henderson Co., CARL Duck Pond, Trap 5	3904071N	35.2711°N	
	368091E	82.45029°W	665 m
Event 01: 24-31 Aug 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 31 Aug - 9 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 9-27 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 27 Sep - 25 Oct 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 25 Oct - 14 Nov 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 14 Nov 2011 - 15 Feb 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 07: 15 Feb - 22 Mar 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 08: 22 Mar - 1 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 09: 1-16 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 10: 16-24 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 11: 24-31 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 12: 31 May - 7 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 13: 7-19 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 14: 19-28 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 15: 12-19 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Front Lake inlet stream	3904065N	35.27111°N	
	368612E	82.44457°W	661 m
Event 01: 2 Mar 2011, by hand, CRParker			
Event 02: 2 Apr 2011, dip net, CRParker			
Event 03: 27 Apr 2011, by hand, CRParker			
Event 04: 26-27 Jul 2011, black light trap, CRParker			
Event 05: 6-7 Oct 2011, black light trap, CRParker			

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Location	UTMs	Lat/Lon	Elevation
NC:Henderson Co., CARL Front Lake inlet stream, Trap 7	3904065N 368612E	35.27111°N 82.44457°W	661 m
Event 01: 6-7 Jun 2011, Malaise trap, CRParker			
Event 02: 24 Aug - 30 Aug 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 30 Aug - 9 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Front Lake ca. 20 m east of inlets	3904091N 368613E	35.27135°N 82.44456°W	661 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
NC:Henderson Co., CARL Front Lake EAST, Trap 8	3904107N 368606E	35.27149°N 82.44464°W	661 m
Event 01: 15 Feb - 22 Mar 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 22 Mar - 1 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Front Lake parking lot spring	3904320N 368536E	35.2734°N 82.44545°W	661 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
Event 02: 26 Jul 2011, black light (sheet), CRParker			
Event 03: 30 Aug 2011, black light (sheet), CRParker			
NC:Henderson Co., CARL Front Lake spring near parking lot	3904308N 368556E	35.27329°N 82.44522°W	661 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
NC:Henderson Co., CARL Front Lake WEST, Trap 6	3904083N 368569E	35.27234°N 82.44567°W	661 m
Event 01: 24-30 Aug 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 30 Aug - 9 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 9-27 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 25 Oct - 14 Nov 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 15 Feb - 22 Mar 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 22 Mar - 1 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 07: 16-24 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 08: 31 May - 7 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 09: 7-19 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 10: 5-12 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 11: 12-19 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Front Lake, along shore	3904203N 368514E	35.27234°N 82.44567°W	661 m
Event 01: 27 Apr 2012, dip net, CRParker			
Event 02: 7 Jun 2011, dip net, CRParker			
Event 03: 26-27 Jul 2011, black light trap, CRParker			
Event 04: 30 Aug 2011, sweeping, CRParker			
Event 05: 27 Apr 2012, dip net, CRParker			
Event 06: 3 May 2012, by hand, CRParker			
Event 07: 22 Aug 2012, black light trap, CR & KAParker			
NC:Henderson Co., CARL Memminger Creek below Front Lake	3904345N 368512E	35.27362°N 82.44571°W	656 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
Event 02: 2 Apr 2011, dip net, CRParker			
Event 03: 19-20 Jun 2012, black light trap, CRParker			
NC:Henderson Co., CARL Mountain Reservoir, Trap 4	3903463N 367988E	35.2656°N 82.45133°W	745 m
Event 01: 30 Aug - 9 Sep 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 25 Oct - 14 Nov 2011, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 15 Feb - 22 Mar 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 22 Mar - 1 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 1-16 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 24 May - 7 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Mountain Reservoir, Trap 4a	3903463N 367988E	35.2656°N 82.45133°W	745 m
Event 01: 7-19 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 19-28 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 28 Jun-5 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 5-12 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 12-19 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 19 Jul-20 Aug 2012, Malaise trap, I. van Hoff & E. Alcantar			

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Location	UTMs	Lat/Lon	Elevation
Event 07: 20 Aug-9 Sep 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 08: 9-20 Sep 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 09: 1-4 Oct 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Pasture Cr inlet to Side Lake, Trap 3	3904323N 368126E	35.27337°N 82.44995°W	665 m
Event 01: 30 Jul - 4 Aug 2011, Malaise trap, I. van Hoff			
NC:Henderson Co., CARL Pasture Creek below Duck Pond	3904094N 368059E	35.2713°N 82.45065°W	681 m
Event 01: 10 Nov 2010, by hand, CRParker			
NC:Henderson Co., CARL Pasture Creek below Side Lake	3904370N 368380E	35.27383°N 82.44716°W	662 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
Event 02: 19-20 Jun 2012, black light trap, CRParker			
NC:Henderson Co., CARL Pasture Creek West, Trap 2	3904164N 367978E	35.27192°N 82.45155°W	672 m
Event 01: 30 Jul - 4 Aug 2011, Malaise trap, I. van Hoff			
NC:Henderson Co., CARL Side Lake	3904339N 368180E	35.27352°N 82.44936°W	664 m
Event 01: 2 Mar 2011, by hand, CRParker & I. van Hoff			
Event 02: 22 Mar 2011, dip net, CRParker			
Event 03: 30 Mar 2011, dip net, CRParker			
Event 04: 2 Apr 2011, dip net, CRParker			
Event 05: 27 Jul 2011, sweeping, CRParker			
Event 06: 16 Aug 2011, sweeping, CRParker			
Event 07: 30-31 Aug 2011, black light trap, CRParker			
Event 08: 31 Aug 2011, dip net, CRParker			
Event 09: 7 Oct 2011, by hand, CRParker			
Event10: 19 Jun 2012, sweeping, CRParker			
Event 11: 19 Jun 2012, black light (sheet), CRParker			
Event 12: 26 Jul 2012, sweeping, CRParker			
Event 13: 26 Jul 2012, observed, CRParker			
NC:Henderson Co., CARL Side Lake at dam	3904361N 368291E	35.27374°N 82.44814°W	664 m
Event 01: 26-27 Jul 2011, black light trap, CRParker			
Event 02: 22-23 Aug 2012, black light trap, CR & KAParker			
NC:Henderson Co., CARL Side Lake North	3904385N 368229E	35.27395°N 82.44883°W	665 m
Event 01: 19-28 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Side Lake North, Trap 9n	3904385N 368229E	35.27395°N 82.44883°W	665 m
Event 01: 14 Nov 2011 - 15 Feb 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 15 Feb - 22 Mar 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 22 Mar - 1 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 11-16 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 16-24 May 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 31 May - 7 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 07: 7-19 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 08: 19-28 Jun 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 09: 28 Jun - 5 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 10: 5-12 Jul 2012, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL Side Lake North, inlet end, Trap 9i	3904337N 368185E	35.27351°N 82.4493°W	665 m
Event 01: 27 Sep-25 Oct 2011, Malaise trap, I. van Hoff & E. Alcantar			
NC:Henderson Co., CARL trib to Pasture Creek below entrance road	3904123N 367955E	35.27155°N 82.4518°W	683 m
Event 01: 26-27 Jul 2012, black light trap, CRParker			
NC:Henderson Co., CARL trib to Side Lake above duck cage	3904284N 368244E	35.27304°N 82.44865°W	672 m
Event 01: 26-27 Jul 2012, black light trap, CRParker			
NC:Henderson Co., CARL Trout Pond	3903843N 368164E	35.26905°N 82.44946°W	689 m
Event 01: 6-7 Jun 2011, black light trap, CRParker			
Event 02: 26-27 Jul 2011, black light trap, CRParker			

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Location	UTMs	Lat/Lon	Elevation
Event 03: 6-7 Oct 2011, black light trap, CRParker			
Event 04: 22-23 Aug 2012, black light trap, CR & KAParker			
Event 05: 27 Apr 2011, by hand, CRParker			
Event 06: 30 May 2011, by hand, CRParker			
Event 07: 26 Jul 2012, observed, CRParker			
NC:Henderson Co., CARL Trout Pond drain	3903945N 368146E	35.26996°N 82.44968°W	689 m
Event 01: 19-20 Jun 2012, black light trap, CRParker			
NC:Henderson Co., CARL Trout Pond effluent	3903967N 368129E	35.27016°N 82.44986°W	684 m
Event 01: 27 Apr 2011, dip net, CRParker			
Event 02: 26-30 Jul 2011, Malaise trap, CRParker & I. van Hoff (Trap 1)			
NC:Henderson Co., CARL Trout Pond spring	3903709N 368197E	35.26785°N 82.44907°W	705 m
Event 01: 26-27 Jul 2012, black light trap, CRParker			
Event 02: 30 May 2012, by hand, CRParker & I. van Hoff			
Event 03: 19 Jun 2012, by hand, CRParker			
NC:Henderson Co., CARL Trout Pond spring, Trap 10	3903709N 368197E	35.26785°N 82.44907°W	705 m
Event 01: 20 8-20 9 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 02: 20-27 Sep 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 03: 27 Sep-4 Oct 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 04: 1-13 Nov 2012, Malaise trap, I. van Hoff & E. Alcantar			
Event 05: 4 Oct 2012 - 7 May 2013, Malaise trap, I. van Hoff & E. Alcantar			
Event 06: 7-31 May 2013, Malaise trap, I. van Hoff & E. Alcantar			
Event 07: date unknown, Malaise trap, I. van Hoff & E. Alcantar			

Appendix 2. Target Species Data

Data for Ephemeroptera, Odonata, Plecoptera, Megaloptera, and Trichoptera are presented below. Each record consists of the order, family, taxon name, and the number and type of specimens, arranged by collecting location and event. Locations and events are arranged alphabetically by SiteCode and chronologically by date. Some specimens could not be identified to species and are presented as, for example, *Ischnura* species or *Hydropsyche betteni/depravata* group. Adult specimens are identified in the table by the ♂ (male) and ♀ (female) symbols, and larvae by the words “larva” or “larvae.” The entry “mmt” means that the specimen is a metamorphotype. Metamorphotype refers to a pupa of a caddisfly that has developed to the point of being identifiable to species on the basis of the developing adult characters, meaning the genitalia, and which still has present in the pupal cocoon the shed larval sclerites. Because of the absolute association that this represents between the adult and larval stages of the species, metamorphotypes are of considerable significance to caddisfly students.

Carl Sandburg Home National Historic Site

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
NC:Henderson Co., CARL cement pond in front of house, 26 May 2011, by hand			
Odonata	Libellulidae	<i>Libellula pulchella</i> Drury, 1773	1 larva
NC:Henderson Co., CARL cement pond in front of house, 7 Jun 2011, by hand			
Odonata	Libellulidae	<i>Erythemis simplicicollis</i> (Say, 1839)	2 larvae
NC:Henderson Co., CARL Duck Pond, 1-16 May 2012, Malaise trap 5			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	1 ♂
		<i>Chromagrion conditum</i> (Selys, 1876)	2 ♀, 5 ♂
		<i>Enallagma signatum</i> (Hagen, 1861)	1 ♀, 1 ♂
		<i>Ischnura hastata</i> (Say, 1839)	2 ♂
		<i>Ischnura posita</i> Hagen, 1861	12 ♀, 10 ♂
		<i>Ischnura</i> species	7 ♀
	Corduliidae	<i>Epithea cynosura</i> (Say, 1839)	1 ♀
	Libellulidae	<i>Erythemis simplicicollis</i> (Say, 1839)	1 ♀
NC:Henderson Co., CARL Duck Pond, 12-19 Jul 2012, Malaise trap 5			
Ephemeroptera	Heptageniidae	Heptageniidae species	1 ♀
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	1 ♀
Trichoptera	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♀
		<i>Oxyethira</i> n. sp. 3	1 ♂
		<i>Oxyethira</i> species	1 ♀
	Leptoceridae	<i>Triaenodes</i> species	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 1 ♂
	Phryganeidae	<i>Ptilostomis ocellifera</i> (Walker, 1852)	1 ♀
NC:Henderson Co., CARL Duck Pond, 14 Nov-15 Feb 2012, Malaise trap 5			
Plecoptera	Capniidae	<i>Allocaonia</i> species	2 ♀
	Perlodidae	<i>Isoperla</i> species	1 ♂
	Taeniopterygidae	<i>Oemopteryx contorta</i> (Needham & Claassen, 1925)	2 ♀
NC:Henderson Co., CARL Duck Pond, 15 Feb-22 Mar 2012, Malaise trap 5			
Plecoptera	Nemouridae	<i>Amphinemura nigritta</i> (Provancher, 1876)	16 ♀, 10 ♂
	Perlodidae	<i>Isoperla</i> species	1 ♂
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	3 ♀, 1 ♂
	Hydroptilidae	<i>Oxyethira forcipata</i> Mosely, 1934	3 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	9 ♀, 6 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♂
NC:Henderson Co., CARL Duck Pond, 16-24 May 2012, Malaise trap 5			
Odonata	Coenagrionidae	<i>Chromagrion conditum</i> (Selys, 1876)	6 ♀, 3 ♂
		<i>Enallagma divagans</i> Selys, 1876	1 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera				
Order	Family	Species	Specimens	
Plecoptera	Chloroperlidae	<i>Enallagma</i> species	2 ♀	
		<i>Ischnura posita</i> Hagen, 1861	7 ♀, 2 ♂	
	Leuctridae	<i>Alloperla nanina</i> Banks	1 ♂	
	Nemouridae	<i>Leuctra</i> species	2 ♀	
Trichoptera	Beraeidae	<i>Amphinemura nigrutta</i> (Provancher, 1876)	16 ♀, 10 ♂	
		<i>Amphinemura</i> species	9 ♀	
	Dipseudopsidae	<i>Beraea gorteba</i> HH Ross, 1944	1 ♂	
		<i>Phylocentropus lucidus</i> (Hagen, 1861)	1 ♂	
	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀	
		<i>Diplectrona modesta</i> N Banks, 1908	3 ♀, 1 ♂	
	Leptoceridae	<i>Triaenodes tardus</i> LJ Milne, 1934	1 ♀	
		Limnephilidae	Limnephilidae species	1 ♀
	Philopotamidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 ♂	
		<i>Chimarra aterrima</i> Hagen, 1861	2 ♀, 2 ♂	
	Polycentropodidae	<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♀, 2 ♂	
		<i>Polycentropus maculatus</i> Banks, 1908	1 ♀	
		<i>Polycentropus</i> species	2 ♀	
Sericostomatidae		<i>Agarodes tetron</i> (Ross, 1948)	1 ♀	
NC:Henderson Co., CARL Duck Pond, 19-28 Jun 2012, Malaise trap 5				
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	4 ♀	
NC:Henderson Co., CARL Duck Pond, 22 Mar-1 May 2012, Malaise trap 5				
Ephemeroptera	Leptophlebiidae	<i>Habrophlebiodes</i> species	1 ♀	
Odonata	Coenagrionidae	<i>Chromagrion conditum</i> (Selys, 1876)	1 ♂	
		<i>Ischnura hastata</i> (Say, 1839)	2 ♀	
Plecoptera	Lestidae	<i>Ischnura posita</i> HA Hagen, 1861	6 ♀, 2 ♂	
		<i>Lestes australis</i> Walker, 1952	1 ♂	
	Chloroperlidae	<i>Alloperla nanina</i> Banks	1 ♂	
	Leuctridae	<i>Leuctra carolinensis</i> Claassen, 1923	1 ♀, 2 ♂	
Trichoptera	Nemouridae	<i>Amphinemura nigrutta</i> (Provancher, 1876)	19 ♀, 22 ♂	
	Perlodidae	<i>Isoperla</i> species	1 ♂	
	Dipseudopsidae	<i>Phylocentropus lucidus</i> (Hagen, 1861)	1 ♀	
		<i>Diplectrona modesta</i> N Banks, 1908	1 ♀, 3 ♂	
	Hydropsychidae	<i>Parapsyche cardis</i> Ross, 1938	1 ♀	
		<i>Oxyethira dualis</i> Morton, 1905	1 ♀	
	Lepidostomatidae	<i>Lepidostoma</i> species	1 ♀	
		<i>Triaenodes marginatus</i> Sibley, 1926	1 ♀	
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 2 ♂	
		<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♀	
Rhyacophilidae	<i>Rhyacophila mycta</i> Ross, 1941	1 ♂		
	Sericostomatidae	<i>Agarodes tetron</i> (Ross, 1948)	5 ♀, 4 ♂	
NC:Henderson Co., CARL Duck Pond, 24-31 Aug 2011, Malaise trap 5				
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀	
		<i>Diplectrona modesta</i> N Banks, 1908	8 ♀	
		<i>Hydropsyche betteni</i> Ross, 1938	2 ♀	
		<i>Hydroptila coweetensis</i> Huryn, 1985	1 ♂	
		<i>Hydroptila</i> n.sp. cf <i>oneili</i>	1 ♂	
		<i>Hydroptila</i> species	3 ♀	
		<i>Oxyethira dualis</i> Morton, 1905	1 ♂	
		<i>Oxyethira</i> species	1 ♀	
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (Banks, 1905)	2 ♀	
		<i>Lepidostoma</i> species	1 ♀	
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♀	
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	4 ♀, 6 ♂	
		Polycentropodidae	<i>Polycentropus</i> species	1 ♀
		<i>Wormaldia moesta</i> (N Banks, 1914)	1 ♂	
		Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀
	NC:Henderson Co., CARL Duck Pond, 24-31 May 2012, Malaise trap 5			
	Plecoptera	Nemouridae	<i>Amphinemura</i> species	1 ♀
	Trichoptera	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀
	NC:Henderson Co., CARL Duck Pond, 25 Oct-14 Nov 2011, Malaise trap 5			
Trichoptera	Thremmatidae	<i>Neophylax mitchelli</i> Carpenter, 1933	1 ♀	
NC:Henderson Co., CARL Duck Pond, 27 Sep-25 Oct 2011, Malaise trap 5				
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	3 ♀, 1 pair in tandem	
Plecoptera	Leuctridae	<i>Leuctra</i> species	1 ♀	
Trichoptera	Hydropsychidae	<i>Hydropsyche betteni</i> Ross, 1938	1 ♀	

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 3 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀, 1 ♂
NC:Henderson Co., CARL Duck Pond, 31 Aug-9 Sep 2011, Malaise trap 5			
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	3 ♀, 1 ♂
NC:Henderson Co., CARL Duck Pond, 31 May-7 Jun 2012, Malaise trap 5			
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	1 ♀
Plecoptera	Chloroperlidae	<i>Haploperla brevis</i> (Banks, 1895)	1 ♀
	Leuctridae	<i>Leuctra carolinensis</i> Claassen, 1923	1 ♂
	Nemouridae	<i>Amphinemura nigritta</i> (Provancher, 1876)	8 ♀, 2 ♂
	Perlodidae	<i>Isoperla</i> species	1 ♀, 1 ♂
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♀
		<i>Hydropsyche betteni</i> HH Ross, 1938	1 ♂
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♀
		<i>Oxyethira dualis</i> Morton, 1905	1 ♀
		<i>Oxyethira</i> species	1 ♀
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 1 ♂
		<i>Dolophilodes distincta</i> (Walker, 1852)	2 ♀
	Polycentropodidae	<i>Polycentropus maculatus</i> Banks, 1908	1 ♀
NC:Henderson Co., CARL Duck Pond, 7-19 Jun 2012, Malaise trap 5			
Plecoptera	Nemouridae	<i>Amphinemura nigritta</i> (Provancher, 1876)	1 ♀, 1 ♂
Trichoptera	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	2 ♀, 2 ♂
		<i>Oxyethira</i> species	1 ♀
	Philopotamidae	<i>Wormaldia moesta</i> (Banks, 1914)	1 ♀
NC:Henderson Co., CARL Duck Pond, 9-27 Sep 2011, Malaise trap 5			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♂
		<i>Cheumatopsyche</i> species	2 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	2 ♂
		<i>Hydropsyche betteni</i> HH Ross, 1938	1 ♀
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (Banks, 1905)	3 ♀, 1 ♂
		<i>Lepidostoma</i> species	1 ♀
	Limnephilidae	<i>Ironoquia punctatissima</i> (Walker, 1852)	6 ♀, 1 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	3 ♀, 5 ♂
		<i>Wormaldia moesta</i> (Banks, 1914)	1 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	2 ♀
NC:Henderson Co., CARL Duck Pond, 6-7 Jun 2011, black light trap 5			
Ephemeroptera	Caenidae	<i>Caenis amica</i> HA Hagen, 1861	1 ♀
	Heptageniidae	<i>Stenacron</i> species	1 ♀
Megaloptera	Corydalidae	<i>Nigronia fasciatus</i> (Walker, 1853)	1 ♂
Plecoptera	Leuctridae	<i>Leuctra</i> species	1 ♀
	Nemouridae	<i>Amphinemura</i> species	3 ♀
	Perlodidae	<i>Isoperla</i> species	2 ♂
Trichoptera	Brachycentridae	<i>Micrasema</i> species	1 ♀
		<i>Micrasema wataga</i> HH Ross, 1938	30 ♀, 2 ♂
	Glossosomatidae	<i>Glossosoma nigrrior</i> N Banks, 1911	1 ♀
		<i>Protophila</i> species	2 ♀
	Goeridae	<i>Goera calcarata</i> N Banks, 1899	1 ♀
	Hydropsychidae	<i>Cheumatopsyche campyla</i> HH Ross, 1938	1 ♂
		<i>Cheumatopsyche pinaca</i> HH Ross, 1941	2 ♂
		<i>Cheumatopsyche</i> species	12 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	2 ♀, 3 ♂
		<i>Hydropsyche betteni</i> HH Ross, 1938	20 ♀, 14 ♂
		<i>Hydropsyche morosa</i> HA Hagen, 1861	1 ♀
		<i>Hydropsyche sparna</i> HH Ross, 1938	20 ♀, 3 ♂
		<i>Hydropsyche</i> species	4 ♀
	Hydroptilidae	<i>Hydroptila gunda</i> Milne, 1936	2 ♂
		<i>Hydroptila</i> species	5 ♀
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 1 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	1 ♂
		<i>Oxyethira michiganensis</i> Mosely, 1934	1 ♂
		<i>Oxyethira</i> species	39 ♀
	Lepidostomatidae	<i>Lepidostoma</i> species	1 ♀
	Leptoceridae	<i>Ceraclea</i> species	1 ♀
		<i>Oecetis inconspicua</i> (Walker, 1852)	6 ♀, 23 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
		<i>Oecetis persimilis</i> (N Banks, 1907)	1 ♂
		<i>Trienodes flavescens</i> N Banks, 1900	3 ♀, 1 ♂
		<i>Trienodes ignitus</i> (Walker, 1852)	1 ♀, 1 ♂
		<i>Trienodes marginatus</i> Sibley, 1926	1 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	2 ♂
	Philopotamidae	<i>Chimarra aterrima</i> HA Hagen, 1862	1 ♂
		<i>Wormaldia moesta</i> (N Banks, 1914)	1 ♂
	Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	1 ♂
	Polycentropodidae	<i>Nyctiophylax affinis</i> (N Banks, 1897)	1 ♂
	Psychomyiidae	<i>Lype diversa</i> (N Banks, 1914)	2 ♀
	Sericostomatidae	<i>Agarodes tetron</i> (HH Ross, 1948)	6 ♀, 5 ♂
NC:Henderson Co., CARL Duck Pond, along shore, 26 Jul 2012, observed			
Odonata	Aeshnidae	<i>Anax junius</i> (Drury, 1773)	2 ♂
	Libellulidae	<i>Erythemis simplicicollis</i> (T Say, 1839)	1 pair in tandem
		<i>Libellula incesta</i> Hagen, 1861	1 ♀, 1 ♂
		<i>Libellula luctuosa</i> Burmeister, 1839	2 ♂
NC:Henderson Co., CARL Duck Pond, along shore, 30 Aug 2011, dip net			
Trichoptera	Leptoceridae	<i>Oecetis</i> species	1 larva
NC:Henderson Co., CARL Front Lake at Inlet, 24-30 Aug 2011, Malaise trap 7			
Ephemeroptera	Baetidae	Baetidae species	1 ♀
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	14 ♂
		<i>Cheumatopsyche</i> species	20 ♀
		<i>Hydropsyche betteni</i> HH Ross, 1938	2 ♀
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	10 ♂
		<i>Oxyethira dualis</i> Morton, 1905	3 ♀, 4 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	1 ♂
	Leptoceridae	<i>Mystacides sepulchralis</i> (Walker, 1852)	1 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀
NC:Henderson Co., CARL Front Lake at Inlet, 6-7 Jun 2011, Malaise trap 7			
Trichoptera	Hydroptilidae	<i>Oxyethira forcipata</i> Mosely, 1934	4 ♂
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	2 ♀
NC:Henderson Co., CARL Front Lake at Inlet, 6-7 Oct 2011, black light trap			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	16 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	5 ♀
		<i>Hydropsyche</i> species	1 ♀
NC:Henderson Co., CARL Front Lake ca. 20 m east of inlets, 2 Mar 2011, by hand			
Odonata	Coenagrionidae	<i>Enallagma divagans</i> Selys, 1876	1 larva
		<i>Ischnura</i> species	2 larvae
	Corduliidae	<i>Epitheca cynosura</i> (Say, 1839)	1 larva
	Libellulidae	<i>Libellula cyanea</i> Fabricius, 1775	1 larva
Trichoptera	Leptoceridae	<i>Oecetis</i> species	1 larva
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	2 larvae
NC:Henderson Co., CARL Front Lake EAST, 15 Feb-22 Mar 2012, Malaise trap 8			
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	1 ♂
Plecoptera	Capniidae	<i>Allocaonia</i> species	1 ♀
	Taeniopterygidae	<i>Taeniopteryx burksi</i> Ricker & Ross, 1968	3 ♀
Trichoptera	Dipseudopsidae	<i>Phylocentropus placidus</i> (N Banks, 1905)	1 ♀
NC:Henderson Co., CARL Front Lake EAST, 22 Mar-1 May 2012, Malaise trap 8			
Trichoptera	Polycentropodidae	<i>Nyctiophylax affinis</i> (N Banks, 1897)	1 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera				
Order	Family	Species	Specimens	
NC:Henderson Co., CARL Front Lake inlet stream, 2 Mar 2011, by hand				
Odonata	Aeshnidae	<i>Boyeria vinosa</i> (Say, 1839)	1 larva	
	Coenagrionidae	<i>Enallagma</i> species	2 larvae	
	Corduliidae	<i>Epitheca cynosura</i> (Say, 1839)	1 larva	
	Gomphidae	<i>Gomphus</i> species	1 larva	
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	8 larvae, 1 prepupa	
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva	
NC:Henderson Co., CARL Front Lake inlet stream, 26-27 Jul 2011, black light trap				
Ephemeroptera	Ephemerellidae	Ephemerellidae species	4 ♀	
	Isonychiidae	<i>Isonychia</i> species	1 ♀	
Megaloptera	Corydalidae	<i>Chauliodes pectinicornis</i> Linnaeus, 1783	2 ♀	
	Sialidae	<i>Sialis</i> species	1 ♀	
Trichoptera	Brachycentridae	<i>Micrasema</i> species	10 ♀	
	Dipseudopsidae	<i>Phylocentropus placidus</i> (Banks, 1905)	1 ♂	
	Hydropsychidae	<i>Hydropsyche betteni</i> Ross, 1938	93 ♀, 4 ♂	
		<i>Hydropsyche sparna</i> Ross, 1938	31 ♀, 2 ♂	
		<i>Hydropsyche</i> species	1 ♀	
	Lepidostomatidae	<i>Lepidostoma</i> species	1 ♀	
	Leptoceridae	<i>Ceraclea</i> species	1 ♀	
		<i>Mystacides sepulchralis</i> (Walker, 1852)	1 ♀, 1 ♂	
		<i>Nectopsyche candida</i> (Hagen, 1861)	27 ♀	
		<i>Nectopsyche exquisita</i> (Walker, 1852)	1 ♀	
		<i>Oecetis inconspicua</i> (Walker, 1852)	25 ♀, 27 ♂	
		<i>Oecetis persimilis</i> (N Banks, 1907)	2 ♀	
		<i>Triaenodes marginatus</i> Sibley, 1926	3 ♀, 2 ♂	
		Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	3 ♂
	Polycentropodidae	<i>Nyctiophylax</i> species	9 ♀	
	NC:Henderson Co., CARL Front Lake near parking lot, 30 Aug 2011, black light (sheet)			
	Ephemeroptera	Baetidae	Baetidae species	~30 ♀
	Trichoptera	Brachycentridae	<i>Micrasema</i> species	4 ♀
		Glossosomatidae	<i>Protoptila</i> species	1 ♀
Hydropsychidae		<i>Cheumatopsyche</i> species	32 ♀	
		<i>Hydropsyche betteni</i> Ross, 1938	4 ♀, 3 ♂	
		<i>Hydropsyche</i> species	1 ♀	
Hydroptilidae		<i>Hydroptila gunda</i> Milne, 1936	4 ♂	
		<i>Hydroptila hamata</i> Morton, 1905	3 ♂	
		<i>Hydroptila</i> species	24 ♀	
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 6 ♂	
		<i>Oxyethira forcipata</i> Mosely, 1934	1 ♂	
		<i>Oxyethira janella</i> Denning, 1948	1 ♂	
		<i>Oxyethira pallida</i> (Banks, 1904)	3 ♂	
		<i>Oxyethira</i> species	64 ♀	
		Lepidostomatidae	<i>Lepidostoma tibiale</i> (Carpenter, 1933)	1 ♀
		Leptoceridae	<i>Nectopsyche exquisita</i> (Walker, 1852)	18 ♀
<i>Oecetis cinerascens</i> (Hagen, 1861)			2 ♀, 4 ♂	
<i>Oecetis inconspicua</i> (Walker, 1852)			3 ♀, 7 ♂	
<i>Oecetis persimilis</i> (Banks, 1907)			3 ♀, 3 ♂	
<i>Triaenodes tardus</i> LJ Milne, 1934			1 ♀	
Phryganeidae		<i>Phryganea sayi</i> Milne, 1931	1 ♀, 6 ♂	
Polycentropodidae		<i>Cernotina</i> species	3 ♀	
		<i>Nyctiophylax</i> species	2 ♀	
NC:Henderson Co., CARL Front Lake parking lot spring, 2 Mar 2011, by hand				
Ephemeroptera	Leptophlebiidae	<i>Leptophlebia johnsoni</i> J McDunnough, 1924	1 larva	
Trichoptera	Phryganeidae	<i>Ptilostomis</i> species	1 larva	
NC:Henderson Co., CARL Front Lake WEST, 12-19 Jul 2012, Malaise trap 6				
Trichoptera	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♂	
		<i>Oxyethira dualis</i> Morton, 1905	1 ♀, 6 ♂	
NC:Henderson Co., CARL Front Lake WEST, 16-24 May 2012, Malaise trap 6				
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♂	
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂	
		<i>Oxyethira</i> species	2 ♀	
		Polycentropodidae	<i>Nyctiophylax</i> species	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 22 Mar-1 May 2012, Malaise trap 6				
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀	
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀	

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
	Leptoceridae	<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 24-30 Aug 2011, Malaise trap 6			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	2 ♂
		<i>Oxyethira dualis</i> Morton, 1905	1 ♂
		<i>Oxyethira</i> species	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 31 May-7 Jun 2012, Malaise trap 6			
Trichoptera	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♂
		<i>Oxyethira</i> nsp3	1 ♂
	Leptoceridae	<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 5-12 Jul 2012, Malaise trap 6			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♂
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	3 ♂
		<i>Oxyethira dualis</i> Morton, 1905	2 ♀
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	1 ♀
		<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 9-27 Sep 2011, Malaise trap 6			
Trichoptera	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♂
	Limnephilidae	<i>Pseudostenophylax sparsus</i> (Banks, 1908)	1 ♀
NC:Henderson Co., CARL Front Lake, along shore, 22 Aug 2012, black light trap			
Ephemeroptera	Baetidae	Baetidae species	3 ♀
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	22 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	3 ♀
	Hydroptilidae	<i>Hydroptila gunda</i> Milne, 1936	1 ♂
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	3 ♂
		<i>Hydroptila</i> species	19 ♀
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 11 ♂
		<i>Oxyethira</i> n. sp. 3	2 ♀
		<i>Oxyethira forcipata</i> Mosely, 1934	1 ♂
		<i>Oxyethira</i> species	8 ♀
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	3 ♀, 7 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♀
		<i>Triaenodes</i> species	5 ♀
	Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	1 ♂
	Polycentropodidae	<i>Cernotina spicata</i> Ross, 1938	3 ♂
		<i>Nyctiophylax</i> species	3 ♀
NC:Henderson Co., CARL Front Lake, along shore, 26-27 Jul 2011, black light trap			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche pinaca</i> Ross, 1941	9 ♂
	Hydroptilidae	<i>Hydroptila</i> species	2 ♀
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	43 ♀, 11 ♂
		<i>Oxyethira</i> n. sp. 3	4 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	5 ♂
		<i>Oxyethira</i> species	121 ♀
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	10 ♀, 10 ♂
		<i>Triaenodes perna</i> HH Ross, 1938	3 ♀
	Philopotamidae	<i>Chimarra</i> species	1 ♀
NC:Henderson Co., CARL Front Lake, along shore, 27 Apr 2011, dip net			
Ephemeroptera	Caenidae	<i>Caenis diminuta</i> diminuta Walker, 1853	1 larva
Odonata	Coenagrionidae	<i>Enallagma</i> species	1 larva
		<i>Ischnura posita</i> Hagen, 1861	1 ♀ exuviae in envelope, 1 ♂
	Gomphidae	<i>Gomphus</i> species	2 adult exuviae
	Lestidae	<i>Lestes vigilax</i> Hagen in Selys, 1862	2 larvae
Trichoptera	Leptoceridae	<i>Oecetis inconspicua</i> (Walker, 1852)	2 larvae
		<i>Oecetis</i> species	2 larvae
NC:Henderson Co., CARL Front Lake, along shore, 30 Aug 2011, sweeping			
Odonata	Libellulidae	<i>Libellula incesta</i> Hagen, 1861	1 ♂
		<i>Pachydiplax longipennis</i> (Burmeister, 1839)	1 ♂
NC:Henderson Co., CARL Front Lake, along shore, 7 Jun 2011, dip net			
Odonata	Coenagrionidae	<i>Enallagma signatum</i> (Hagen, 1861)	1 ♂
		<i>Enallagma traviatum</i> Selys, 1876	1 ♀, 1 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
NC:Henderson Co., CARL Memminger Creek below Front Lake, 19-20 Jun 2012, black light trap			
Ephemeroptera	Heptageniidae	<i>Maccaffertium modestum</i> (N Banks, 1910)	12 ♀, 4 ♂
Plecoptera	Perlidae	<i>Acroneuria abnormis</i> (Newman, 1838)	1 ♀
		<i>Eccoptura xanthenes</i> (Newman, 1828)	1 ♀
		<i>Perlesta</i> species	3 ♀, 2 ♂
Trichoptera	Glossosomatidae	<i>Glossosoma nigrior</i> N Banks, 1911	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (N Banks, 1903)	1 ♀, 248 ♂
		<i>Cheumatopsyche pinaca</i> Ross, 1941	1 ♂
		<i>Hydropsyche betteni</i> HH Ross, 1938	113 ♀, 36 ♂
		<i>Hydropsyche sparna</i> HH Ross, 1938	1 ♂
		<i>Hydropsyche</i> species	2 ♀
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂
		<i>Hydroptila</i> species	6 ♀
		<i>Hydroptila waubesiana</i> Betten, 1934	1 ♂
		<i>Oxyethira dualis</i> Morton, 1905	2 ♀
		<i>Oxyethira</i> species	3 ♂
		<i>Oxyethira</i> species	26 ♀
	Leptoceridae	<i>Ceraclea neffi</i> (Resh, 1974)	1 ♂
		<i>Ceraclea</i> species	1 ♀
		<i>Oecetis cinerascens</i> (HA Hagen, 1861)	4 ♀, 2 ♂
		<i>Oecetis inconspicua</i> (F Walker, 1852)	7 ♀, 5 ♂
		<i>Oecetis persimilis</i> (N Banks, 1907)	8 ♀, 5 ♂
		<i>Triaenodes ignitus</i> (F Walker, 1852)	4 ♀, 5 ♂
	Limnephilidae	<i>Platycentropus radiatus</i> (T Say, 1824)	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> HA Hagen, 1861	19 ♀, 8 ♂
		<i>Chimarra obscura</i> (F Walker, 1852)	2 ♀, 1 ♂
		<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♀, 3 ♂
	Polycentropodidae	<i>Cernotina spicata</i> Ross, 1938	1 ♂
		<i>Nyctiophylax affinis</i> (Banks, 1897)	1 ♀, 2 ♂
NC:Henderson Co., CARL Memminger Creek below Front Lake, 2 Apr 2011, dip net			
Megaloptera	Corydalidae	<i>Corydalus cornutus</i> (Linnaeus, 1763)	1 larva
NC:Henderson Co., CARL Memminger Creek below Front Lake, 2 Mar 2011, by hand			
Odonata	Aeshnidae	<i>Boyeria vinosa</i> (Say, 1839)	1 larva
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	4 larvae
		<i>Hydropsyche betteni</i> Ross, 1938	6 larvae
NC:Henderson Co., CARL Mountain Reservoir, 1-16 May 2012, Malaise trap 4			
Plecoptera	Leuctridae	<i>Leuctra</i> species	13 ♀
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♀, 1 ♂
	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♂
	Odontoceridae	<i>Psilotreta frontalis</i> Banks, 1899	1 ♀
	Philopotamidae	<i>Wormaldia moesta</i> (Banks, 1914)	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♂
	Rhyacophilidae	<i>Rhyacophila mycta</i> Ross, 1941	1 ♀
NC:Henderson Co., CARL Mountain Reservoir, 15 Feb-22 Mar 2012, Malaise trap 4			
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	1 ♀, 2 ♂
	Gomphidae	<i>Lanthus vernalis</i> Carle, 1980	1 ♀
	Lestidae	<i>Lestes australis</i> Walker, 1952	1 ♂
Plecoptera	Capniidae	<i>Allocapnia aurora</i> Ricker, 1952	3 ♀, 1 ♂
		<i>Allocapnia recta</i> (Claassen, 1924)	2 ♂
		<i>Allocapnia</i> species	11 ♀
	Leuctridae	<i>Leuctra biloba</i> Claassen, 1923	5 ♀, 3 ♂
		<i>Leuctra</i> species	1 ♀
	Nemouridae	<i>Amphinemura</i> species	1 ♀
Trichoptera	Taeniopterygidae	<i>Oemopteryx contorta</i> (Needham & Claassen, 1925)	1 ♂
	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♀, 1 ♂
		<i>Homoplectra doringa</i> Milne, 1936	2 ♀, 2 ♂
	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♂
		<i>Oxyethira</i> species	1 ♀
	Lepidostomatidae	<i>Lepidostoma</i> species	1 ♀
	Ptilocolepidae	<i>Palaeagapetus celsus</i> (HH Ross, 1938)	1 ♂
	Rhyacophilidae	<i>Rhyacophila mycta</i> HH Ross, 1941	1 ♀
		<i>Rhyacophila torva</i> HA Hagen, 1861	1 ♀
NC:Henderson Co., CARL Mountain Reservoir, 19-28 Jun 2012, Malaise trap 4			
Plecoptera	Chloroperlidae	Chloroperlidae species	1 ♀
	Nemouridae	<i>Amphinemura</i> species	4 ♀

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
Trichoptera	Perlidae	<i>Beloneuria georgiana</i> (Banks, 1914)	1 ♀
	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	2 ♀, 2 ♂
		<i>Hydropsyche betteni</i> Ross, 1938	1 ♀
	Hydroptilidae	<i>Hydroptila coweetensis</i> Huryn, 1985	1 ♂
		<i>Hydroptila gunda</i> Milne, 1936	2 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	8 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 2 ♂
		<i>Wormaldia moesta</i> (Banks, 1914)	1 ♀
	Polycentropodidae	<i>Polycentropus carlsoni</i> Morse, 1971	3 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♂
		<i>Rhyacophila torva</i> Hagen, 1861	1 ♀, 1 ♂
NC:Henderson Co., CARL Mountain Reservoir, 22 Mar-1 May 2012, Malaise trap 4			
Plecoptera	Capniidae	<i>Allocapnia aurora</i> Ricker, 1952	1 ♂
	Leuctridae	<i>Leuctra biloba</i> Claassen, 1923	8 ♂
		<i>Leuctra</i> species	24 ♀
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♀
		<i>Homoplectra doringa</i> (Milne, 1936)	2 ♀, 1 ♂
		<i>Hydropsyche betteni</i> HH Ross, 1938	1 ♀
	Hydroptilidae	<i>Hydroptila</i> species	1 ♀
		Rhyacophilidae	<i>Rhyacophila mycta</i> HH Ross, 1941
NC:Henderson Co., CARL Mountain Reservoir, 24 May-7 Jun 2012, Malaise trap 4			
Ephemeroptera	Leptophlebiidae	<i>Leptophlebiidae</i> species	2 ♀
Plecoptera	Chloroperlidae	<i>Alloperla</i> species	1 ♀
	Leuctridae	<i>Leuctra biloba</i> Claassen, 1923	4 ♂
		<i>Leuctra</i> species	47 ♀
Trichoptera	Nemouridae	<i>Amphinemura wui</i> (Claassen, 1936)	24 ♀, 2 ♂
	Perlidae	<i>Beloneuria stewarti</i> Stark & Szczytko, 1976	1 ♀, 1 ♂
	Dipseudopsidae	<i>Phylocentropus lucidus</i> (Hagen, 1861)	1 ♀
	Glossosomatidae	<i>Agapetus jocassee</i> Morse, 1989	1 ♀
		<i>Glossosoma nigrior</i> N Banks, 1911	3 ♀
	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	29 ♀, 3 ♂
		<i>Parapsyche cardis</i> HH Ross, 1938	1 ♀, 1 ♂
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	12 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	16 ♀
	Philopotamidae	<i>Chimarra aterrima</i> HA Hagen, 1861	3 ♂
		<i>Dolophilodes distincta</i> (F Walker, 1852)	6 ♀, 7 ♂
		<i>Wormaldia moesta</i> (N Banks, 1914)	1 ♀
	Polycentropodidae	<i>Polycentropus carolinensis</i> N Banks, 1905	2 ♂
		<i>Polycentropus colei</i> HH Ross, 1941	1 ♀, 1 ♂
		<i>Polycentropus</i> species	2 ♀
Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀	
	<i>Rhyacophila mycta</i> HH Ross, 1941	29 ♀, 13 ♂	
	<i>Rhyacophila nigrita</i> N Banks, 1907	42 ♀, 5 ♂	
	<i>Rhyacophila torva</i> HA Hagen, 1861	2 ♀, 1 ♂	
	NC:Henderson Co., CARL Mountain Reservoir, 30 Aug-9 Sep 2011, Malaise trap 4		
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♀
	Lepidostomatidae	<i>Lepidostoma carrolli</i> OS Flint, 1958	1 ♂
<i>Lepidostoma griseum</i> (N Banks, 1911)		2 ♂	
<i>Lepidostoma</i> species		5 ♀	
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♀
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	54 ♀, 23 ♂
NC:Henderson Co., CARL Mountain Reservoir, 5-12 Jul 2012, Malaise trap 4			
Ephemeroptera	Heptageniidae	<i>Stenacron</i> species	1 ♀
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (HA Hagen, 1861)	5 ♀, 5 ♂, 1 pair in tandem
		<i>Chromagrion conditum</i> (Selys, 1876)	1 ♀
		<i>Ischnura posita</i> HA Hagen, 1861	1 ♂
	Gomphidae	<i>Stylogomphus albistylus</i> (Hagen in Selys, 1878)	1 ♀, 1 ♂
	Libellulidae	<i>Libellula incesta</i> HA Hagen, 1861	1 ♂
Plecoptera	Leuctridae	<i>Leuctra</i> species	2 ♀
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (N Banks, 1903)	1 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	4 ♀, 1 ♂
	Hydroptilidae	<i>Hydroptila coweetensis</i> Huryn, 1985	1 ♂
		<i>Oxyethira</i> species	1 ♀

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	5 ♀
	Philopotamidae	<i>Dolophilodes distincta</i> (Walker, 1852)	2 ♀
	Polycentropodidae	<i>Polycentropus carolinensis</i> N Banks, 1905	1 ♂
		<i>Polycentropus</i> species	1 ♀
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀, 1 ♂
		<i>Rhyacophila</i> n. sp.	1 ♂
		<i>Rhyacophila torva</i> Hagen, 1861	7 ♀, 7 ♂
NC:Henderson Co., CARL Pasture Cr inlet to Side Lake, 30 Jul-4 Aug 2011, Malaise trap 9i			
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	3 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♀
	Philopotamidae	<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♂
NC:Henderson Co., CARL Pasture Creek below Duck Pond, 10 Nov 2010, by hand			
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> Banks, 1908	1 larva
NC:Henderson Co., CARL Pasture Creek below Side Lake, 19-20 Jun 2012, black light trap			
Ephemeroptera	Heptageniidae	<i>Maccaffertium meririvulatum</i> (Carle & Lewis, 1978)	2 ♀, 2 ♂
Plecoptera	Nemouridae	<i>Amphinemura</i> species	1 ♀
	Perlidae	<i>Acroneuria abnormis</i> (Newman, 1838)	1 ♀
	Perlodidae	<i>Isoperla</i> species	4 ♀, 2 ♂
Trichoptera	Phylocentropodidae	<i>Phylocentropus placidus</i> (Banks, 1905)	1 ♀
	Glossosomatidae	<i>Glossosoma nigrior</i> Banks, 1911	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	36 ♂
		<i>Cheumatopsyche pinaca</i> Ross, 1941	2 ♂
		<i>Cheumatopsyche</i> species	129 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	89 ♀, 29 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	1 ♀
	Leptoceridae	<i>Ceraclea</i> species	1 ♀
		<i>Oecetis cinerascens</i> (Hagen, 1861)	1 ♀
		<i>Oecetis inconspicua</i> (F Walker, 1852)	3 ♂
		<i>Oecetis persimilis</i> (Banks, 1907)	3 ♂
		<i>Triaenodes ignitus</i> (F Walker, 1852)	1 ♀
		<i>Triaenodes perna</i> HH Ross, 1938	1 ♂
		<i>Triaenodes tardus</i> LJ Milne, 1934	2 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	6 ♀
NC:Henderson Co., CARL Pasture Creek below Side Lake, 2 Mar 2011, by hand			
Odonata	Macromiidae	<i>Macromia alleghaniensis</i> Williamson, 1909	1 larva
Trichoptera	Hydropsychidae	<i>Hydropsyche betteni/depravata</i> group	1 larva
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva
	Phryganeidae	<i>Ptilostomis</i> species	1 larva
NC:Henderson Co., CARL Pasture Creek West, 30 Jul-4 Aug 2011, Malaise trap 2			
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♀, 2 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	2 ♀, 2 ♂
		<i>Rhyacophila torva</i> Hagen, 1861	1 ♀
NC:Henderson Co., CARL Side Lake, 16 Aug 2011, sweeping			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	2 ♂
		<i>Enallagma civile</i> (Hagen, 1861)	1 ♀
		<i>Ischnura posita</i> Hagen, 1861	2 ♂
	Lestidae	<i>Lestes australis</i> Walker, 1952	1 ♀
	Libellulidae	<i>Perithemis tenera</i> (Say, 1839)	1 ♀
Trichoptera	Dipseudopsidae	<i>Phylocentropus lucidus</i> (Hagen, 1861)	1 ♂
NC:Henderson Co., CARL Side Lake, 19 Jun 2012, black light (sheet)			
Ephemeroptera	Baetidae	Baetidae species	1 ♀
	Caenidae	<i>Caenis diminuta diminuta</i> Walker, 1853	5 ♀, 4 ♂
		<i>Caenis punctata</i> J McDunnough, 1931	4 ♀, 3 ♂
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	2 ♂
		<i>Cheumatopsyche</i> species	13 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	11 ♀, 2 ♂
		<i>Hydropsyche fattigi</i> Ross, 1941	1 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	1 ♀
		<i>Hydropsyche</i> species	1 ♀
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	2 ♂
		<i>Hydroptila</i> species	9 ♀
		<i>Oxyethira forcipata</i> Mosely, 1934	11 ♂
		<i>Oxyethira pallida</i> (Banks, 1904)	6 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
		<i>Oxyethira</i> species	190 ♀
	Leptoceridae	<i>Ceraclea</i> species	2 ♀
		<i>Oecetis cinerascens</i> (Hagen, 1861)	4 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	13 ♀, 18 ♂
		<i>Trienodes marginatus</i> Sibley, 1926	4 ♀
		<i>Trienodes perna</i> HH Ross, 1938	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♂
		<i>Chimarra socia</i> Hagen, 1861	2 ♀
	Polycentropodidae	<i>Holocentropus</i> species	1 ♀
NC:Henderson Co., CARL Side Lake, 19 Jun 2012, sweeping			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	1 ♀, 1 ♂
		<i>Enallagma divagans</i> Selys, 1876	1 ♀
		<i>Ischnura hastata</i> (Say, 1839)	1 ♀
		<i>Ischnura posita</i> Hagen, 1861	1 ♀, 3 ♂
NC:Henderson Co., CARL Side Lake, 2 Apr 2011, dip net			
Trichoptera	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva
NC:Henderson Co., CARL Side Lake, 2 Mar 2011, by hand			
Trichoptera	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva
NC:Henderson Co., CARL Side Lake, 22 Mar 2011, dip net			
Ephemeroptera	Caenidae	<i>Caenis</i> species	1 larva
	Ephemerellidae	<i>Dannella lita</i> (Burks, 1949)	4 larvae
Odonata	Coenagrionidae	<i>Chromagrion conditum</i> (Selys, 1876)	1 ♀
Plecoptera	Perlodidae	<i>Isoperla</i> species	1 larva
Trichoptera	Limnephilidae	<i>Pycnopsyche</i> species	1 larva
	Phryganeidae	<i>Agrypnia vestita</i> (Walker, 1852)	2 larvae
NC:Henderson Co., CARL Side Lake, 26 Jul 2012, observed			
Odonata	Aeshnidae	<i>Anax junius</i> (Drury, 1773)	2 ♂
	Libellulidae	<i>Erythemis simplicicollis</i> (Say, 1839)	5 ♀, 5 ♂
		<i>Libellula incesta</i> Hagen, 1861	2 ♂
		<i>Libellula luctuosa</i> Burmeister, 1839	1 ♀, 3 ♂
		<i>Perithemis tenera</i> (Say, 1839)	2 ♀, 5 ♂
NC:Henderson Co., CARL Side Lake, 26 Jul 2012, sweeping			
Odonata	Libellulidae	<i>Sympetrum vicinum</i> (Hagen, 1861)	1 ♀
NC:Henderson Co., CARL Side Lake, 27 Jul 2011, sweeping			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	6 ♂
		<i>Ischnura hastata</i> (Say, 1839)	1 ♂
		<i>Ischnura posita</i> Hagen, 1861	3 ♀, 6 ♂
		<i>Ischnura verticalis</i> (Say, 1839)	1 ♀
NC:Henderson Co., CARL Side Lake, 30 Mar 2011, dip net			
Odonata	Corduliidae	<i>Epitheca cynosura</i> (Say, 1839)	1 ♂ with exuviae in envelope
NC:Henderson Co., CARL Side Lake, 30-31 Aug 2011, black light trap			
Ephemeroptera	Caenidae	<i>Caenis diminuta diminuta</i> Walker, 1853	2 ♀, 2 ♂
		<i>Caenis punctata</i> J McDunnough, 1931	11 ♀
		<i>Caenis</i> species	12 ♀
Odonata	Libellulidae	<i>Celithemis fasciata</i> Kirby, 1889	1 ♂
		<i>Libellula incesta</i> Hagen, 1861	1 ♂
		<i>Sympetrum vicinum</i> (Hagen, 1861)	2 ♂
Trichoptera	Hydropsychidae	<i>Hydropsyche betteni</i> Ross, 1938	2 ♀, 2 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	3 ♀
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 8 ♂
		<i>Oxyethira dualis</i> Morton, 1905	2 ♀, 1 ♂
		<i>Oxyethira forcipata</i> Morton, 1905	5 ♂
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	2 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	8 ♀, 2 ♂
		<i>Trienodes marginatus</i> Sibley, 1926	1 ♀
	Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	1 ♂
	Polycentropodidae	<i>Nyctiophylax</i> species	1 ♀

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
NC:Henderson Co., CARL Side Lake, 31 Aug 2011, dip net			
Ephemeroptera	Siphonuridae	<i>Siphonurus</i> species	2 larva
Trichoptera	Leptoceridae	<i>Oecetis</i> species	1 larva
NC:Henderson Co., CARL Side Lake, 7 Oct 2011, by hand			
Ephemeroptera	Caenidae	<i>Caenis</i> species	14 larvae
Megaloptera	Corydalidae	<i>Corydalidae</i> species	1 larva
Odonata	Aeshnidae	<i>Boyeria vinosa</i> (Say, 1839)	3 larvae
	Gomphidae	<i>Arigomphus</i> species	1 larva
	Lestidae	<i>Lestes</i> species	1 ♀, 1 ♂
	Libellulidae	<i>Sympetrum vicinum</i> (Hagen, 1861)	1 ♂
Trichoptera	Hydroptilidae	<i>Hydroptilidae</i> species	12 larvae
	Leptoceridae	<i>Oecetis</i> species	10 larvae
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva
NC:Henderson Co., CARL Side Lake at dam, 22-23 Aug 2012, black light trap			
Ephemeroptera	Caenidae	<i>Caenis diminuta diminuta</i> Walker, 1853	8 ♀, 1 ♂
		<i>Caenis punctata</i> J McDunnough, 1931	7 ♀
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	10 ♂
		<i>Cheumatopsyche</i> species	130 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	351 ♀, 151 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	3 ♀, 1 ♂
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	4 ♂
		<i>Hydroptila</i> species	20 ♀
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	7 ♀, 7 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	42 ♂
		<i>Oxyethira</i> species	52 ♀
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	11 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	13 ♀, 5 ♂
		<i>Triaenodes marginatus</i> Sibley, 1926	8 ♀
		<i>Triaenodes perna</i> HH Ross, 1938	3 ♀
		<i>Triaenodes tardus</i> LJ Milne, 1934	1 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	41 ♀, 3 ♂
		<i>Chimarra obscura</i> (Walker, 1852)	2 ♀, 2 ♂
	Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	1 ♀, 15 ♂
	Polycentropodidae	<i>Cernotina spicata</i> Ross, 1938	2 ♀, 2 ♂
		<i>Nyctiophylax</i> species	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♀
NC:Henderson Co., CARL Side Lake at dam, 26-27 Jul 2011, black light trap			
Ephemeroptera	Caenidae	<i>Caenis diminuta diminuta</i> Walker, 1853	3 ♀, 1 ♂
		<i>Caenis punctata</i> J McDunnough, 1931	2 ♀
Trichoptera	Brachycentridae	<i>Micrasema</i> species	8 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	11 ♂
		<i>Cheumatopsyche ela</i> Denning, 1942	1 ♂
		<i>Cheumatopsyche pinaca</i> Ross, 1941	5 ♂
		<i>Cheumatopsyche</i> species	235 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	362 ♀, 277 ♂
		<i>Hydropsyche morosa</i> Hagen, 1861	3 ♀, 1 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	7 ♀
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	11 ♀, 3 ♂
		<i>Hydroptila</i> species	2 ♀
		<i>Hydroptilidae</i> species	772 ♀
		<i>Oxyethira dualis</i> Morton, 1905	2 ♀
		<i>Oxyethira forcipata</i> Mosely, 1934	67 ♂
	Leptoceridae	<i>Nectopsyche candida</i> (Hagen, 1861)	21 ♀, 1 ♂
		<i>Nectopsyche exquisita</i> (Walker, 1852)	6 ♀, 1 ♂
		<i>Oecetis cinerascens</i> (Hagen, 1861)	4 ♀, 26 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	21 ♀, 22 ♂
		<i>Oecetis persimilis</i> (Banks, 1907)	2 ♀, 1 ♂
		<i>Triaenodes marginatus</i> Sibley, 1926	22 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	2 ♀, 4 ♂
		<i>Chimarra socia</i> Hagen, 1861	1 ♂
		<i>Chimarra</i> species	1 ♀
		<i>Wormaldia moesta</i> (Banks, 1914)	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	3 ♂
NC:Henderson Co., CARL Side Lake North, date unknown, Malaise trap 9n			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	6 ♀, 24 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera					
Order	Family	Species	Specimens		
Trichoptera	Libellulidae	<i>Enallagma geminatum</i> Kellicott, 1895	1 ♀		
		<i>Ischnura posita</i> Hagen, 1861	9 ♀		
		<i>Erythemis simplicicollis</i> (Say, 1839)	4 ♂		
		<i>Pachydiplax longipennis</i> (Burmeister, 1839)	1 ♂		
	Hydroptilidae	<i>Sympetrum vicinum</i> (Hagen, 1861)	1 ♂		
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	10 ♂		
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	11 ♂		
		<i>Oxyethira dualis</i> Morton, 1905	many ♀ & ♂		
		<i>Oxyethira forcipata</i> Mosely, 1934	2 ♀, 24 ♂		
		<i>Oxyethira</i> n. sp. 3	3 ♂		
		<i>Oxyethira pallida</i> (Banks, 1904)	1 ♂		
		<i>Oxyethira</i> species	8 ♀		
NC:Henderson Co., CARL Side Lake North, 14 Nov-15 Feb 2012, Malaise trap 9n					
Odonata	Coenagrionidae	<i>Ischnura posita</i> Hagen, 1861	4 ♂		
Plecoptera	Capniidae	<i>Allocapnia</i> species	1 ♀		
Trichoptera	Nemouridae	<i>Amphinemura</i> species	1 ♀		
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♀, 2 ♂		
		<i>Hydropsyche betteni</i> Ross, 1938	1 ♀		
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♀, 93 ♂		
		<i>Oxyethira dualis</i> Morton, 1905	1 ♀		
		<i>Oxyethira forcipata</i> Mosely, 1934	5 ♂		
		NC:Henderson Co., CARL Side Lake North, 15 Feb-22 Mar 2012, Malaise trap 9n			
Odonata	Aeshnidae	<i>Basiaeschna janata</i> (Say, 1839)	1 ♀, 2 ♂		
	Coenagrionidae	<i>Chromagrion conditum</i> (Selys, 1876)	7 ♀, 1 ♂		
Trichoptera	Libellulidae	<i>Enallagma aspersum</i> (Hagen, 1861)	3 ♂		
		<i>Enallagma geminatum</i> Kellicott, 1895	2 ♂		
		<i>Ischnura hastata</i> (Say, 1839)	1 ♂		
		<i>Ischnura posita</i> Hagen, 1861	3 ♀, 4 ♂		
		<i>Ischnura verticalis</i> (Say, 1839)	1 ♂		
		<i>Gomphus exilis</i> Selys, 1854	2 ♀, 6 ♂		
		<i>Ladona deplanata</i> (Rambur, 1842)	2 ♂		
		<i>Didymops transversa</i> (Say, 1839)	2 ♀		
		<i>Diplectrona modesta</i> N Banks, 1908	1 ♀		
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	10 ♀, 197 ♂		
	Hydropsychidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	3 ♂		
		<i>Oxyethira dualis</i> Morton, 1905	4 ♀, 1 ♂		
		<i>Oxyethira</i> n. sp. 3	3 ♂		
		<i>Oxyethira forcipata</i> Mosely, 1934	87 ♂		
		<i>Oxyethira michiganensis</i> Mosely, 1934	7 ♂		
		<i>Oxyethira pallida</i> (Banks, 1904)	1 ♂		
		<i>Oxyethira</i> species	45 ♀		
NC:Henderson Co., CARL Side Lake North, 22 Mar-1 May 2012, Malaise trap 9n					
Odonata	Coenagrionidae	<i>Chromagrion conditum</i> (Selys, 1876)	1 ♀, 1 ♂		
		<i>Enallagma</i> species	1 ♀		
		<i>Ischnura posita</i> Hagen, 1861	5 ♀, 1 ♂		
		<i>Ischnura</i> species	1 ♀		
Trichoptera	Gomphidae	<i>Gomphus exilis</i> Selys, 1876	2 ♀, 2 ♂		
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	9 ♀, 77 ♂		
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 148 ♂		
		<i>Oxyethira forcipata</i> Mosely, 1934	69 ♂		
		<i>Oxyethira michiganensis</i> Mosely, 1934	5 ♂		
		<i>Oxyethira pallida</i> (N Banks, 1904)	3 ♂		
		<i>Oxyethira</i> species	25 ♀		
		<i>Oecetis inconspicua</i> (Walker, 1852)	1 ♀		
		NC:Henderson Co., CARL Side Lake North, 28 Jun-5 Jul 2012, Malaise trap 9n			
		Trichoptera	Hydropsychidae	<i>Hydropsyche betteni</i> HH Ross, 1938	1 ♀
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	4 ♂		
		<i>Hydroptila remita</i> Blickle & WC Morse, 1954	1 ♂		
		<i>Hydroptila</i> species	2 ♀		
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	1 ♀, 9 ♂		
		<i>Oxyethira dualis</i> Morton, 1905	25 ♀, 184 ♂		
		<i>Oxyethira forcipata</i> Mosely, 1934	64 ♂		
		<i>Oxyethira pallida</i> (N Banks, 1904)	4 ♂		
		<i>Oxyethira</i> species	40 ♀		
		Leptoceridae	<i>Oecetis</i> species	1 ♀	

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
		<i>Triaenodes perna</i> HH Ross, 1938	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♀
NC:Henderson Co., CARL Side Lake North, 31 May-7 Jun 2012, Malaise trap 9n			
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	40 ♂
		<i>Hydroptila</i> species	9 ♂
		<i>Hydroptila</i> species	9 ♀
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	2 ♀, 5 ♂
		<i>Oxyethira dualis</i> Morton, 1905	many ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	121 ♂
		<i>Oxyethira pallida</i> (Banks, 1904)	6 ♂
	Leptoceridae	<i>Oecetis inconspicua</i> (Walker, 1852)	3 ♀
	Phryganeidae	<i>Ptilostomis ocellifera</i> (Walker, 1852)	1 ♀
NC:Henderson Co., CARL Side Lake North, 5-12 Jul 2012, Malaise trap 9n			
Odonata	Calopterygidae	<i>Calopteryx maculata</i> (Beauvois, 1805)	1 ♂
	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	1 ♀, 5 ♂
		<i>Ischnura posita</i> Hagen, 1861	5 ♀, 1 ♂
	Libellulidae	<i>Erythemis simplicicollis</i> (Say, 1839)	1 ♂
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♀, 5 ♂
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	4 ♂
		<i>Oxyethira dualis</i> Morton, 1905	9 ♀, 144 ♂
		<i>Oxyethira</i> n. sp. 3	2 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	18 ♂
		<i>Oxyethira</i> species	12 ♀
	Leptoceridae	<i>Triaenodes perna</i> HH Ross, 1938	1 ♀
NC:Henderson Co., CARL Side Lake North, 7-19 Jun 2012, Malaise trap 9n			
Odonata	Coenagrionidae	<i>Argia fumipennis violacea</i> (Hagen, 1861)	4 ♀, 19 ♂
		<i>Chromagrion conditum</i> (Selys, 1876)	1 ♀
		<i>Enallagma aspersum</i> (Hagen, 1861)	1 ♂
		<i>Enallagma dackii</i> (Calvert, 1903)	1 ♀
		<i>Enallagma geminatum</i> Kellicott, 1895	1 ♀
		<i>Enallagma signatum</i> (Hagen, 1861)	1 ♂
		<i>Enallagma</i> species	1 ♀
		<i>Ischnura hastata</i> (Say, 1839)	2 ♀, 1 ♂
		<i>Ischnura posita</i> Hagen, 1861	6 ♀, 4 ♂
		<i>Ischnura</i> species	2 ♀
	Gomphidae	<i>Gomphus exilis</i> Selys, 1854	1 ♂
	Libellulidae	<i>Celithemis elisa</i> (Hagen, 1861)	1 ♀
Trichoptera	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	24 ♂
		<i>Oxyethira dualis</i> Morton, 1905	many ♂
		<i>Oxyethira</i> species	16 ♀
NC:Henderson Co., CARL trib to Pasture Creek below entrance road, 26-27 Jul 2012, black light trap			
Trichoptera	Glossosomatidae	<i>Glossosoma nigrrior</i> N Banks, 1911	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (N Banks, 1903)	1 ♂
		<i>Cheumatopsyche geora</i> Denning, 1948	1 ♂
		<i>Cheumatopsyche pinaca</i> HH Ross, 1941	2 ♂
		<i>Cheumatopsyche</i> species	21 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	8 ♀, 6 ♂
		<i>Hydropsyche betteni</i> HH Ross, 1938	4 ♀, 1 ♂
		<i>Hydropsyche sparna</i> HH Ross, 1938	3 ♀, 1 ♂
	Hydroptilidae	<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂
		<i>Oxyethira</i> n. sp. 3	1 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	2 ♂
		<i>Oxyethira rivicola</i> Blickle & WC Morse, 1954	1 ♂
		<i>Oxyethira</i> species	4 ♀
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (N Banks, 1905)	6 ♀, 4 ♂
	Leptoceridae	<i>Triaenodes ignitus</i> (F Walker, 1852)	1 ♀, 1 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♂
	Philopotamidae	<i>Chimarra aterrima</i> HA Hagen, 1861	1 ♀
		<i>Dolophilodes distincta</i> (F Walker, 1852)	1 ♀, 1 ♂
	Phryganeidae	<i>Ptilostomis ocellifera</i> (F Walker, 1852)	1 ♀
	Polycentropodidae	<i>Polycentropus</i> species	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (N Banks, 1914)	2 ♀
	Rhyacophilidae	<i>Rhyacophila carolina</i> N Banks, 1911	1 ♂
		<i>Rhyacophila glaberrima</i> Ulmer, 1907	2 ♀, 4 ♂
		<i>Rhyacophila torva</i> HA Hagen, 1861	1 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
NC:Henderson Co., CARL trib to Side Lake above duck cage, 26-27 Jul 2012, black light trap			
Ephemeroptera	Baetidae	<i>Procloeon</i> species	1 ♂
Megaloptera	Corydalidae	<i>Chauliodes pectinicornis</i> Linnaeus, 1783	1 ♀
Trichoptera	Dipseudopsidae	<i>Phylocentropus lucidus</i> (Hagen, 1861)	4 ♀+♂
		<i>Phylocentropus placidus</i> (Banks, 1905)	1 ♂
	Glossosomatidae	<i>Glossosoma nigrior</i> Banks, 1911	1 ♀+♂
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	9 ♂
		<i>Cheumatopsyche oxa</i> Ross, 1938	1 ♂
		<i>Cheumatopsyche</i> species	38 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	10 ♀, 10 ♂
		<i>Hydropsyche betteni</i> Ross, 1938	37 ♀, 8 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	27 ♀, 8 ♂
	Hydroptilidae	<i>Hydroptila gunda</i> Milne, 1936	1 ♂
		<i>Hydroptila</i> n. sp. cf. <i>oneili</i>	1 ♂
		<i>Hydroptila</i> species	1 ♀
		<i>Oxyethira</i> n. sp. 3	1 ♂
		<i>Oxyethira forcipata</i> Mosely, 1934	21 ♂
		<i>Oxyethira</i> species	38 ♀
	Leptoceridae	<i>Oecetis cinerascens</i> (Hagen, 1861)	6 ♀, 6 ♂
		<i>Oecetis inconspicua</i> (Walker, 1852)	7 ♀, 13 ♂
		<i>Oecetis persimilis</i> (Banks, 1907)	1 ♀, 1 ♂
		<i>Trienodes marginatus</i> Sibley, 1926	2 ♀
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	2 ♀, 5 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	5 ♀, 1 ♂
		<i>Chimarra obscura</i> (Walker, 1852)	2 ♀+♂
		<i>Dolophilodes distincta</i> (Walker, 1852)	4 ♀, 2 ♂
		<i>Wormaldia moesta</i> (Banks, 1914)	2 ♂
	Polycentropodidae	<i>Nyctiophylax</i> species	1 ♀
NC:Henderson Co., CARL Trout Pond, 22-23 Aug 2012, black light trap			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♂
		<i>Cheumatopsyche</i> species	1 ♀+♂
		<i>Diplectrona modesta</i> N Banks, 1908	1 ♀+♂
		<i>Hydropsyche betteni</i> Ross, 1938	3 ♀+♂
		<i>Hydropsyche sparna</i> Ross, 1938	1 ♀+♂
	Hydroptilidae	<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	3 ♀+♂
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (Banks, 1905)	1 ♀, 1 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♂
	Philopotamidae	<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♂
	Polycentropodidae	<i>Polycentropus</i> species	1 ♀+♂
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♀+♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀, 7 ♂
NC:Henderson Co., CARL Trout Pond, 26 Jul 2012, observed			
Odonata	Calopterygidae	<i>Calopteryx maculata</i> (Beauvois, 1805)	1 ♀
	Libellulidae	<i>Libellula incesta</i> Hagen, 1861	2 ♂
		<i>Plathemis lydia</i> (Drury, 1773)	1 ♂
NC:Henderson Co., CARL Trout Pond, 26-27 Jul 2011, black light trap			
Ephemeroptera	Baetidae	<i>Pseudocloeon</i> species	1 ♀
Megaloptera	Corydalidae	<i>Chauliodes rastricornis</i> Rambur, 1842	2 larvae
Trichoptera	Brachycentridae	<i>Micrasema</i> species	2 ♀
	Glossosomatidae	<i>Glossosoma nigrior</i> Banks, 1911	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	5 ♂
		<i>Cheumatopsyche pinaca</i> Ross, 1941	24 ♂
		<i>Cheumatopsyche</i> species	37 ♀+♂
		<i>Diplectrona modesta</i> N Banks, 1908	2 ♂
		<i>Hydropsyche betteni</i> Ross, 1938	8 ♀, 12 ♂
		<i>Hydropsyche mississippiensis</i> Flint, 1965	2 ♂
		<i>Hydropsyche morosa</i> Hagen, 1861	1 ♂
		<i>Hydropsyche</i> species	1 ♀
	Hydroptilidae	<i>Hydroptila gunda</i> Milne, 1936	1 ♂
		<i>Oxyethira rivicola</i> Blickle & Morse, 1954	1 ♂
		<i>Oxyethira</i> species	16 ♀
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (Banks, 1905)	1 ♀, 2 ♂
	Leptoceridae	<i>Oecetis inconspicua</i> (Walker, 1852)	4 ♀
		<i>Trienodes marginatus</i> Sibley, 1926	4 ♀, 5 ♂
		<i>Trienodes perna</i> HH Ross, 1938	1 ♂

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
	Philopotamidae	<i>Dolophilodes distincta</i> (Walker, 1852)	2 ♀
	Phryganeidae	<i>Phryganea sayi</i> Milne, 1931	5 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♀
	Rhyacophilidae	<i>Rhyacophila carolina</i> Banks, 1911	1 ♀
		<i>Rhyacophila glaberrima</i> Ulmer, 1907	13 ♀, 4 ♂
NC:Henderson Co., CARL Trout Pond, 6-7 Jun 2011, black light trap			
Ephemeroptera	Heptageniidae	<i>Maccaffertium</i> species	3 ♀
Plecoptera	Leuctridae	<i>Leuctra carolinensis</i> Claassen, 1923	4 ♀, 3 ♂
	Nemouridae	<i>Amphinemura nigrutta</i> (Provancher, 1876)	2 ♀
	Peltoperlidae	<i>Tallaperla anna</i> (Needham & Smith, 1916)	1 ♀
	Perlodidae	<i>Isoperla</i> species	1 ♀
Trichoptera	Brachycentridae	<i>Micrasema</i> species	2 ♀
		<i>Micrasema wataga</i> HH Ross, 1938	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	5 ♀
		<i>Cheumatopsyche harwoodi</i> DG Denning, 1948	1 ♀
		<i>Cheumatopsyche pinaca</i> HH Ross, 1941	2 ♀
		<i>Cheumatopsyche</i> species	4 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	2 ♀, 7 ♂
		<i>Hydropsyche betteni</i> Ross, 1938	13 ♀, 38 ♂
		<i>Hydropsyche incommoda</i> HA Hagen, 1861	2 ♀
		<i>Hydropsyche mississippiensis</i> Flint, 1965	1 ♀
		<i>Hydropsyche morosa</i> Hagen, 1861	1 ♀
		<i>Hydropsyche</i> species	1 ♀
	Leptoceridae	<i>Ceraclea enodis</i> Whitlock & Morse, 1994	1 ♀
		<i>Ceraclea</i> species	2 ♀
		<i>Oecetis inconspicua</i> (F Walker, 1852)	1 ♀
		<i>Triaenodes ignitus</i> (F Walker, 1852)	1 ♀
		<i>Triaenodes marginatus</i> Sibley, 1926	4 ♀
		<i>Triaenodes perna</i> HH Ross, 1938	1 ♀
	Limnephilidae	<i>Pseudostenophylax uniformis</i> (Betten, 1934)	1 ♀
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	2 ♀
	Odontoceridae	<i>Psilotreta frontalis</i> Banks, 1899	2 ♀
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	1 ♀, 2 ♂
		<i>Chimarra</i> species	1 ♀
		<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♀
		<i>Wormaldia moesta</i> (Banks, 1914)	6 ♀
	Polycentropodidae	<i>Plectrocnemia cinerea</i> (Hagen, 1861)	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♀, 1 ♂
	Sericostomatidae	<i>Agarodes griseus</i> N Banks, 1899	14 ♀, 2 ♂
		<i>Agarodes</i> species	7 ♀
		<i>Agarodes tetron</i> (HH Ross, 1948)	4 ♀, 4 ♂
NC:Henderson Co., CARL Trout Pond, 6-7 Oct 2011, black light trap			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	1 ♀
		<i>Hydropsyche betteni</i> Ross, 1938	1 ♀
	Limnephilidae	<i>Pycnopsyche gentilis</i> (McLachlan, 1871)	1 ♀
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀
NC:Henderson Co., CARL Trout Pond drain, 19-20 Jun 2012, black light trap			
Ephemeroptera	Baetidae	Baetidae species	1 ♂ subimago
Plecoptera	Nemouridae	<i>Amphinemura</i> species	1 ♀
Trichoptera	Glossosomatidae	<i>Glossosoma nigrrior</i> Banks, 1911	1 ♀
	Hydropsychidae	<i>Cheumatopsyche analis</i> (Banks, 1903)	1 ♀
		<i>Cheumatopsyche</i> species	2 ♀
		<i>Diplectrona modesta</i> N Banks, 1908	12 ♀, 7 ♂
		<i>Hydropsyche betteni</i> Ross, 1938	4 ♀, 1 ♂
		<i>Hydropsyche sparna</i> Ross, 1938	2 ♀, 1 ♂
	Lepidostomatidae	<i>Lepidostoma latipenne</i> (Banks, 1905)	1 ♀
	Leptoceridae	<i>Triaenodes</i> species	1 ♀
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♀, 6 ♂
	Philopotamidae	<i>Chimarra aterrima</i> Hagen, 1861	4 ♀
		<i>Dolophilodes distincta</i> (Walker, 1852)	2 ♀, 1 ♂
		<i>Wormaldia moesta</i> (Banks, 1914)	1 ♀, 1 ♂
	Polycentropodidae	<i>Polycentropus</i> species	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	2 ♀
	Rhyacophilidae	<i>Rhyacophila carolina</i> Banks, 1911	1 ♀, 4 ♂
NC:Henderson Co., CARL Trout Pond effluent, 27 Apr 2011, dip net			

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
Ephemeroptera	Leptophlebiidae	<i>Leptophlebia johnsoni</i> J McDunnough, 1924	1 larva
Plecoptera	Nemouridae	<i>Amphinemura</i> species	2 larvae
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 larva
	Limnephilidae	<i>Platycentropus radiatus</i> (Say, 1824)	1 larva
	Phryganeidae	<i>Ptilostomis</i> species	1 larva
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 larva
NC:Henderson Co., CARL Trout Pond spring, 26-27 Jul 2012, black light trap			
Trichoptera	Hydropsychidae	<i>Cheumatopsyche</i> species	2 ♀
NC:Henderson Co., CARL Trout Pond spring, 30 May 2012, by hand			
Megaloptera	Corydalidae	<i>Nigronia serricornis</i> (Say, 1824)	1 larva
Plecoptera	Nemouridae	<i>Amphinemura</i> species	1 ♀
	Perlodidae	<i>Isoperla</i> species	1 ♂
Trichoptera	Lepidostomatidae	<i>Lepidostoma</i> species	2 larvae
	Limnephilidae	<i>Pycnopsyche gentilis</i> (McLachlan, 1871)	2 larvae
NC:Henderson Co., CARL Trout Pond spring, 8 Aug-20 Sep 2012, Malaise trap 10			
Trichoptera	Lepidostomatidae	<i>Lepidostoma</i> species	1 ♀
		<i>Lepidostoma wigginsii</i> JS Weaver, 2002	3 ♀, 1 ♂
	Limnephilidae	<i>Pycnopsyche gentilis</i> (McLachlan, 1871)	1 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	1 ♀
	Philopotamidae	<i>Dolophilodes distincta</i> (F Walker, 1852)	1 ♂
	Polycentropodidae	<i>Polycentropus</i> species	1 ♂
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	18 ♂
Trichoptera	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀, 1 ♂
NC:Henderson Co., CARL Trout Pond spring, 20-27 Sep 2012, Malaise trap 10			
Plecoptera	Leuctridae	<i>Leuctra</i> species	1 ♀
Trichoptera	Limnephilidae	<i>Pycnopsyche gentilis</i> (McLachlan, 1871)	1 ♀
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	1 ♂
NC:Henderson Co., CARL Trout Pond spring, 27 Sep-4 Oct 2012, Malaise trap 10			
Plecoptera	Leuctridae	<i>Leuctra</i> species	2 ♀
		<i>Leuctra tenella</i> Provancher, 1878	1 ♂
Trichoptera	Polycentropodidae	<i>Polycentropus</i> n. species	1 ♂
	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀
NC:Henderson Co., CARL Trout Pond spring, 4 Oct-13 Nov 2012, Malaise trap 10			
Plecoptera	Leuctridae	<i>Leuctra carolinensis</i> Claassen, 1923	6 ♀, 8 ♂
NC:Henderson Co., CARL Trout Pond spring, 13 Nov 2012 - 7 May 2013, Malaise trap 10			
Odonata	Coenagrionidae	<i>Ischnura</i> species	1 adult
	Cordulegastridae	<i>Cordulegaster bilineata</i> (Carle, 1983)	1 ♂
Plecoptera	Chloroperlidae	<i>Sweltsa lateralis</i> (N Banks, 1911)	1 ♀
	Leuctridae	<i>Leuctra biloba</i> Claassen, 1923	132 ♂
		<i>Leuctra carolinensis</i> Claassen, 1923	4 ♂
		<i>Leuctra</i> species	197 ♀
	Nemouridae	<i>Amphinemura nigrutta</i> (Provancher, 1876)	4 ♀, 2 ♂
	Perlidae	<i>Perlesta</i> species	8 ♀
Trichoptera	Dipseudopsidae	<i>Phylocentropus auriceps</i> (N Banks, 1905)	5 ♀, 3 ♂
	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	2 ♀, 2 ♂
		<i>Homoplectra doringa</i> (Milne, 1936)	1 ♀
	Hydroptilidae	<i>Oxyethira dualis</i> Morton, 1905	1 ♀
	Lepidostomatidae	<i>Lepidostoma ontario</i> HH Ross, 1941	42 ♀, 6 ♂
		<i>Lepidostoma</i> species	4 ♀
	Limnephilidae	<i>Pseudostenophylax uniformis</i> (Betten, 1934)	3 ♀, 2 ♂
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	2 ♂
	Odontoceridae	<i>Psilotreta amera</i> (HH Ross, 1939)	1 ♂
		<i>Psilotreta frontalis</i> N Banks, 1899	2 ♀, 3 ♂
	Philopotamidae	<i>Dolophilodes distincta</i> (Walker, 1852)	1 ♀, 1 ♂
		<i>Wormaldia moesta</i> (N Banks, 1914)	3 ♀, 1 ♂
	Polycentropodidae	<i>Polycentropus carolinensis</i> N Banks, 1905	2 ♀, 3 ♂
		<i>Polycentropus maculatus</i> N Banks, 1908	1 ♂
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	8 ♂
	Rhyacophilidae	<i>Rhyacophila celadon</i> Etnier, Stocks, & Parker, 2004	1 ♀
		<i>Rhyacophila mycta</i> HH Ross, 1941	1 ♀, 1 ♂
	Sericostomatidae	<i>Fattigia pele</i> (HH Ross, 1938)	2 ♀
NC:Henderson Co., CARL Trout Pond spring, 13 Nov 2012 - 7 May 2013, Malaise trap 10			
Trichoptera	Hydropsychidae	<i>Diplectrona modesta</i> N Banks, 1908	1 ♂ mmt

Carl Sandburg National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Ephemeroptera, Odonata, Plecoptera, Megaloptera, Trichoptera			
Order	Family	Species	Specimens
NC:Henderson Co., CARL Trout Pond spring, date unknown, Malaise trap 10			
Plecoptera	Leuctridae	<i>Leuctra carolinensis</i> Claassen, 1923	21 ♀, 9 ♂, 1 pair in copula
Trichoptera	Rhyacophilidae	<i>Rhyacophila glaberrima</i> Ulmer, 1907	1 ♀

Appendix 3. Non-Target Taxa Data

The records for 259 non-target taxa from Carl Sandburg Home National Historic Site (CARL) are presented in the table below, organized by State and County, SiteCode, date of collection, and collection method. All non-target taxa collected during this survey are listed, except those that remain unsorted and unidentified. Non-target taxa represent 6 phyla, 9 classes, 21 orders, 120 families, and 230 genera. This includes some taxa in catchall groups that indicate specimens that the authors did not identify to species. These are indicated in the table by entries such as “Coleoptera_family” and “Coleoptera species”.

Carl Sandburg Home National Historic Site

Non-Target Taxa Data			
Order	Family	Species	Specimens
NC:Henderson Co., CARL cement pond in front of house, 26 May 2011, by hand			
Coleoptera	Coleoptera_family	Coleoptera species	1 adult
Coleoptera	Hydrophilidae	<i>Tropisternus</i> species	1 larva
Hemiptera	Gerridae	Gerridae species	1 adult
Hemiptera	Notonectidae	Notonectidae species	1 larva
NC:Henderson Co., CARL Duck Pond, 30 May 2011, by hand			
Hemiptera	Plataspidae	<i>Megacopta cribraria</i> (Fabricius, 1798)	1 adults
NC:Henderson Co., CARL Duck Pond, 1-16 May 2012, Malaise trap			
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius, 1793)	4 adults
Lepidoptera	Hesperiidae	<i>Thorybes bathyllus</i> (J. E. Smith, 1797)	1 adult
Lepidoptera	Lycaenidae	<i>Calycopis cecrops</i> (Fabricius)	3 adult
NC:Henderson Co., CARL Duck Pond, 12-19 Jul 2012, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 ♂
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	1 adult
Lepidoptera	Hesperiidae	Hesperiidae species	1 larva
Lepidoptera	Hesperiidae	<i>Urbanus proteus</i> (Linnaeus, 1758)	1 adult
Orthoptera	Acrididae	Acrididae species	1 ♀
Orthoptera	Orthoptera_family	Orthoptera species	1 ♂
NC:Henderson Co., CARL Duck Pond, 14 Nov-15 Feb 2012, Malaise trap			
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	2 adults
NC:Henderson Co., CARL Duck Pond, 15 Feb-22 Mar 2012, Malaise trap			
Coleoptera	Buprestidae	Buprestidae species	3 adults
Coleoptera	Carabidae	Carabidae species	2 adults
Coleoptera	Carabidae	<i>Cicindela sexguttata</i> Fabricius	1 ♂
Coleoptera	Cerambycidae	<i>Leptorhabdium pictum</i> (Haldeman, 1847)	1 adult
Coleoptera	Chrysomelidae	Chrysomelidae species	1 adult
Coleoptera	Chrysomelidae	<i>Paria</i> species	2 adults
Coleoptera	Coccinellidae	Coccinellidae species	3 adults
Coleoptera	Coleoptera_family	Coleoptera species	5 adults
Coleoptera	Elateridae	Elateridae species	2 adults
Coleoptera	Lampyridae	Lampyridae species	12 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	5 adults
Coleoptera	Staphylinidae	Staphylinidae species	1 adult
Diptera	Bombyliidae	<i>Bombylius</i> species	2 adults
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	4 adults, 1 ♀
Hemiptera	Cicadellidae	Cicadellidae species	1 adult
Hemiptera	Hemiptera_family	Hemiptera species	5 adults
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	3 workers

Non-Target Taxa Data			
Order	Family	Species	Specimens
Hymenoptera	Vespidae	<i>Polistes</i> species	1 ♀
Hymenoptera	Vespidae	<i>Vespula germanica</i> Fabricius, 1793	6 workers
Orthoptera	Tetrigidae	Tetrigidae species	3 adults
NC:Henderson Co., CARL Duck Pond, 19-28 Jun 2012, Malaise trap			
Lepidoptera	Nymphalidae	<i>Phyciodes tharos</i> (Drury)	1 adult
Lepidoptera	Pieridae	<i>Pieris rapae</i> (Linnaeus)	1 adult
Lepidoptera	Sphingidae	<i>Laothoe juglandis</i> (J. E. Smith)	4 adults
NC:Henderson Co., CARL Duck Pond, 22 Mar-1 May 2012, Malaise trap			
Coleoptera	Coleoptera_family	Coleoptera species	38 adults
Coleoptera	Elateridae	Elateridae species	2 adults
Dermaptera	Dermaptera_family	Dermaptera species	22 adults, 2 indivs.
Diptera	Syrphidae	Syrphidae species	2 adults
Hemiptera	Hemiptera_family	Hemiptera species	7 adults
Hemiptera	Plataspidae	<i>Megacopta cribraria</i> (Fabricius, 1798)	5 adults
Hymenoptera	Formicidae	Formicidae species	1 adult
Hymenoptera	Symphyta_family	Symphyta species	2 adults
Lepidoptera	Sphingidae	<i>Deidamia inscripta</i> (Harris, 1839)	2 adult
Mecoptera	Panorpidae	<i>Panorpa claripennis</i> Hine, 1901	4 ♀
Orthoptera	Tetrigidae	Tetrigidae species	1 adult
NC:Henderson Co., CARL Duck Pond, 24-31 Aug 2011, Malaise trap			
Dermaptera	Forficulidae	<i>Forficula auricularia</i> Linnaeus, 1758	1 ♂
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 workers
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	2 adults
Neuroptera	Coniopterygidae	Coniopterygidae species	5 adults
Orthoptera	Orthoptera_family	Orthoptera species	1 adult
NC:Henderson Co., CARL Duck Pond, 24-31 May 2012, Malaise trap			
Neuroptera	Hemerobiidae	Hemerobiidae species	1 adult
NC:Henderson Co., CARL Duck Pond, 27 Sep-25 Oct 2011, Malaise trap			
Coleoptera	Carabidae	Carabidae species	4 adults
Coleoptera	Coccinellidae	Coccinellidae species	6 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	3 adults
Coleoptera	Silphidae	<i>Nicrophorus</i> species	1 adult
Diptera	Asilidae	Asilidae species	2 adults
Diptera	Diptera_family	Diptera species	2 adults
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	2 ♂
Diptera	Syrphidae	Syrphidae species	2 adults
Hymenoptera	Formicidae	Formicidae species	1 worker
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Ichneumonidae	Ichneumonidae species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 worker
Hymenoptera	Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	1 ♀
Hymenoptera	Vespidae	<i>Vespula</i> species	1 worker
Orthoptera	Orthoptera_family	Orthoptera species	1 adult
NC:Henderson Co., CARL Duck Pond, 30 May 2011, by hand			
Hemiptera	Plataspidae	<i>Megacopta cribraria</i> (Fabricius, 1798)	1 adult
NC:Henderson Co., CARL Duck Pond, 31 Aug-9 Sep 2011, Malaise trap			
Coleoptera	Anobiidae	Anobiidae species	1 adult
Coleoptera	Carabidae	Carabidae species	4 adults
Coleoptera	Chrysomelidae	Chrysomelidae species	5 adults
Coleoptera	Coccinellidae	Coccinellidae species	9 adults
Coleoptera	Coleoptera_family	Coleoptera species	150 adults
Coleoptera	Curculionidae	Curculionidae species	5 adults
Coleoptera	Elateridae	Elateridae species	61 adults
Coleoptera	Latridiidae	<i>Corticaria</i> species	23 adults, 11 ♀, 1 ♂
Coleoptera	Mycetophagidae	<i>Litargus</i> species	1 adult
Coleoptera	Mycetophagidae	Mycetophagidae species	1 adult

Non-Target Taxa Data			
Order	Family	Species	Specimens
Coleoptera	Scarabaeidae	Scarabaeidae species	3 adults
Coleoptera	Scirtidae	<i>Prionocyphon</i> species	3 adults
Coleoptera	Scydmaenidae	Scydmaenidae species	2 adults
Coleoptera	Silphidae	<i>Nicrophorus</i> species	1 adult
Coleoptera	Staphylinidae	Pselaphinae species	1 adult
Diptera	Asilidae	Asilidae species	2 adults
Diptera	Diptera_family	Diptera species	40 adults
Diptera	Dolichopodidae	<i>Campsicnemus</i> species	5 ♀, 4 ♂
Diptera	Dolichopodidae	<i>Condylostylus</i> species	1 ♀
Diptera	Dolichopodidae	Dolichopodidae species	1 adult, 17 ♀, 6 ♂
Diptera	Dolichopodidae	<i>Hercostomus</i> species	3 ♀, 1 ♂
Diptera	Dolichopodidae	<i>Medetera</i> species	1 ♀
Diptera	Dolichopodidae	<i>Thrypticus</i> species	10 ♀, 16 ♂
Hemiptera	Hemiptera_family	Hemiptera species	114 adults
Hymenoptera	Formicidae	Formicidae species	1 worker
Hymenoptera	Hymenoptera_family	Hymenoptera species	2 adults
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 alate
Hymenoptera	Vespidae	<i>Dolichovespula</i> species (Fabricius)	1 alate
Hymenoptera	Vespidae	<i>Vespa crabro</i> Linnaeus, 1758	1 alate
Hymenoptera	Vespidae	<i>Vespula squamosa</i> (Drury, 1773)	1 worker
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	2 adults
Orthoptera	Orthoptera_family	Orthoptera species	3 adults, 1 ♂
NC:Henderson Co., CARL Duck Pond, 31 May-7 Jun 2012, Malaise trap			
Coleoptera	Carabidae	Carabidae species	2 adults
Coleoptera	Cerambycidae	<i>Microgoes oculus</i> (LeConte, 1862)	1 adult
Coleoptera	Cerambycidae	<i>Strangalepta abbreviata</i> (Germar, 1824)	1 ♀
Coleoptera	Cerambycidae	<i>Strophiona nitens</i> (Forster, 1771)	1 adult
Coleoptera	Coccinellidae	Coccinellidae species	1 adult
Coleoptera	Elateridae	Elateridae species	15 adults
Coleoptera	Lampyridae	Lampyridae species	11 adults
Coleoptera	Scarabaeidae	<i>Popillia japonica</i> Newman, 1841	1 adult
Coleoptera	Tenebrionidae	<i>Arthromacra aenea</i> T Say	1 ♂
Dermaptera	Dermaptera_family	Dermaptera species	2 ♂
Diptera	Asilidae	Asilidae species	4 ♀
Diptera	Bombyliidae	<i>Anthrax</i> species	2 adults
Diptera	Bombyliidae	<i>Villa</i> species	1 adult
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 ♀
Diptera	Xylophagidae	<i>Rachicerus obscuripennis</i> Loew, 1863	6 ♂
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
Hemiptera	Membracidae	Membracidae species	1 adult
Hemiptera	Plataspidae	<i>Megacopta cribraria</i> (Fabricius, 1798)	1 adult
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Symphyta_family	Symphyta species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	2 worker
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 worker
Orthoptera	Orthoptera_family	Orthoptera species	1 adult, 1 larva
NC:Henderson Co., CARL Duck Pond, 6-7 Jun 2011, black light trap			
Coleoptera	Coleoptera_family	Coleoptera species	3 adults
Coleoptera	Elateridae	Elateridae species	9 adults
Coleoptera	Hydrophilidae	Hydrophilidae species	7 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	12 adults
Coleoptera	Staphylinidae	Staphylinidae species	1 adult
Hemiptera	Hemiptera_family	Hemiptera species	2 adults
Hemiptera	Membracidae	<i>Acutalis tartarea</i> (T Say, 1830)	1 adult
Hymenoptera	Hymenoptera_family	Hymenoptera species	5 adults
NC:Henderson Co., CARL Duck Pond, 7-19 Jun 2012, Malaise trap			
Coleoptera	Carabidae	Carabidae species	4 adults
Coleoptera	Coleoptera_family	Coleoptera species	2 adults

Non-Target Taxa Data			
Order	Family	Species	Specimens
Coleoptera	Elateridae	Elateridae species	56 adults
Coleoptera	Lampyridae	Lampyridae species	22 adults
Coleoptera	Lycidae	Lycidae species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	13 adults
Dermaptera	Dermaptera_family	Dermaptera species	2 ♂, 2 ♀
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	4 ♂
Hemiptera	Hemiptera_family	Hemiptera species	3 adults
Hemiptera	Membracidae	Membracidae species	1 adult
Hymenoptera	Formicidae	Formicidae species	19 alates, 2 workers
Hymenoptera	Hymenoptera_family	Hymenoptera species	23 adults
Hymenoptera	Sphecidae	Sphecidae species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	2 workers
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	5 workers
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	6 workers
Hymenoptera	Vespidae	<i>Vespula squamosa</i> (Drury, 1773)	1 worker
NC:Henderson Co., CARL Duck Pond, 9-27 Sep 2011, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	2 adult, 1 ♀
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	2 adult
Neuroptera	Hemerobiidae	Hemerobiidae species	1 adult
NC:Henderson Co., CARL Duck Pond, along shore, 30 Aug 2011, dip net			
Hemiptera	Hydrometridae	<i>Hydrometra</i> species	1 adult, 4 nymphs
Hemiptera	Veliidae	Veliidae species	2 adults
NC:Henderson Co., CARL Front Lake at Inlet, 2 Apr 2011, dip net			
Coleoptera	Halipidae	<i>Pelodytes shermani</i> Roberts, 1913	8 ♀, 5 ♂
NC:Henderson Co., CARL Front Lake at inlet, 24-30 Aug 2011, Malaise trap			
Coleoptera	Carabidae	Carabidae species	1 adult
NC:Henderson Co., CARL Front Lake at inlet, 26-27 Jul 2011, black light trap			
Coleoptera	Carabidae	Carabidae species	2 adults
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	3 adults
Diptera	Diptera_family	Diptera species	2 adults
NC:Henderson Co., CARL Front Lake at inlet, 30 Aug-9 Sep 2011, Malaise trap			
Blattaria	Blatellidae	<i>Parcoblatta</i> species	1 ♂
Coleoptera	Anobiidae	Anobiidae species	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	8 adults
Coleoptera	Curculionidae	Curculionidae species	1 adult
Coleoptera	Elateridae	Elateridae species	2 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	4 adults
Coleoptera	Staphylinidae	Staphylinidae species	1 adult
Coleoptera	Staphylinidae	Staphylinidae species	11 adults
Coleoptera	Throscidae	Throscidae species	1 adult
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
Hymenoptera	Formicidae	Formicidae species	3 workers
NC:Henderson Co., CARL Front Lake at inlet, 6-7 Jun 2011, Malaise trap			
Coleoptera	Coleoptera_family	Coleoptera species	2 adults
Coleoptera	Elateridae	Elateridae species	2 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Diptera	Asilidae	Asilidae species	2 adults
Hymenoptera	Hymenoptera_family	Hymenoptera species	9 adults
Hymenoptera	Ichneumonidae	Ichneumonidae species	1 adult
Hymenoptera	Vespidae	<i>Vespula</i> species	3 adults, 1 worker
NC:Henderson Co., CARL Front Lake at inlet, 6-7 Oct 2011, black light trap			
Blattaria	Blatellidae	<i>Parcoblatta</i> species	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	2 adults
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
NC:Henderson Co., CARL Front Lake ca. 20 m east of inlets, 2 Mar 2011, by hand			

Non-Target Taxa Data			
Order	Family	Species	Specimens
Acariformes	Acari_family	Acari species	1 indiv.
Basommatophora	Ancylidae	Ancylidae species	1 indiv.
Cladocera	Cladocera_family	Cladocera species	2 indivs.
Coleoptera	Dytiscidae	Dytiscidae species	1 adult
Diptera	Chironomidae	Chironomidae species	2 indivs., 3 larvae
Hemiptera	Gerridae	<i>Limnaporus canaliculatus</i> (T Say)	1 adult
Neotaenioglossa	Pleuroceridae	<i>Goniobasis</i> species	2 indiv.
Veneroida	Sphaeriidae	Sphaeriidae species	4 indiv.
NC:Henderson Co., CARL Front Lake east, 15 Feb-22 Mar 2012, Malaise trap			
Hemiptera	Membracidae	Membracidae species	1 adult
Neuroptera	Hemerobiidae	<i>Micromus subanticus</i> (Walker, 1853)	1 ♀
NC:Henderson Co., CARL Front Lake inlet stream, 2 Mar 2011, by hand			
Acariformes	Acari_family	Acari species	1 indiv.
Basommatophora	Physidae	<i>Physa</i> species	3 indiv.
Coleoptera	Dytiscidae	Dytiscidae species	1 adult
Coleoptera	Halipilidae	Halipilidae species	1 adult
Diptera	Chironomidae	Chironomidae species	4 larvae
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 larva
Diptera	Simuliidae	<i>Simulium</i> species	3 larvae
Tricladida	Planariidae	Planariidae species	7 indivs.
Veneroida	Sphaeriidae	Sphaeriidae species	1 indiv.
NC:Henderson Co., CARL Front Lake inlet stream, 26-27 Jul 2011, black light trap			
Coleoptera	Carabidae	Carabidae species	1 adult
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	3 adults
Diptera	Diptera_family	Diptera species	2 adults
Diptera	Tipulidae	<i>Prionocera</i> species	1 adult
NC:Henderson Co., CARL Front Lake near parking lot, 30 Aug 2011, black light (sheet)			
Coleoptera	Coleoptera_family	Coleoptera species	2 adults
Diptera	Limoniidae	<i>Elephantomyia westwoodi</i> Osten Sacken, 1869	1 ♂
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
NC:Henderson Co., CARL Front Lake spring near parking lot, 2 Mar 2011, by hand			
Coleoptera	Dytiscidae	<i>Neoporus undulatus</i> (T Say, 1823)	5 adults
Coleoptera	Halipilidae	<i>Peltodytes shermani</i> Roberts, 1913	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 12-19 Jul 2012, Malaise trap			
Coleoptera	Cerambycidae	Cerambycidae species	1 adult
Coleoptera	Cerambycidae	<i>Hyperplatys aspersa</i> (T Say, 1824)	1 adult
Coleoptera	Cerambycidae	<i>Neoclytus acuminatus acuminatus</i> (Fabricius, 1775)	1 adult
Coleoptera	Cerambycidae	<i>Orthosoma brunneum</i> (Forster, 1771)	1 ♀
Coleoptera	Coleoptera_family	Coleoptera species	1 adult
Coleoptera	Curculionidae	Curculionidae species	3 adults
Coleoptera	Elateridae	Elateridae species	5 adults
Coleoptera	Eucnemidae	<i>Dirrhagofarsus</i> species	1 adult
Coleoptera	Eucnemidae	<i>Isorhipis obliqua</i> (T Say, 1836)	3 ♀
Coleoptera	Hydrophilidae	Hydrophilidae species	1 adult
Coleoptera	Lampyridae	Lampyridae species	1 adult
Coleoptera	Lampyridae	<i>Photinus</i> species	1 ♂
Coleoptera	Lampyridae	<i>Photuris lucicrescens</i> Barber, 1951	1 ♀
Coleoptera	Lycidae	Lycidae species	7 adults
Coleoptera	Monotomidae	<i>Bactridium</i> species	1 adult
Coleoptera	Mordellidae	<i>Mordellistena</i> species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Coleoptera	Silphidae	<i>Nicrophorus orbicollis</i> T Say, 1825	1 adult
Coleoptera	Silphidae	<i>Nicrophorus</i> species	1 adult
Coleoptera	Staphylinidae	Staphylinidae species	2 adults
Coleoptera	Tenebrionidae	Alleculinae species	1 adult
Coleoptera	Tenebrionidae	<i>Capnochroa fuliginosa</i> (Melsheimer, 1846)	1 adult

Non-Target Taxa Data			
Order	Family	Species	Specimens
Diptera	Asilidae	<i>Ommatius</i> species	1 ♀
Diptera	Syrphidae	Syrphidae species	1 adult
Diptera	Tipulomorpha family	Tipulomorpha species	4 adults
Hemiptera	Hemiptera family	Hemiptera species	1 adult
Hymenoptera	Formicidae	Formicidae species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula</i> species (Fabricius)	1 adult
Hymenoptera	Vespidae	<i>Vespula acadica</i> (Sladen, 1918)	1 adult, 1 worker
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	1 adult
Orthoptera	Acrididae	Acrididae species	1 larva
NC:Henderson Co., CARL Front Lake WEST, 15 Feb-22 Mar 2012, Malaise trap			
Coleoptera	Hydrophilidae	Hydrophilidae species	2 adults
Coleoptera	Salpingidae	<i>Rhinosimus viridiaeneus</i> (Randall, 1838)	3 adults
NC:Henderson Co., CARL Front Lake WEST, 16-24 May 2012, Malaise trap			
Coleoptera	Elateridae	Elateridae species	1 adult
Diptera	Tabanidae	Tabanidae species	1 adult
NC:Henderson Co., CARL Front Lake WEST, 22 Mar-1 May 2012, Malaise trap			
Diptera	Asilidae	Asilidae species	2 ♀
Diptera	Asilidae	<i>Asilus</i> species	1 ♀
Diptera	Bibionidae	<i>Dilophus spiniceps</i> T Say, 1823	4 ♀
Diptera	Stratiomyidae	<i>Sargus</i> species	1 adult
Diptera	Therevidae	<i>Viriliricta</i> species	1 ♀
NC:Henderson Co., CARL Front Lake WEST, 24-30 Aug 2011, Malaise trap			
Coleoptera	Elateridae	Elateridae species	2 adults
Coleoptera	Silphidae	<i>Nicrophorus tomentosus</i> Weber, 1801	1 adult
Coleoptera	Staphylinidae	<i>Philonthus caeruleipennis</i> (Mannerheim, 1830)	2 adults
Coleoptera	Staphylinidae	<i>Philonthus</i> species	1 adult
Neuroptera	Coniopterygidae	Coniopterygidae species	2 adults
NC:Henderson Co., CARL Front Lake WEST, 25 Oct-14 Nov 2011, Malaise trap			
Coleoptera	Silphidae	<i>Nicrophorus</i> species	1 adult
NC:Henderson Co., CARL Front Lake WEST, 30 Aug-9 Sep 2011, Malaise trap			
Coleoptera	Coleoptera family	Coleoptera species	12 adults
Diptera	Asilidae	Asilidae species	4 adults, 1 ♀, 1 ♂
Hymenoptera	Formicidae	Formicidae species	2 workers
Hymenoptera	Hymenoptera family	Hymenoptera species	5 adults
NC:Henderson Co., CARL Front Lake WEST, 31 May-7 Jun 2012, Malaise trap			
Coleoptera	Carabidae	<i>Clivina bipustulata</i> (Fabricius, 1801)	1 adult
Coleoptera	Coleoptera family	Coleoptera species	1 adult
NC:Henderson Co., CARL Front Lake WEST, 7-19 Jun 2012, Malaise trap			
Coleoptera	Cerambycidae	<i>Strangalia luteicornis</i> (Fabricius, 1775)	1 adult
Coleoptera	Cerambycidae	<i>Typocerus velutinas velutinas</i> (Olivier, 1795)	1 adult
Coleoptera	Eucnemidae	<i>Deltometopus amoenicornis</i> T Say, 1836	1 adult
Coleoptera	Eucnemidae	<i>Isorhipis obliqua</i> (T Say, 1836)	7 ♀
Hemiptera	Hemiptera family	Hemiptera species	1 adult
NC:Henderson Co., CARL Front Lake WEST, 9-27 Sep 2011, Malaise trap			
Hemiptera	Membracidae	Membracidae species	1 adult
NC:Henderson Co., CARL Front Lake, along shore, 26-27 Jul 2011, black light trap			
Coleoptera	Cerambycidae	<i>Orthosoma brunneum</i> (Forster, 1771)	1 adult
NC:Henderson Co., CARL Front Lake, along shore, 27 Apr 2011, dip net			
Coleoptera	Halipidae	<i>Peltodytes</i> species	5 adults
Hemiptera	Gerridae	Gerridae species	2 adults
Hemiptera	Nepidae	<i>Ranatra australis</i> Hungerford, 1922	2 adults
NC:Henderson Co., CARL Front Lake, along shore, 3 May 2012, by hand			
Coleoptera	Dytiscidae	<i>Laccophilus maculosus</i> T Say, 1823	1 ♀
Hemiptera	Belostomatidae	<i>Belostoma flumineum</i> T Say, 1832	1 adult
Hemiptera	Naucoridae	<i>Pelocoris femoratus</i> (Palisot, 1820)	1 ♀
Hemiptera	Nepidae	<i>Ranatra buenoi</i> Hungerford, 1922	1 adult

Non-Target Taxa Data			
Order	Family	Species	Specimens
NC:Henderson Co., CARL Front Lake, along shore, 30 Aug 2011, sweeping			
Coleoptera	Coleoptera_family	Coleoptera species	1 adult
Coleoptera	Halipidae	<i>Peltodytes muticus</i> (LeConte, 1863)	1 adult
Hemiptera	Nepidae	<i>Ranatra buenoi</i> Hungerford, 1922	1 adult
NC:Henderson Co., CARL Front Lake, along shore, 7 Jun 2011, dip net			
Coleoptera	Coleoptera_family	Coleoptera species	3 adults
Hemiptera	Gerridae	Gerridae species	1 adult
NC:Henderson Co., CARL Memminger Creek below Front Lake, 19-20 Jun 2012, black light trap			
Coleoptera	Anobiidae	<i>Calymnaderus obsoletus</i> (Fall, 1905)	1 adult
Coleoptera	Anobiidae	<i>Petalium incisum</i> Ford, 1973	1 adult
Coleoptera	Curculionidae	<i>Dryophthorus americanus</i> Bedel, 1885	15 adults
Coleoptera	Curculionidae	<i>Xyleborinus saxeseni</i> (Ratzeburg)	28 adults
Coleoptera	Curculionidae	<i>Xyleborus ferrugineus</i> (Fabricius, 1801)	1 adult
Coleoptera	Hydrophilidae	<i>Anacena limbata</i> (Fabricius, 1792)	4 adults
Coleoptera	Hydrophilidae	<i>Berosus aculeatus</i> LeConte, 1855	1 ♀
Coleoptera	Hydrophilidae	<i>Cercyon praetextatus</i> (T Say, 1825)	3 adults
Coleoptera	Hydrophilidae	<i>Enochrus sublongus</i> (Fall, 1926)	2 adults
Coleoptera	Scarabaeidae	<i>Ataenius imbricatus</i> (Melsheimer, 1845)	1 adult
Coleoptera	Scarabaeidae	<i>Serica</i> species	3 adults
NC:Henderson Co., CARL Memminger Creek below Front Lake, 2 Mar 2011, by hand			
Basommatophora	Lymnaeidae	<i>Lymnaea</i> species	1 indiv.
Basommatophora	Physidae	<i>Physa</i> species	1 indiv.
NC:Henderson Co., CARL Mountain Reservoir, 1-16 May 2012, Malaise trap			
Coleoptera	Carabidae	Carabidae species	1 adult
Coleoptera	Carabidae	<i>Cicindela sexguttata</i> Fabricius	2 adults
Coleoptera	Cerambycidae	<i>Microgoes oculatus</i> (LeConte, 1862)	1 adult
Coleoptera	Cerambycidae	<i>Strophiona nitens</i> (Forster, 1771)	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	29 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	5 adults
Diptera	Asilidae	<i>Tipulogaster glabrata</i> Wiedemann, 1828	1 ♀
Diptera	Stratiomyidae	<i>Sargus</i> species	1 adult
Diptera	Syrphidae	<i>Blera</i> species	2 ♀
Diptera	Syrphidae	<i>Epistrophe</i> species	1 ♀
Diptera	Syrphidae	<i>Microdon</i> species	1 adult
Diptera	Syrphidae	Syrphidae species	8 adults
Diptera	Syrphidae	<i>Temnostoma</i> species	1 adult
Diptera	Tabanidae	<i>Chrysops cincticornis</i> Walker, 1848	4 ♀
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
Hymenoptera	Hymenoptera_family	Hymenoptera species	48 adults
NC:Henderson Co., CARL Mountain Reservoir, 12-19 Jul 2012, Malaise trap			
Hymenoptera	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	2 ♀, 10 ♂
NC:Henderson Co., CARL Mountain Reservoir, 15 Feb-22 Mar 2012, Malaise trap			
Diptera	Limoniidae	<i>Chionea scita</i> Walker, 1848	2 ♀, 2 ♂
Lepidoptera	Hesperiidae	<i>Erynnis juvenalis</i> (Fabricius, 1793)	5 adults
Lepidoptera	Nymphalidae	<i>Limenitis arthemis astyanax</i> (Fabricius, 1775)	2 adults
Neuroptera	Coniopterygidae	Coniopterygidae species	1 adult
NC:Henderson Co., CARL Mountain Reservoir, 19-28 Jun 2012, Malaise trap			
Hymenoptera	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	3 ♂, 4 workers
Hymenoptera	Vespidae	<i>Vespula squamosa</i> (Drury, 1773)	1 worker
Hymenoptera	Vespidae	<i>Vespula vidua</i> (Saussure, 1854)	1 worker
NC:Henderson Co., CARL Mountain Reservoir, 22 Mar-1 May 2012, Malaise trap			
Lepidoptera	Sphingidae	<i>Darapsa myron</i> (Cram.)	1 adult
Neuroptera	Coniopterygidae	Coniopterygidae species	4 adults
NC:Henderson Co., CARL Mountain Reservoir, 24 May-7 Jun 2012, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 ♀
NC:Henderson Co., CARL Mountain Reservoir, 28 Jun-5 Jul 2012, Malaise trap			

Non-Target Taxa Data			
Order	Family	Species	Specimens
Lepidoptera	Nymphalidae	<i>Limenitis arthemis astyanax</i> (Fabricius, 1775)	1 adult
NC:Henderson Co., CARL Mountain Reservoir, 30 Aug-9 Sep 2011, Malaise trap			
Coleoptera	Carabidae	Carabidae species	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	1 adult
Coleoptera	Erotylidae	Erotylidae species	2 adults
Coleoptera	Latridiidae	Latridiidae species	1 adult
Coleoptera	Scolytidae	Scolytidae species	1 adult
Coleoptera	Staphylinidae	Staphylinidae species	6 adults
Hymenoptera	Formicidae	Formicidae species	6 workers
Neuroptera	Coniopterygidae	Coniopterygidae species	5 adult
NC:Henderson Co., CARL Mountain Reservoir, 5-12 Jul 2012, Malaise trap			
Diptera	Asilidae	<i>Asilus</i> species	1 ♂
Diptera	Asilidae	<i>Laphria</i> species	1 ♂
Diptera	Asilidae	<i>Leptogaster</i> species	1 ♀, 4 ♂
Diptera	Asilidae	<i>Taracticus</i> species	2 ♀
Diptera	Asilidae	<i>Tipulogaster glabrata</i> Wiedemann, 1828	1 ♂
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	3 workers
NC:Henderson Co., CARL Mountain Reservoir, date unknown, Malaise trap			
Neuroptera	Hemerobiidae	<i>Hemerobius stigma</i> Stephens, 1836	1 ♂
NC:Henderson Co., CARL Pasture Cr inlet to Side Lake, 30 Jul-4 Aug 2011, Malaise trap			
Coleoptera	Curculionidae	Curculionidae species	1 adult
Coleoptera	Elateridae	Elateridae species	24 adults
Coleoptera	Lampyridae	Lampyridae species	6 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	2 adults
Hemiptera	Cercopidae	<i>Prosapia bicincta</i> (T Say, 1830)	8 adults
Hemiptera	Cicadellidae	Cicadellidae species	1 adult
Hemiptera	Pentatomidae	<i>Euschistus tristigmus</i> (T Say, 1832)	1 ♂
Hymenoptera	Chrysididae	Chrysididae species	1 adult
Hymenoptera	Hymenoptera_family	Hymenoptera species	4 adults
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	2 workers
Mecoptera	Bittacidae	<i>Bittacus stigmaterus</i> T Say, 1923	1 ♂
NC:Henderson Co., CARL Pasture Creek below Side Lake, 19-20 Jun 2012, black light trap			
Coleoptera	Carabidae	Carabidae species	5 adults
Coleoptera	Carabidae	<i>Semiclivina dentipes</i> (Dejean, 1825)	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	2 adults
Coleoptera	Dytiscidae	<i>Ilybius biguttulus</i> (Germar, 1824)	1 ♂
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	12 adults
Mecoptera	Bittacidae	<i>Bittacus pilicornis</i> Westwood, 1846	1 ♂
Neuroptera	Coniopterygidae	Coniopterygidae species	1 adult
NC:Henderson Co., CARL Pasture Creek below Side Lake, 2 Mar 2011, by hand			
Basommatophora	Lymnaeidae	<i>Lymnaea</i> species	1 indiv.
Coleoptera	Dryopidae	<i>Helichus basalis</i> LeConte, 1852	1 adult
Coleoptera	Ptilodactylidae	<i>Anchytarsus bicolor</i> (Melsheimer, 1846)	1 larva
Diptera	Ceratopogonidae	<i>Bezzia/Palpomyia</i> species	1 larva
Diptera	Chironomidae	Chironomidae species	6 larvae
Neotaenioglossa	Pleuroceridae	<i>Goniobasis</i> species	4 indivs.
Neotaenioglossa	Pleuroceridae	Pleuroceridae species	1 indiv.
Oligochaeta_order	Oligochaeta_family	Oligochaeta species	4 indivs.
NC:Henderson Co., CARL Pasture Creek West, 30 Jul-4 Aug 2011, Malaise trap			
Diptera	Diptera_family	Diptera species	12 adults
Hemiptera	Coreidae	Coreidae species	1 adult
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	3 workers
Hymenoptera	Vespidae	<i>Vespula</i> species	1 worker
Mecoptera	Meropidae	<i>Merope tuber</i> Newman, 1838	1 ♂
Mecoptera	Panorpidae	<i>Panorpa rufescens</i> Rambur, 1842	1 ♂
NC:Henderson Co., CARL Side Lake at dam, 22-23 Aug 2012, black light trap			

Non-Target Taxa Data			
Order	Family	Species	Specimens
Coleoptera	Carabidae	Carabidae species	7 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	14 adults
Neuroptera	Coniopterygidae	Coniopterygidae species	1 adult
Neuroptera	Sisyridae	<i>Sisyra vicaria</i> (Walker, 1853)	1 adult
NC:Henderson Co., CARL Side Lake at dam, 26-27 Jul 2011, black light trap			
Coleoptera	Coleoptera family	Coleoptera species	24 adults
Hemiptera	Hemiptera family	Hemiptera species	1 adult
NC:Henderson Co., CARL Side Lake North, date unknown, Malaise trap			
Coleoptera	Buprestidae	<i>Paragrillus tenuis</i> (LeConte, 1863)	2 adults
Coleoptera	Carabidae	Carabidae species	1 adult
Coleoptera	Dryopidae	<i>Helichus lithophilus</i> (Germar, 1824)	1 adult
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Haliplidae	<i>Haliplus fasciatus</i> Aubé, 1838	2 adults
Coleoptera	Haliplidae	<i>Peltodytes shermani</i> Roberts, 1913	1 ♀, 1 ♂
Coleoptera	Lampyridae	Lampyridae species	2 adults
Coleoptera	Lycidae	Lycidae species	2 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	4 adults
Diptera	Asilidae	Asilidae species	76 adults
Diptera	Ceratopogonidae	<i>Echinohelea lanei</i> Wirth, 1951	7 ♀, 11 ♂
Diptera	Chloropidae	<i>Ceratobarys eulophus</i> (Loew, 1872)	11 adults
Diptera	Diptera family	Diptera species	9 adults
Diptera	Richardiidae	<i>Odontomera ferruginea</i> Macquart, 1843	1 ♀
Diptera	Sciomyzidae	<i>Dictya</i> species	1 adult
Diptera	Syrphidae	<i>Ocyrtamys fuscipennis</i> (Macquart, 1834)	1 adult
Diptera	Tabanidae	<i>Chlorotabanus crepuscularis</i> (Bequaert, 1926)	1 ♀
Hemiptera	Cercopidae	<i>Prosapia bicincta</i> (T Say, 1830)	2 adults
Hemiptera	Membracidae	Membracidae species	1 adult
Hemiptera	Pentatomidae	<i>Chinavia hilaris</i> (T Say, 1832)	1 adult
Hymenoptera	Formicidae	Formicidae species	1 worker
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 worker
Hymenoptera	Vespidae	<i>Polistes</i> species	2 adults
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	1 worker
Hymenoptera	Vespidae	<i>Vespula squamosa</i> (Drury, 1773)	1 worker
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	7 adults
Lepidoptera	Hesperiidae	<i>Epargyreus clarus</i> (Cramer, 1775)	1 adult
Lepidoptera	Hesperiidae	<i>Polites coras</i> (Cram.)	2 adults
Lepidoptera	Papilionidae	<i>Papilio glaucus</i> Linnaeus	3 adults
NC:Henderson Co., CARL Side Lake North, 11-16 May 2012, Malaise trap			
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	14 adults
Lepidoptera	Lycaenidae	<i>Celastrina neglectamajor</i> Tutt	3 adults
Lepidoptera	Lycaenidae	<i>Everes comyntas</i> (Godart, 1824)	12 adults
Lepidoptera	Nymphalidae	<i>Junonia coenia</i> Hübner, 1822	1 adult
Lepidoptera	Nymphalidae	<i>Polygonia interrogationis</i> (Fabricius, 1798)	1 adult
NC:Henderson Co., CARL Side Lake North, 14 Nov-15 Feb 2012, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 ♀
Neuroptera	Hemerobiidae	<i>Hemerobius stigma</i> Stephens, 1836	1 ♀
Neuroptera	Hemerobiidae	<i>Micromus subanticus</i> (Walker, 1853)	1 adult
NC:Henderson Co., CARL Side Lake North, 15 Feb-22 Mar 2012, Malaise trap			
Coleoptera	Dytiscidae	<i>Neoporus carolinus</i> (Fall, 1917)	1 ♀
Coleoptera	Haliplidae	<i>Peltodytes muticus</i> (LeConte, 1863)	10 adults
Coleoptera	Haliplidae	<i>Peltodytes shermani</i> Roberts, 1913	1 ♀
Coleoptera	Hydrophilidae	<i>Enochrus</i> species	1 ♀
Coleoptera	Hydrophilidae	<i>Hydrochara soror</i> Smetana, 1980	1 adult
Hemiptera	Gerridae	Gerridae species	1 adult
Hemiptera	Veliidae	Veliidae species	1 adult
Lepidoptera	Hesperiidae	<i>Erynnis juvenalis</i> (Fabricius, 1793)	1 adult
Lepidoptera	Lycaenidae	<i>Everes comyntas</i> (Godart, 1824)	4 adults
Lepidoptera	Nymphalidae	<i>Phyciodes tharos</i> (Drury)	1 adult

Non-Target Taxa Data			
Order	Family	Species	Specimens
Lepidoptera	Papilionidae	<i>Papilio troilus</i> Linnaeus	1 adult
NC:Henderson Co., CARL Side Lake North, 19-28 Jun 2012, Malaise trap			
Hymenoptera	Hymenoptera_family	Hymenoptera species	1 adult
Hymenoptera	Ichneumonidae	Ichneumonidae species	1 adult
Hymenoptera	Vespidae	<i>Polistes</i> species	3 ♀
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	1 worker
Neuroptera	Coniopterygidae	Coniopterygidae species	1 adult
NC:Henderson Co., CARL Side Lake North, 22 Mar-1 May 2012, Malaise trap			
Lepidoptera	Nymphalidae	<i>Junonia coenia</i> Hübner, 1822	1 adult
Lepidoptera	Nymphalidae	<i>Vanessa atalanta rubria</i> (Fruhstorfer, 1909)	1 adult
NC:Henderson Co., CARL Side Lake North, 28 Jun-5 Jul 2012, Malaise trap			
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	11 adults
Lepidoptera	Nymphalidae	<i>Phyciodes tharos</i> (Drury)	1 adult
Lepidoptera	Nymphalidae	<i>Satyroides appalachia</i> (R. Chermock)	1 adult
Lepidoptera	Nymphalidae	<i>Vanessa atalanta rubria</i> (Fruhstorfer, 1909)	1 adult
NC:Henderson Co., CARL Side Lake North, 31 May-7 Jun 2012, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	3 ♀, 5 ♂
NC:Henderson Co., CARL Side Lake North, 5-12 Jul 2012, Malaise trap			
Coleoptera	Buprestidae	Buprestidae species	1 adult
Coleoptera	Coleoptera_family	Coleoptera species	7 adults
Coleoptera	Curculionidae	<i>Dryophthorus americanus</i> Bedel, 1885	1 adult
Coleoptera	Curculionidae	<i>Laemosaccus nephele</i> (Herbst, 1797)	1 adult
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Halplidae	<i>Pelodytes muticus</i> (LeConte, 1863)	6 adults
Coleoptera	Hydrophilidae	<i>Anacena suturalis</i> (Fabricius, 1792)	10 adults
Coleoptera	Scarabaeidae	<i>Popillia japonica</i> Newman, 1841	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Diptera	Diptera_family	Diptera species	7 adults
Diptera	Rhagionidae	<i>Chrysopilus basalis</i> (Walker, 1860)	2 adults
Hemiptera	Anthocoridae	Anthocoridae species	2 adults
Hemiptera	Cercopidae	<i>Prosapia bicincta</i> (T Say, 1830)	2 adults
Hemiptera	Tingidae	Tingidae species	11 adults
Hymenoptera	Mutillidae	<i>Pseudomethoca</i> species	1 adult
Hymenoptera	Mutillidae	<i>Timulla</i> species	1 ♀
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 adult
Hymenoptera	Vespidae	<i>Vespula maculifrons</i> (Buysson, 1905)	4 adults
Hymenoptera	Vespidae	<i>Vespula squamosa</i> (Drury, 1773)	1 adult
Lepidoptera	Sphingidae	<i>Xylophanes tersa</i> (Linnaeus)	1 adult
Neuroptera	Coniopterygidae	Coniopterygidae species	4 adults
NC:Henderson Co., CARL Side Lake North, 7-19 Jun 2012, Malaise trap			
Coleoptera	Cerambycidae	Cerambycidae species	4 adults
Coleoptera	Coleoptera_family	Coleoptera species	9 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Hymenoptera	Sphecidae	Sphecidae species	2 ♀
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	2 workers
Hymenoptera	Vespidae	<i>Dolichovespula</i> species (Fabricius)	2 workers
Hymenoptera	Vespidae	<i>Polistes</i> species	1 worker
Lepidoptera	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	2 adults
Lepidoptera	Hesperiidae	<i>Epargyreus clarus</i> (Cramer, 1775)	1 adult
Lepidoptera	Lycaenidae	<i>Everes comyntas</i> (Godart, 1824)	2 adults
Lepidoptera	Nymphalidae	<i>Chlosyne nycteis</i> (E Doubleday, 1847)	1 adult
Lepidoptera	Nymphalidae	<i>Junonia coenia</i> Hübner, 1822	2 adults
Lepidoptera	Nymphalidae	<i>Satyroides appalachia</i> (R. Chermock)	3 adults
Lepidoptera	Papilionidae	<i>Papilio glaucus</i> L.	1 ♂
Lepidoptera	Sphingidae	<i>Xylophanes tersa</i> (Linnaeus)	4 adults

Non-Target Taxa Data			
Order	Family	Species	Specimens
NC:Henderson Co., CARL Side Lake, 16 Aug 2011, sweeping			
Coleoptera	Coleoptera_family	Coleoptera species	1 adult
Diptera	Diptera_family	Diptera species	1 adult
Hemiptera	Pentatomidae	Pentatomidae species	1 adult
Hemiptera	Veliidae	Veliidae species	6 adults
NC:Henderson Co., CARL Side Lake, 19 Jun 2012, black light (sheet)			
Coleoptera	Cleridae	Cleridae species	1 adult
Coleoptera	Hydrophilidae	Hydrophilidae species	2 adults
Coleoptera	Hydrophilidae	<i>Tropisternus collaris</i> (Fabricius, 1775)	1 adult
Strepsiptera	Corioxenidae	<i>Triozocera</i> species	1 ♂
NC:Henderson Co., CARL Side Lake, 2 Mar 2011, by hand			
Acariformes	Acar_i_family	Acar_i species	7 indivs.
Coleoptera	Halipidae	Halipidae species	4 adults
Tricladida	Tricladida_family	Tricladida species	1 indiv.
NC:Henderson Co., CARL Side Lake, 27 Jul 2011, sweeping			
Diptera	Asilidae	Asilidae species	1 adult
Lepidoptera	Sesiidae	<i>Synanthedon scitula</i> (Harr)	1 ♀
NC:Henderson Co., CARL Side Lake, 30-31 Aug 2011, black light trap			
Coleoptera	Carabidae	Carabidae species	33 adults
Coleoptera	Halipidae	<i>Peltodytes muticus</i> (LeConte, 1863)	2 adults
Coleoptera	Heteroceridae	<i>Heterocerus</i> species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	2 adults
Hemiptera	Pentatomidae	<i>Euschistus tristigmus</i> (T Say, 1832)	1 ♀
NC:Henderson Co., CARL Side Lake, 31 Aug 2011, dip net			
Coleoptera	Halipidae	<i>Peltodytes muticus</i> (LeConte, 1863)	4 adults
Coleoptera	Halipidae	<i>Peltodytes sexmaculatus</i> Roberts, 1913	1 adult
Coleoptera	Hydrophilidae	<i>Derallus altus</i> (LeConte, 1855)	1 adult
Hemiptera	Hemiptera_family	Hemiptera species	2 larvae
Hemiptera	Mesoveliidae	<i>Mesovelia mulsanti</i> White, 1879	2 ♀, 1 ♀ larva
Hemiptera	Veliidae	<i>Microvelia</i> species	3 ♀
NC:Henderson Co., CARL Side Lake, 7 Oct 2011, by hand			
Acariformes	Acar_i_family	Acar_i species	16 indivs.
Basommatophora	Physidae	<i>Physa</i> species	2 indiv.
Coleoptera	Halipidae	<i>Halipus fasciatus</i> Aubé, 1838	1 ♀, 4 ♂
Coleoptera	Halipidae	<i>Peltodytes lengi</i> Roberts, 1913	2 ♀
Coleoptera	Halipidae	<i>Peltodytes oppositus</i> Roberts, 1913	1 ♀
Diptera	Chironomidae	Chironomidae species	5 larvae, 1 pupa
Diptera	Culicidae	<i>Anopheles</i> species	2 larvae
Diptera	Syrphidae	Syrphidae species	1 adult
Gastropoda_order	Gastropoda_family	Slug species	1 indiv.
Hemiptera	Aphididae	Aphididae species	11 adults
Hemiptera	Gerridae	<i>Limnporus</i> species	1 larva
Hemiptera	Gerridae	<i>Neogerris hesione</i> (Kirkaldy, 1902)	3 ♀, 3 ♂
Hemiptera	Gerridae	<i>Trepobates inermis</i> Esaki, 1926	1 ♀, 1 ♂
Hemiptera	Mesoveliidae	<i>Mesovelia mulsanti</i> White, 1879	2 ♂
Hemiptera	Pentatomidae	<i>Amaurochrous cinctipes</i> (T Say, 1828)	1 ♂
Hemiptera	Veliidae	<i>Microvelia pulchella</i> Westwood, 1834	10 ♀, 1 ♂, 2 larvae
Orthoptera	Orthoptera_family	Orthoptera species	1 ♀
NC:Henderson Co., CARL trib to Pasture Creek below entrance road, 26-27 Jul 2012, black light trap			
Coleoptera	Carabidae	Carabidae species	2 adults
Coleoptera	Cerambycidae	Cerambycidae species	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	1 adult
Hemiptera	Cicadellidae	Cicadellidae species	2 adults
NC:Henderson Co., CARL trib to Side Lake above duck cage, 26-27 Jul 2012, black light trap			
Dermaptera	Dermaptera_family	Dermaptera species	1 adult
Diptera	Diptera_family	Diptera species	1 adult
Hemiptera	Cercopidae	<i>Prosapia bicincta</i> (T Say, 1830)	6 adults

Non-Target Taxa Data			
Order	Family	Species	Specimens
Hemiptera	Cicadellidae	Cicadellidae species	6 adults
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
Hymenoptera	Hymenoptera_family	Hymenoptera species	2 adults
Lepidoptera	Hesperiidae	<i>Poanes zabulon</i> (Boisduval & LeConte, 1837)	1 ♂
Mecoptera	Bittacidae	<i>Bittacus pilicornis</i> Westwood, 1846	1 ♀
Neuroptera	Chrysopidae	Chrysopidae species	2 adults
Orthoptera	Orthoptera_family	Orthoptera species	1 ♀
NC:Henderson Co., CARL Trout Pond drain, 19-20 Jun 2012, black light trap			
Coleoptera	Curculionidae	Curculionidae species	1 adult
Coleoptera	Hydrophilidae	<i>Cymbiodyta</i> species	1 adult
Coleoptera	Staphylinidae	Staphylinidae species	1 adult
Diptera	Ceratopogonidae	<i>Echinohelea lanei</i> Wirth, 1951	1 ♂
NC:Henderson Co., CARL Trout Pond effluent, 26-30 Jul 2011, Malaise trap			
Hymenoptera	Vespidae	<i>Dolichovespula maculata</i> (Linnaeus, 1763)	1 adult
NC:Henderson Co., CARL Trout Pond effluent, 27 Apr 2011, dip net			
Hemiptera	Veliidae	<i>Microvelia</i> species	2 adults
NC:Henderson Co., CARL Trout Pond spring, 19 Jun 2012, by hand			
Diptera	Micropezidae	<i>Rainieria antennae</i> (T Say, 1823)	1 ♀
Orthoptera	Rhaphidophoridae	<i>Ceuthophilus uhleri</i> Scudder, 1862	1 ♀
NC:Henderson Co., CARL Trout Pond spring, 26-27 Jul 2012, black light trap			
Coleoptera	Carabidae	Carabidae species	4 adults
Coleoptera	Coleoptera_family	Coleoptera species	6 adults
Coleoptera	Passalidae	<i>Odontotaenius disjunctus</i> (Illiger, 1800)	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	12 adults
Hemiptera	Hemiptera_family	Hemiptera species	6 adults
Hemiptera	Membracidae	Membracidae species	2 adults
Hymenoptera	Formicidae	Formicidae species	1 worker
Orthoptera	Gryllidae	Gryllidae species	1 adult
NC:Henderson Co., CARL Trout Pond spring, 30 May 2012, by hand			
Diptera	Limoniidae	<i>Hexatoma</i> species	1 larva
Nematomorpha_order	Nematomorpha_family	Nematomorpha species	4 indivs.
Tricladida	Tricladida_family	Tricladida species	5 indivs.
NC:Henderson Co., CARL Trout Pond spring, 4 Oct 2012-7 May 2013, Malaise trap			
Diptera	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	1 adult
Lepidoptera	Geometridae	<i>Trichodezia albovittata</i> (Guenée, 1857)	1 adult
Neuroptera	Chrysopidae	Chrysopidae_genus species	1 ♀
Neuroptera	Hemerobiidae	<i>Hemerobius stigma</i> Stephens, 1836	1 ♀
NC:Henderson Co., CARL Trout Pond spring, date unknown, Malaise trap			
Neuroptera	Coniopterygidae	Coniopterygidae species	1 ♂
NC:Henderson Co., CARL Trout Pond, 22-23 Aug 2012, black light trap			
Coleoptera	Elateridae	Elateridae species	1 adult
Coleoptera	Heteroceridae	<i>Tropicus pusillus</i> (T Say, 1823)	1 adult
Coleoptera	Scarabaeidae	Scarabaeidae species	3 adults
Hemiptera	Hemiptera_family	Hemiptera species	1 adult
Orthoptera	Gryllidae	Gryllidae species	2 adults
NC:Henderson Co., CARL Trout Pond, 26-27 Jul 2011, black light trap			
Coleoptera	Elateridae	Elateridae species	1 adult
NC:Henderson Co., CARL Trout Pond, 30 May 2011, by hand			
Coleoptera	Coleoptera_family	Coleoptera species	2 adults
Coleoptera	Hydrophilidae	<i>Cymbiodyta eumera</i> Smetana, 1974	1 ♀, 2 ♂
NC:Henderson Co., CARL Trout Pond, 6-7 Jun 2011, black light trap			
Coleoptera	Coleoptera_family	Coleoptera species	7 adults
Coleoptera	Scarabaeidae	Scarabaeidae species	25 adults
Diptera	Rhagionidae	Rhagionidae species	2 adults

Appendix 4. Species List

All taxa found to occur in Carl Sandburg Home National Historic Site (CARL) during this study are listed below. We found 336 taxa, of which 212 are aquatic. Of the aquatic species, 165 are target species, including 13 Ephemeroptera, 38 Odonata, 19 Plecoptera, 6 Megaloptera, and 89 Trichoptera.

Common names are provided in the list for those taxa that have common names. The Odonata and Plecoptera have “official” common names that are in wide use and are generally widely accepted. Common names are used for those insects. Most insects and other invertebrate groups do not have “official” common names for different species. For those groups, only a few species have assigned common names. For a separate project, we created common names for some mayflies and caddisflies. These names are included here. The names provided for the rest of the taxa are names that apply to genera, families, orders, or in some cases to higher taxonomic categories.

Species are presented as names that include the genus, the species epithet, and the author, such as “*Calymmaderus obsoletus* (Fall, 1905)”. Taxa include those entries such as “*Paria* species” in a genus not identified to species, that was collected, but that could not be identified to species. No other representatives of the genus *Paria* were collected that could be identified to species. Since the genus *Paria* is clearly present in CARL, such entries are included to recognize the occurrence of the genus in the park.

The majority of taxa listed are aquatic. One hundred nineteen taxa are terrestrial. These are indicated in the table by a tan background.

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
BLATTARIA	Blattellidae	<i>Parcoblatta</i> species	Wood Roach
COLEOPTERA	Anobiidae	<i>Calymmaderus obsoletus</i> (Fall, 1905)	Death-watch Beetle
		<i>Petalium incisum</i> Ford, 1973	Death-watch Beetle
	Buprestidae	<i>Paragrilus tenuis</i> (LeConte, 1863)	Metallic Wood Boring Beetle
	Carabidae	<i>Cicindela sexguttata</i> Fabricius	Six-spotted Tiger Beetle
		<i>Clivina bipustulata</i> (Fabricius, 1801)	Ground Beetle
		<i>Clivina dentipes</i> Dejean, 1825	Ground Beetle
	Cerambycidae	<i>Hyperplatys aspersa</i> (Say, 1824)	Spotted Longhorn Beetle
		<i>Leptorhabdium pictum</i> (Haldeman, 1847)	Long-horned Beetle
		<i>Microgoes oculatus</i> (LeConte, 1862)	Northeastern Pine Sawyer
		<i>Neoclytus acuminatus acuminatus</i> (Fabricius, 1775)	Redheaded Ash Borer
		<i>Orthosoma brunneum</i> (Forster, 1771)	Brown Prionid
		<i>Strangalepta abbreviata</i> (Germar, 1824)	Flower Long-horn Beetle
		<i>Strangalia luteicornis</i> (Fabricius, 1775)	Zebra-striped Flower Long-horn Beetle
		<i>Strophiona nitens</i> (Forster, 1771)	Chestnut Bark Borer
		<i>Typocerus velutinas velutinas</i> (Olivier, 1795)	Banded Long-horn Beetle
	Chrysomelidae	<i>Paria</i> species	Leaf Beetle
	Curculionidae	<i>Dryophthorus americanus</i> Bedel, 1885	Weevil
		<i>Laemosaccus nephele</i> (Herbst, 1797)	Weevil
		<i>Xyleborinus saxeseni</i> (Ratzeburg)	Fruit-tree Pinhole Borer
		<i>Xyleborus ferrugineus</i> (Fabricius, 1801)	Ambrosia Beetle
	Dryopidae	<i>Helichus basalis</i> LeConte, 1852	Long-toed Water Beetle

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
	Dytiscidae	<i>Helichus lithophilus</i> (Germar, 1824)	Long-toed Water Beetle
		<i>Ilybius biguttulus</i> (Germar, 1824)	Predaceous Diving Beetle
		<i>Laccophilus maculosus</i> Say, 1823	Predaceous Diving Beetle
		<i>Neoporus carolinus</i> (Fall, 1917)	Predaceous Diving Beetle
		<i>Neoporus undulatus</i> (Say, 1823)	Predaceous Diving Beetle
	Eucnemidae	<i>Deltometopus amoenicornis</i> Say, 1836	False Click Beetle
		<i>Dirrhagofarsus</i> species	False Click Beetle
		<i>Isorhipis obliqua</i> (Say, 1836)	False Click Beetle
	Haliplidae	<i>Haliplus fasciatus</i> Aubé, 1838	Crawling Water Beetle
		<i>Peltodytes lengi</i> Roberts, 1913	Crawling Water Beetle
		<i>Peltodytes muticus</i> (LeConte, 1863)	Crawling Water Beetle
		<i>Peltodytes oppositus</i> Roberts, 1913	Crawling Water Beetle
		<i>Peltodytes sexmaculatus</i> Roberts, 1913	Crawling Water Beetle
		<i>Peltodytes shermani</i> Roberts, 1913	Crawling Water Beetle
	Heteroceridae	<i>Heterocerus</i> species	Variegated Mud-loving Beetle
		<i>Tropicus pusillus</i> (Say, 1823)	Variegated Mud-loving Beetle
	Hydrophilidae	<i>Anacena limbata</i> (Fabricius, 1792)	Water Scavenger Beetle
		<i>Anacena suturalis</i> (Fabricius, 1792)	Water Scavenger Beetle
		<i>Berosus aculeatus</i> LeConte, 1855	Water Scavenger Beetle
		<i>Cercyon praetextatus</i> (Say, 1825)	Water Scavenger Beetle
		<i>Cymbiodyta eumera</i> Smetana, 1974	Water Scavenger Beetle
		<i>Derallus altus</i> (LeConte, 1855)	Water Scavenger Beetle
		<i>Enochrus</i> species	Water Scavenger Beetle
		<i>Hydrochara soror</i> Smetana, 1980	Water Scavenger Beetle
		<i>Tropisternus collaris</i> (Fabricius, 1775)	Water Scavenger Beetle
	Lampyridae	<i>Photinus</i> species	Firefly, Lightningbug
		<i>Photuris lucicrescens</i> Barber, 1951	Firefly, Lightningbug
	Latridiidae	<i>Corticaria</i> species	Minute Brown Scavenger Beetle
	Monotomidae	<i>Bactridium</i> species	Root-eating Beetle
	Mordellidae	<i>Mordellistena</i> species	Tumbling Flower Beetle
	Mycetophagidae	<i>Litargus</i> species	Hairy Fungus Beetle
	Passalidae	<i>Odontotaenius disjunctus</i> (Illiger, 1800)	Horned Passalus
	Ptilodactylidae	<i>Anchytarsus bicolor</i> (Melsheimer, 1846)	Long-toed Water Beetle
	Salpingidae	<i>Rhinosimus viridiaeneus</i> (Randall, 1838)	Narrow-waisted Bark Beetle
	Scarabaeidae	<i>Ataenius imbricatus</i> (Melsheimer, 1845)	Scarab Beetle
		<i>Popillia japonica</i> Newman, 1841	Japanese Beetle
		<i>Serica</i> species	Scarab Beetle
	Scirtidae	<i>Prionocyphon</i> species	Marsh Beetle
	Silphidae	<i>Nicrophorus orbicollis</i> Say, 1825	Roundneck Sexton Beetle
		<i>Nicrophorus tomentosus</i> Weber, 1801	Tomentose Burying Beetle
	Staphylinidae	<i>Philonthus caeruleipennis</i> (Mannerheim, 1830)	Rove Beetle
	Tenebrionidae	<i>Arthromacra aenea</i> Say	Darkling Beetle
		<i>Capnochora fuliginosa</i> (Melsheimer, 1846)	Comb-clawed Beetle
DERMAPTERA	Forficulidae	<i>Forficula auricularia</i> Linnaeus, 1758	European Earwig
DIPTERA	Asilidae	<i>Asilus</i> species	Robber Fly
		<i>Laphria</i> species	Robber Fly
		<i>Leptogaster</i> species	Grass Fly
		<i>Ommatius</i> species	Robber Fly

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
		<i>Taracticus</i> species	Robber Fly
		<i>Tipulogaster glabrata</i> Wiedemann, 1828	Grass Fly
	Bibionidae	<i>Dilophus spiniceps</i> Say, 1823	March Fly
	Bombyliidae	<i>Anthrax</i> species	Bee Fly
		<i>Bombylius</i> species	Bee Fly
		<i>Villa</i> species	Bee Fly
	Ceratopogonidae	<i>Echinohelea lanei</i> Wirth, 1951	Spiny Predaceous No-see-um
	Chloropidae	<i>Ceratobarys eulophus</i> (Loew, 1872)	Frit Fly
	Culicidae	<i>Anopheles</i> species	Mosquito
	Dolichopodidae	<i>Campsicnemus</i> species	Long-legged Fly
		<i>Condylostylus</i> species	Long-legged Fly
		<i>Hercostomus</i> species	Long-legged Fly
		<i>Medetera</i> species	Long-legged Fly
		<i>Thrypticus</i> species	Long-legged Fly
	Limoniidae	<i>Chionea scita</i> Walker, 1848	Snow Crane Fly
		<i>Elephantomyia westwoodi</i> Osten Sacken, 1869	Long-snouted Crane Fly
		<i>Hexatoma</i> species	Crane Fly
	Micropezidae	<i>Rainieria antennaepe</i> s (Say, 1823)	Stilt-legged Fly
	Ptychopteridae	<i>Bittacomorpha clavipes</i> (Fabricius, 1781)	Phantom Crane Fly
	Rhagionidae	<i>Chrysopilus basalis</i> (Walker, 1860)	Snipe Fly
	Richardiidae	<i>Odontomera ferruginea</i> Macquart, 1843	Richardid Fly
	Sciomyzidae	<i>Dictya</i> species	Snail-killing Fly, Marsh Fly
	Simuliidae	<i>Simulium</i> species	Black Fly
	Stratiomyidae	<i>Sargus</i> species	Soldier Fly
	Syrphidae	<i>Blera</i> species	Hover Fly, Flower Fly
		<i>Epistrophe</i> species	Hover Fly, Flower Fly
		<i>Microdon</i> species	Hover Fly, Flower Fly
		<i>Ocyptamus fuscipennis</i> (Macquart, 1834)	Hover Fly, Flower Fly
		<i>Temnostoma</i> species	Hover Fly, Flower Fly
	Tabanidae	<i>Chlorotabanus crepuscularis</i> (Bequaert, 1926)	Horse Fly
		<i>Chrysops cincticornis</i> Walker, 1848	Deer Fly
	Therevidae	<i>Viriliricta</i> species	Stilto Fly
	Tipulidae	<i>Prionocera</i> species	Crane Fly
	Xylophagidae	<i>Rachicercus obscuripennis</i> Loew, 1863	Xylophagid Fly
Ephemeroptera	Baetidae	<i>Procladius</i> species	Small Minnow Mayfly
		<i>Pseudocloeon</i> species	Small Minnow Mayfly
	Caenidae	<i>Caenis amica</i> HA Hagen, 1861	Small Squaregill Mayfly
		<i>Caenis diminuta diminuta</i> Walker, 1853	Small Squaregill Mayfly
		<i>Caenis punctata</i> J McDunnough, 1931	Small Squaregill Mayfly
	Ephemerellidae	<i>Dannella lita</i> (Burks, 1949)	Spiny Crawler Mayfly
	Heptageniidae	<i>Maccaffertium merivulcanum</i> (Carle & Lewis, 1978)	Flat-headed Mayfly
		<i>Maccaffertium modestum</i> (Banks, 1910)	Flat-headed Mayfly
		<i>Stenacron</i> species	Flat-headed Mayfly
	Isonychiidae	<i>Isonychia</i> species	Brushy-legged Minnow Mayfly
	Leptophlebiidae	<i>Habrophlebiodes</i> species	Pronggill Mayfly
		<i>Leptophlebia johnsoni</i> J McDunnough, 1924	Pronggill Mayfly
	Siphonuridae	<i>Siphonurus</i> species	Big Minnow Mayfly

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
HEMIPTERA	Belostomatidae	<i>Belostoma flumineum</i> Say, 1832	Giant Water Bug
	Cercopidae	<i>Prosapia bicincta</i> (Say, 1830)	Two-lined Spittlebug
	Gerridae	<i>Limnporus canaliculatus</i> (Say)	Water Strider
		<i>Neogerris hesione</i> (Kirkaldy, 1902)	Water Strider
		<i>Trepobates inermis</i> Esaki, 1926	Water Strider
	Hydrometridae	<i>Hydrometra</i> species	Marsh Treader
	Membracidae	<i>Acutalis tartarea</i> (Say, 1830)	Treehopper
	Mesoveliidae	<i>Mesovelia mulsanti</i> White, 1879	Water Treader
	Naucoridae	<i>Pelocoris femoratus</i> (Palisot, 1820)	Creeping Water Bug
	Nepidae	<i>Ranatra australis</i> Hungerford, 1922	Water Scorpion
		<i>Ranatra buenoi</i> Hungerford, 1922	Waterscorpion
	Pentatomidae	<i>Amaurochrous cinctipes</i> (Say, 1828)	Turtle Bug
		<i>Chinavia hilaris</i> (Say, 1832)	Green Stink Bug
		<i>Euschistus tristigmus</i> (Say, 1832)	Dusky Stink Bug
	Plataspidae	<i>Megacopta cribraria</i> (Fabricius, 1798)	Kudzu Bug, Bean Plataspid
	Veliidae	<i>Microvelia pulchella</i> Westwood, 1834	Broad-shouldered Water Strider
HYMENOPTERA	Mutillidae	<i>Pseudomethoca</i> species	Velvet Ant
		<i>Timulla</i> species	Velvet Ant
	Vespidae	<i>Dolichovespula arenaria</i> (Fabricius, 1775)	Aerial Yellowjacket
		<i>Dolichovespula maculata</i> (Linnaeus, 1763)	Bald-faced Hornet
		<i>Polistes</i> species	Paper Wasp
		<i>Vespa crabro</i> Linnaeus, 1758	European Hornet
		<i>Vespula acadica</i> (Sladen, 1918)	Forest Yellowjacket
		<i>Vespula germanica</i> Fabricius, 1793	German Yellowjacket
		<i>Vespula maculifrons</i> (Buysson, 1905)	Eastern Yellowjacket
		<i>Vespula squamosa</i> (Drury, 1773)	Southern Yellowjacket
		<i>Vespula vidua</i> (Saussure, 1854)	Widow Yellowjacket
LEPIDOPTERA	Geometridae	<i>Trichodezia albiovittata</i> (Guenée, 1857)	White-striped Black
	Hesperiidae	<i>Ancyloxypha numitor</i> (Fabricius 1793)	Least Skipperling
		<i>Epargyreus clarus</i> (Cramer, 1775)	Silver Spotted Skipper
		<i>Erynnis juvenalis</i> (Fabricius, 1793)	Juvenal's Duskywing
		<i>Poanes zabulon</i> (Boisduval & LeConte, 1837)	Zabulon Skipper
		<i>Polites peckius</i> (W. Kirby, 1837)	Peck's Skipper
		<i>Thorybes bathyllus</i> (J. E. Smith, 1797)	Southern Cloudywing
		<i>Urbanus proteus</i> (Linnaeus, 1758)	Long-tailed Skipper
		<i>Calycopis cecrops</i> (Fabricius, 1793)	Red-banded Hairstreak
	Lycaenidae	<i>Celastrina neglectamajor</i> Opler & Krizek, 1894	Hairstreak
		<i>Cupido comyntas</i> (Godart, 1824)	Eastern Tailed Blue
		<i>Chlosyne nycteis</i> (E Doubleday, 1847)	Silvery Checkerspot
	Nymphalidae	<i>Junonia coenia</i> Hübner, 1822	Buckeye
		<i>Limnitis arthemis astyanax</i> (Fabricius, 1775)	White Admiral And Red Spotted Purple
		<i>Phyciodes tharos</i> (Drury)	Southern Pearly Crescentspot
		<i>Polygonia interrogationis</i> (Fabricius, 1798)	Question Mark
		<i>Satyrodes appalachia</i> (R. Chermock)	Appalachian Brown
		<i>Vanessa atalanta rubria</i> (Fruhstorfer, 1909)	Red Admiral
		<i>Papilio glaucus</i> L.	Tiger Swallowtail
		<i>Papilio troilus</i> Linnaeus	Spicebush Swallowtail
	Pieridae	<i>Pieris rapae</i> (Linnaeus)	Cabbage White

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
	Sesiidae	<i>Synanthedon scitula</i> (Harr)	Clearwing Moth
	Sphingidae	<i>Darapsa myron</i> (Cram.)	Virginia Creeper Sphinx
		<i>Deidamia inscripta</i> (Harris, 1839)	Lettered Sphinx
		<i>Laothoe juglandis</i> (J. E. Smith)	Walnut Sphinx
		<i>Xylophanes tersa</i> (Linnaeus)	Tersa Sphinx
MECOPTERA	Bittacidae	<i>Bittacus pilicornis</i> Westwood, 1846	Hanging Scorpionfly
		<i>Bittacus stigmaterus</i> Say, 1923	Hanging Scorpionfly
	Meropeidae	<i>Merope tuber</i> Newman, 1838	Forcepsfly
	Panorpidae	<i>Panorpa claripennis</i> Hine, 1901	Scorpionfly
		<i>Panorpa rufescens</i> Rambur, 1842	Common Scorpionfly
MEGALOPTERA	Corydalidae	<i>Chauliodes pectinicornis</i> Linnaeus, 1783	Fishfly
		<i>Chauliodes rastricornis</i> Rambur, 1842	Fishfly
		<i>Corydalis cornutus</i> (Linnaeus, 1763)	Dobsonfly, Hellgrammite
		<i>Nigronia fasciatus</i> (Walker, 1853)	Fishfly
		<i>Nigronia serricornis</i> (Say, 1824)	Fishfly
	Sialidae	<i>Sialis</i> species	Alderfly
NEUROPTERA	Hemerobiidae	<i>Hemerobius stigma</i> Stephens, 1836	Brown Lacewing
		<i>Micromus posticus</i> (Walker, 1853)	Brown Lacewing
		<i>Micromus subanticus</i> (Walker, 1853)	Brown Lacewing
	Sisyridae	<i>Sisyra vicaria</i> (Walker, 1853)	Spongilla
ODONATA	Aeshnidae	<i>Anax junius</i> (Drury, 1773)	Common Green Darner
		<i>Basiaeschna janata</i> (T Say, 1839)	Springtime Darner
		<i>Boyeria vinosa</i> (T Say, 1839)	Fawn Darner
	Calopterygidae	<i>Calopteryx maculata</i> (Beauvois, 1805)	Ebony Jewelwing
	Coenagrionidae	<i>Argia fumipennis violacea</i> (HA Hagen, 1861)	Violet Dancer
		<i>Chromagrion conditum</i> (Selys, 1876)	Aurora Damsel
		<i>Enallagma aspersum</i> (HA Hagen, 1861)	Azure Bluet
		<i>Enallagma civile</i> (HA Hagen, 1861)	Familiar Bluet
		<i>Enallagma daeckii</i> (Calvert, 1903)	Attenuated Bluet
		<i>Enallagma divagans</i> Selys, 1876	Turquoise Bluet
		<i>Enallagma geminatum</i> Kellicott, 1895	Skimming Bluet
		<i>Enallagma signatum</i> (HA Hagen, 1861)	Orange Bluet
		<i>Enallagma traviatum</i> Selys, 1876	Slender Bluet
		<i>Ischnura hastata</i> (T Say, 1839)	Citrine Forktail
		<i>Ischnura posita</i> HA Hagen, 1861	Fragile Forktail
		<i>Ischnura verticalis</i> (T Say, 1839)	Eastern Forktail
	Cordulegastridae	<i>Cordulegaster bilineata</i> (Carle, 1983)	Brown Spiketail
	Corduliidae	<i>Epithecus cynosura</i> (T Say, 1839)	Common Baskettail
	Gomphidae	<i>Arigomphus</i> species	Dragonfly
		<i>Gomphus exilis</i> Selys, 1854	Lancet Clubtail
		<i>Lanthus vernalis</i> Carle, 1980	Southern Pygmy Clubtail
		<i>Stylogomphus albistylus</i> (HA Hagen in Selys, 1878)	Least Clubtail
	Lestidae	<i>Lestes australis</i> Walker, 1952	Southern Spreadwing
		<i>Lestes vigilax</i> HA Hagen in Selys, 1862	Swamp Spreadwing
	Libellulidae	<i>Celithemis elisa</i> (HA Hagen, 1861)	Calico Pennant
		<i>Celithemis fasciata</i> Kirby, 1889	Banded Pennant
		<i>Erythemis simplicicollis</i> (T Say, 1839)	Eastern Pondhawk
		<i>Ladona deplanata</i> (Rambur, 1842)	Blue Corporal

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
		<i>Libellula cyanea</i> Fabricius, 1775	Spangled Skimmer
		<i>Libellula incesta</i> HA Hagen, 1861	Slaty Skimmer
		<i>Libellula luctuosa</i> Burmeister, 1839	Widow Skimmer
		<i>Libellula pulchella</i> Drury, 1773	Twelve-spotted Skimmer
		<i>Pachydiplax longipennis</i> (Burmeister, 1839)	Blue Dasher
		<i>Perithemis tenera</i> (T Say, 1839)	Eastern Amberwing
		<i>Plathemis lydia</i> (Drury, 1773)	Common Whitetail
		<i>Sympetrum vicinum</i> (HA Hagen, 1861)	Yellow-legged Meadowhawk
	Macromiidae	<i>Didymops transversa</i> (T Say, 1839)	Stream Cruiser
		<i>Macromia alleghaniensis</i> Williamson, 1909	Allegheny River Cruiser
ORTHOPTERA	Rhaphidophoridae	<i>Ceuthophilus uhleri</i> Scudder, 1862	Uhler's Camel Cricket
PLECOPTERA	Capniidae	<i>Allocaenia aurora</i> Ricker, 1952	Aurora Snowfly
		<i>Allocaenia recta</i> (Claassen, 1924)	Eastern Snowfly
	Chloroperlidae	<i>Alloperla nanina</i> N Banks	Swannanoa Sallfly
		<i>Haploperla brevis</i> (N Banks, 1895)	Least Sallfly
		<i>Sweltsa lateralis</i> (N Banks, 1911)	Curved Sallfly
	Leuctridae	<i>Leuctra biloba</i> Claassen, 1923	Two-lobed Needlefly
		<i>Leuctra carolinensis</i> Claassen, 1923	Carolina Needlefly
		<i>Leuctra tenella</i> Provancher, 1878	Broad-lobed Needlefly
	Nemouridae	<i>Amphinemura nigrilla</i> (Provancher, 1876)	Little Black Forestfly
		<i>Amphinemura wui</i> (Claassen, 1936)	Spiked Forestfly
	Peltoperlidae	<i>Tallaperla anna</i> (Needham & Smith, 1916)	Piedmont Roachfly
	Perlidae	<i>Acroneuria abnormis</i> (Newman, 1838)	Common Stone
		<i>Beloneuria georgiana</i> (N Banks, 1914)	Georgia Stone
		<i>Beloneuria stewarti</i> Stark & Szczytko, 1976	Piedmont Stone
		<i>Eccopectura xanthenes</i> (Newman, 1828)	Yellow Stone
		<i>Perlesta</i> species	Stone
	Perlodidae	<i>Isoperla</i> species	Stripetail
	Taeniopterygidae	<i>Oemopteryx contorta</i> (Needham & Claassen, 1925)	Dark Willowfly
		<i>Taeniopteryx burksi</i> Ricker & HH Ross, 1968	Eastern Willowfly
STREPSIPTERA	Corioxenidae	<i>Triozocera</i> species	Twisted-wing Parasite
TRICHOPTERA	Beraeidae	<i>Beraea gorteba</i> HH Ross, 1944	Uncommon Silt-dweller Caddisfly
	Brachycentridae	<i>Micrasema wataga</i> HH Ross, 1938	Short-horned Caddisfly
	Dipseudopsidae	<i>Phylocentropus auriceps</i> (N Banks, 1905)	Buried Tube Caddisfly
		<i>Phylocentropus lucidus</i> (HA Hagen, 1861)	Buried Tube Caddisfly
		<i>Phylocentropus placidus</i> (N Banks, 1905)	Buried Tube Caddisfly
	Glossosomatidae	<i>Agapetus jocassee</i> JC Morse, 1989	Saddle-case Making Caddisfly
		<i>Glossosoma nigrilor</i> N Banks, 1911	Saddle-case Making Caddisfly
		<i>Protophila</i> species	Saddle-case Making Caddisfly
	Goeridae	<i>Goera calcarata</i> N Banks, 1899	Retreat-making Caddisfly
	Hydropsychidae	<i>Cheumatopsyche analis</i> (N Banks, 1903)	Retreat-making Caddisfly
		<i>Cheumatopsyche campyla</i> HH Ross, 1938	Retreat-making Caddisfly
		<i>Cheumatopsyche ela</i> DG Denning, 1942	Retreat-making Caddisfly
		<i>Cheumatopsyche geora</i> DG Denning, 1948	Retreat-making Caddisfly
		<i>Cheumatopsyche oxa</i> HH Ross, 1938	Retreat-making Caddisfly
		<i>Cheumatopsyche pinaca</i> HH Ross, 1941	Retreat-making Caddisfly
		<i>Diplectrona modesta</i> N Banks, 1908	Retreat-making Caddisfly
		<i>Homoplectra doringa</i> (Milne, 1936)	Retreat-making Caddisfly

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
		<i>Hydropsyche betteni</i> HH Ross, 1938	Retreat-making Caddisfly
		<i>Hydropsyche fattigi</i> HH Ross, 1941	Retreat-making Caddisfly
		<i>Hydropsyche mississippiensis</i> OS Flint, 1965	Retreat-making Caddisfly
		<i>Hydropsyche morosa</i> HA Hagen, 1861	Retreat-making Caddisfly
		<i>Hydropsyche sparna</i> HH Ross, 1938	Retreat-making Caddisfly
		<i>Parapsyche cardis</i> HH Ross, 1938	Retreat-making Caddisfly
	Hydroptilidae	<i>Hydroptila coweetensis</i> Huryn, 1985	Micro-caddisfly
		<i>Hydroptila gunda</i> Milne, 1936	Micro-caddisfly
		<i>Hydroptila hamata</i> Morton, 1905	Micro-caddisfly
		<i>Hydroptila waubesiana</i> Betten, 1934	Micro-caddisfly
		<i>Orthotrichia aegerfasciella</i> (Chambers, 1873)	Micro-caddisfly
		<i>Oxyethira dualis</i> Morton, 1905	Micro-caddisfly
		<i>Oxyethira forcipata</i> Mosely, 1934	Micro-caddisfly
		<i>Oxyethira janella</i> Denning, 1948	Micro-caddisfly
		<i>Oxyethira michiganensis</i> Mosely, 1934	Micro-caddisfly
		<i>Oxyethira pallida</i> (N Banks, 1904)	Micro-caddisfly
		<i>Oxyethira rivicola</i> Blickle & Morse, 1954	Micro-caddisfly
	Lepidostomatidae	<i>Lepidostoma carrolli</i> Flint, 1958	Scale-mouthed Caddisfly
		<i>Lepidostoma griseum</i> (Banks, 1911)	Scale-mouthed Caddisfly
		<i>Lepidostoma latipenne</i> (Banks, 1905)	Scale-mouthed Caddisfly
		<i>Lepidostoma ontario</i> HH Ross, 1941	Scale-mouthed Caddisfly
		<i>Lepidostoma wigginsii</i> JS Weaver, 2002	Scale-mouthed Caddisfly
		<i>Lepidostoma tibiale</i> (Carpenter, 1933)	Scale-mouthed Caddisfly
	Leptoceridae	<i>Ceraclea enodis</i> Whitlock & Morse, 1994	Long-horned Caddisfly
		<i>Ceraclea neffi</i> (Resh, 1974)	Long-horned Caddisfly
		<i>Mystacides sepulchralis</i> (Walker, 1852)	Long-horned Caddisfly
		<i>Nectopsyche candida</i> (Hagen, 1861)	Long-horned Caddisfly
		<i>Nectopsyche exquisita</i> (Walker, 1852)	Exquisite Long-horned Caddisfly
		<i>Oecetis cinerascens</i> (Hagen, 1861)	Long-horned Caddisfly
		<i>Oecetis inconspicua</i> (Walker, 1852)	Long-horned Caddisfly
		<i>Oecetis persimilis</i> (Banks, 1907)	Long-horned Caddisfly
		<i>Triaenodes flavescens</i> N Banks, 1900	Long-horned Caddisfly
		<i>Triaenodes ignitus</i> (Walker, 1852)	Long-horned Caddisfly
		<i>Triaenodes marginatus</i> Sibley, 1926	Long-horned Caddisfly
		<i>Triaenodes perna</i> HH Ross, 1938	Long-horned Caddisfly
		<i>Triaenodes tardus</i> Milne, 1934	Long-horned Caddisfly
	Limnephilidae	<i>Ironoquia punctatissima</i> (Walker, 1852)	Northern Caddisfly
		<i>Platycentropus radiatus</i> (Say, 1824)	Northern Caddisfly
		<i>Pseudostenophylax sparsus</i> (N Banks, 1908)	Northern Caddisfly
		<i>Pseudostenophylax uniformis</i> (Betten, 1934)	Northern Caddisfly
		<i>Pycnopsyche gentilis</i> (McLachlan, 1871)	Stickbait Caddisfly
	Molannidae	<i>Molanna blenda</i> Sibley, 1926	Molannid Caddisfly
	Odontoceridae	<i>Psilotreta amera</i> (HH Ross, 1939)	Large Sturdy-case Caddisfly
		<i>Psilotreta frontalis</i> N Banks, 1899	Large Sturdy-case Caddisfly
	Philopotamidae	<i>Chimarra aterrima</i> HA Hagen, 1861	Finger-net Caddisfly
		<i>Chimarra obscura</i> (Walker, 1852)	Finger-net Caddisfly
		<i>Chimarra socia</i> HA Hagen, 1861	Finger-net Caddisfly
		<i>Dolophilodes distincta</i> (Walker, 1852)	Winter Caddisfly

Phylum Arthropoda		Class Insecta	
Order	Family	Taxon	Common Name
		<i>Wormaldia moesta</i> (N Banks, 1914)	Finger-net Caddisfly
	Phryganeidae	<i>Agrypnia vestita</i> (Walker, 1852)	Phryganeid Caddisfly
		<i>Phryganea sayi</i> Milne, 1931	Phryganeid Caddisfly
		<i>Ptilostomis ocellifera</i> (Walker, 1852)	Phryganeid Caddisfly
	Polycentropodidae	<i>Cernotina spicata</i> HH Ross, 1938	Fine-net Caddisfly
		<i>Holocentropus</i> species	Fine-net Caddisfly
		<i>Nyctiophylax affinis</i> (N Banks, 1897)	Fine-net Caddisfly
		<i>Plectrocnemia cinerea</i> (HA Hagen, 1861)	Fine-net Caddisfly
		<i>Polycentropus blicklei</i> HH Ross & Yamamoto, 1965	Fine-net Caddisfly
		<i>Polycentropus carlsoni</i> JC Morse, 1971	Fine-net Caddisfly
		<i>Polycentropus carolinensis</i> N Banks, 1905	Fine-net Caddisfly
		<i>Polycentropus colei</i> HH Ross, 1941	Fine-net Caddisfly
		<i>Polycentropus maculatus</i> N Banks, 1908	Fine-net Caddisfly
	Psychomyiidae	<i>Lype diversa</i> (Banks, 1914)	Fine-net Caddisfly
	Rhyacophilidae	<i>Rhyacophila carolina</i> N Banks, 1911	Free-living Caddisfly
		<i>Rhyacophila celadon</i> Etnier, Stocks, & Parker, 2004	Free-living Caddisfly
		<i>Rhyacophila glaberrima</i> Ulmer, 1907	Free-living Caddisfly
		<i>Rhyacophila mycta</i> HH Ross, 1941	Free-living Caddisfly
		<i>Rhyacophila nigrita</i> N Banks, 1907	Free-living Caddisfly
		<i>Rhyacophila torva</i> HA Hagen, 1861	Free-living Caddisfly
	Sericostomatidae	<i>Agarodes griseus</i> N Banks, 1899	Delicate Case-maker Caddisfly
		<i>Agarodes tetron</i> (HH Ross, 1948)	Delicate Case-maker Caddisfly
		<i>Fattigia pele</i> (HH Ross, 1938)	Delicate Case-maker Caddisfly
	Thremmatidae	<i>Neophylax mitchelli</i> Carpenter, 1933	Dog-faced Caddisfly
Phylum Ectoprocta		Class Phylactolaemata	
Order	Family	Taxon	Common Name
PLUMATELLIDA	Pectinatellidae	<i>Pectinatella magnifica</i> (Leidy, 1851)	Magnificent Bryozoan Or Moss Animal
Phylum Mollusca		Class Gastropoda	
Order	Family	Taxon	Common Name
BASOMMATOPHORA	Lymnaeidae	<i>Lymnaea</i> species	Freshwater Snail
	Physidae	<i>Physa</i> species	Freshwater Snail
NEOTAENIOGLOSSA	Pleuroceridae	<i>Goniobasis</i> species	Freshwater Snail

Appendix 5. Species of Interest

Many of the species found during this survey are of particular interest because of their rarity, conservation ranking, sensitivity to contamination and disturbance, or unique habitat requirements. These taxa may warrant special attention in management considerations affecting aquatic habitats, and thus are presented in the tables below with additional information about their biology, distribution, and sensitivity, that might be helpful to managers.

The 114 species included in the tables were selected on the basis of the following criteria: (1) they are known from only one, two, or three parks, and thus are considered rare for this study; (2) they have a NatureServe global rank of G1, G2, or G3, or a state conservation rank of S1, S2, or S3 for any one of the seven states in the Appalachian Highlands and Cumberland Piedmont Monitoring Networks area; (3) they have a tolerance value of 3.0 or less; or (4) they have special habitat requirements that may result in their being potentially at risk in the parks.

(1) Number of parks - One of the purposes of the larger study is to assess the role of the parks as conservation reserves for aquatic species in the region, and species that are found in three or fewer of the parks (less than 17 percent) are potentially more at risk than species that occur in a larger number of parks. Therefore, highlighting those species and the parks in which they occur may serve to alert managers to the possible need for greater scrutiny of the environmental concerns connected with those species and their habitats. The parks and their official National Park Service (NPS) acronyms are listed here. Of course, the occurrence of species in the parks is partially a function of the number of samples that have been collected in each park (for example, the number of collecting trips, monitoring programs, historic interest by scientists, and so on). Thus, because many more samples have been collected in GRSM, including a long history of visits by aquatic entomologists dating back decades, many species are recorded from there that are not known in any other park. Some of these species have widespread distributions in the study area and almost certainly occur in other parks. Only further sampling will overcome this problem. We know some records of species in the parks from the literature, and where such records are known for a park, a superscript (L) is appended to the park's acronym. Thus, GRSM^(L) indicates that a record for GRSM is based, at least in part or perhaps entirely, on a literature reference.

(2) Conservation rankings - Conservation rankings are coded systems in which species' vulnerability to extinction are assessed

Appalachian Highlands Monitoring Network

• BISO	Big South Fork National River and Recreation Area
• BLRI	Blue Ridge Parkway
• GRSM	Great Smoky Mountains National Park
• OBRI	Obed Wild and Scenic River

Cumberland Piedmont Monitoring Network

• ABLI	Abraham Lincoln Birthplace National Historic Site
• CARL	Carl Sandburg Home National Historic Site
• CHCH	Chickamauga and Chattanooga National Military Park
• COWP	Cowpens National Battlefield
• CUGA	Cumberland Gap National Historic Park
• FODO	Fort Donelson National Battlefield
• GUCO	Guilford Courthouse National Military Park
• KIMO	Kings Mountain National Military Park
• LIRI	Little River Canyon National Preserve
• MACA	Mammoth Cave National Park
• NISI	Ninety Six National Historic Site
• RUCA	Russell Cave National Monument
• SHIL	Shiloh National Military Park
• STRI	Stones River National Battlefield

and rated on large geographic scales, such as global, which covers the entire range of a species, or national, which assess the species' vulnerability to extinction within a country. NatureServe (<http://www.natureserve.org/index.jsp>) maintains a list of species that have been evaluated in a standardized and objective manner, and assigned a rank that reflects each species' vulnerability. In this system, species are assigned ranks according to the criteria given in Table 6–1. Many state conservation agencies have adopted a very similar system of ranking the conservation status of state species. In the tables below, state ranks are presented as, for example, ALS2 or TNS1 for Alabama state ranking of S2 and Tennessee state ranking of S1, respectively. The evaluation by NatureServe or any of the states in the study area that a species' rank is 1, 2, or 3 is justification for that species to be listed in the tables below.

Table 6–1. The three most critical ranks in the NatureServe global system used in this study. Other ranks are included in the NatureServe system, but those are not used here.

Rank	Definition
G1	Critically imperiled — Critically imperiled globally because of extreme rarity or because of some factor(s) making it extremely vulnerable to extinction. Typically five or fewer occurrences or very few remaining individuals (<1,000) or acres (<2,000) or linear miles (<10).
G2	Imperiled — Imperiled globally because of rarity or because of some factor(s) making it very vulnerable to extinction or elimination. Typically 6 to 20 occurrences or few remaining individuals (1,000 to 3,000) or acres (2,000 to 10,000) or linear miles (10 to 50).
G3	Vulnerable — Vulnerable globally because very rare and local throughout its range, or found only in a restricted range (even if abundant at some locations), or because of other factors making it vulnerable to extinction or elimination. Typically 21 to 100 occurrences or between 3,000 and 10,000 individuals.

(3) Tolerance values - Tolerance values are numbers assigned to taxa based on empirical assessments of how sensitive different taxa are to various forms of pollution or habitat disturbance (Barbour and others, 1999; Blocksom and Winters, 2006; Klemm and others, 2003; Lenat, 1988). Most systems use values in the range of 0–10, in which 0 represents those taxa that are highly sensitive to pollution and tend to be the first taxa to be eliminated from a polluted system, and 10 represents those taxa which are most tolerant of pollution and become the most common taxa in heavily polluted systems. Tolerance values are considered valuable when biologists sample communities, and assess the species found in each community as a function of the tolerance values and the relative abundances of the species encountered. This normally leads to an index of biotic integrity, which is taken as a direct measure of how healthy, or stressed, a community, is at the time it was sampled. Various rating systems are in use in the study region, so we have adopted the system used by the North Carolina Department of Environment and Natural Resources (Biological Assessment Unit, 2006) wherever possible. Some taxa are not represented in the North Carolina (NC) system. For those species, we examined the tolerance values listed by the Tennessee Division of Water Pollution Control (Arnwine, 2006) or the Kentucky Division of Water (Kentucky Division of Water, 2009), and if a taxon was listed in one of those two sources, we used that tolerance value. If a taxon was not found in those sources, we searched the U.S. Environmental Protection Agency (EPA) biomonitoring protocol manual (Barbour and others, 1999), which lists tolerance values for several regions, including NC. If that list included a value for a taxon not found in

the NC, Tennessee (TN), or Kentucky (KY) systems we accepted the tolerance value in the following preference sequence: Mid-Atlantic (MACS), Midwest (OH), Upper Midwest (WI). Taxa not having any tolerance value from one of these sources are indicated in the tables with an entry of n/a.

(4) Special habitat requirements - Unique habitat requirements include isolated springs and bogs, madicolous and hygropetric habitats, and semi-terrestrial habitats. Some of these habitats are on the peripheries of more readily recognized aquatic habitats, and thus may not be seen as unique or vulnerable habitats. For example, small rock face seeps, often found along roadways, are unique habitats for a number of species specialized on the madicolous habitat in which the larvae (rarely the adult) live in a thin film of water flowing over the nearly vertical face of the rocks. Such habitats, particularly if found along a roadway, are subject to loss of shading because of the open nature of roadways, roadside mowing operations, and paving of the drainage ditches they flow into. Other organisms live not in streams or seeps, but rather along the periphery of such habitats in the leaf litter and under or among the rocks and soils around the edges. These species are vulnerable to trampling by visitors and park employees, exotic animals such as European wild boars that root in these places, and other activities that may open up the habitats and lead to excessive drying of the edges. Species that have special habitat requirements therefore are also included in the tables, with entries in the Comments row below the species' entry row.

Additional information is provided in the tables, as well. This includes the elevation range at which each species was found during our surveys. We did not have elevations for a small number of localities, and therefore a small number of species do not have elevations reported in the tables. The list of United States and Mexican states and Canadian provinces in which each species has been recorded is presented, as far as is known. Flight periods are reported for adult specimens collected during this study, followed in parentheses by flight periods reported in the literature. Specimens collected during this study only as immatures do not have a flight period, although, wherever possible a flight period is reported on the basis of literature records. Some species in the tables are based on literature records that did not include any additional information, and for those species some of the entries are listed as n/a.

Following each species record is a Comments record, which contains biological and ecological information about the species based on the authors' knowledge and reports in the literature. Information in this row may include details on food, growth, habitat, behavior, mating, egg laying, parasites, rarity, endemism, and points of interest.

For each genus, the first listing in square brackets [] is the summary Habitat, Habit, and Trophic Relationships from the summary tables at the end of each taxon chapter in Merritt and others, (2008). These summaries are valuable, concise statements of the basic known ecological characteristics of each genus. The meanings of the entries are explained in the tables below, which are from Tables 6A, 6B, and 6C of Cummins and others, (2008).

Table 6–2. Aquatic habitat classification system. From Table 6A of Cummins and others, (2008).

General Category	Specific Category	Description
Lotic erosional (running-water riffles)	Sediments	Coarse sediments (cobbles, pebbles, gravel) typical of stream riffles.
	Vascular hydrophytes	Vascular plants growing on (e.g., moss <i>Fontinalis</i>) or among (e.g., pondweed <i>Potamogeton pectinatus</i>) coarse sediments in riffles.
	Detritus	Leaf packs (accumulations of leaf litter and other coarse particulate detritus at leading edge or behind obstructions such as logs or large cobbles and boulders) and debris (e.g., logs, branches) in riffles.
Lotic depositional	Sediments	Fine sediments (sand and silt) typical of stream pools and margins.
	Vascular hydrophytes	Vascular plants growing in fine sediments (e.g., <i>Elodea</i> , broad-leaved species of <i>Potamogeton</i> , <i>Ranunculus</i>).
	Detritus	Leaf litter and other particulate detritus in pools and alcoves (backwaters).
Lentic limnetic (standing water)	Open water	On the surface or in the water column of lakes, bogs, ponds.
Lentic littoral (standing water, shallow shore area)	Erosional	Wave-swept shore area of coarse (cobbles, pebbles, gravel) sediments.
	Vascular hydrophytes	Rooted or floating (e.g., duckweed <i>Lemna</i>) aquatic vascular plants (usually with associated macroscopic filamentous algae).
	Emergent zone	Plants on the immediate shore area, e.g., <i>Typha</i> (cattail), with most of the leaves above water.
	Floating zone	Rooted plants with large floating leaves, e.g., <i>Nymphaea</i> (pond lily), and non-rooted plants (e.g., <i>Lemna</i>).
	Submerged zone	Rooted plants with most leaves beneath the surface.
	Sediments	Fine sediments (sand and silt) of the vascular plant beds.
Lentic profundal (standing water, basin)	Sediments	Fine sediments (fine sand, silt and clay) mixed with organic matter of the deeper basins of lakes.
Beach zone	Freshwater lakes	Moist sand beach areas of large lakes.

Table 6–3. Categorization of aquatic insect habits (mode of existence). From Table 6B of Cummins and others, (2008).

Category	Description
Skaters	Adapted for “skating” on the surface where they feed as scavengers on organisms trapped in the surface film (example: Hemiptera: Gerridae - water striders).
Swimmers	Adapted for “fishlike” swimming in lotic or lentic habitats. Individuals usually cling to submerged objects, such as rocks (lotic riffles) or vascular plants (lentic), between short bursts of swimming (examples: Ephemeroptera: Siphonuridae, Leptophlebiidae).
Clingers	Representatives have behavioral (e.g., fixed retreat construction) and morphological (e.g., long, curved tarsal claws, dorsoventral flattening, and ventral gills arranged as a sucker) adaptations for attachment to surfaces in stream riffles and wave-swept rocky littoral zones of lakes (examples: Ephemeroptera: Heptageniidae; Trichoptera: Hydropsychidae; Diptera: Blephariceridae).
Sprawlers	Inhabiting the surface of floating leaves of vascular hydrophytes or fine sediments, usually with modification for staying on top of the substrate and maintaining the respiratory surfaces free of silt (examples: Ephemeroptera: Caenidae; Odonata: Libellulidae).
Climbers	Adapted for living on vascular hydrophytes or detrital debris (e.g., overhanging branches, roots and vegetation along streams, and submerged brush in lakes) with modifications for moving vertically on stem-type surfaces (examples: Odonata: Aeshnidae).

Burrowers	Inhabiting the fine sediments of streams (pools) and lakes. Some construct discrete burrows which may have sand grain tubes extending above the surface of the substrate or individuals may ingest their way through the sediments(examples: Ephemeroptera: Ephemeridae - burrowing mayflies; Diptera: most Chironominae, Chironomini- “blood worm” midges). Some burrow (tunnel) into plant stem, leaves, or roots (miners).
------------------	---

Table 6–4. General classification system for aquatic insect trophic relations. (Applicable only to immature and adult stages that occur in the water.) From Table 6C of Cummins and others, (2008).

Functional Group (General category based on feeding mechanism)	SUBDIVISION OF FUNCTIONAL GROUP		General Particle Size Range of Food (microns)
	Dominant Food	Feeding Mechanism	
Shredders	Living vascular hydrophyte tissue	Herbivores - chewers and miners of live macrophytes	
	Decomposing vascular plant tissue - coarse particulate organic matter (CPOM)	Detritivores - chewers of CPOM	>10 ³
	Wood	Gougers - excavate and gallery, wood	
Collectors	Decomposing fine particulate organic matter (FPOM)	Detritivores - filterers or suspension feeders	
		Detritivores - gatherers or deposit (sediment) feeders (includes feeders on loose surface films)	<10 ³
Scrapers	Periphyton - attached algae and associated material	Herbivores - grazing scrapers of mineral and organic surfaces	<10 ³
Macrophyte Piercers	Living vascular hydrophyte cell and tissue fluids or filamentous (macroscopic) algal cell fluids	Herbivores - pierce tissues or cells and suck fluids	>10 ⁻² - >10 ³
Predators	Living animal tissue	Engulfers - carnivores, attach prey and ingest whole animals or parts	>10 ³
		Piercers - carnivores, attack prey, pierce tissues and cells, and suck fluids	

Two letter abbreviations are used in the columns labeled States. These are based on the standard US Postal Service and Canadian Postal Service abbreviations. Mexican states and Central American country abbreviations follow those used in various publications. The complete list of abbreviations is given in the table below.

Table 6–5. Postal codes used in the Species of Interest tables.

States of United States of America			
Code	State	Code	State
AL	Alabama	MT	Montana
AK	Alaska	NE	Nebraska
AZ	Arizona	NV	Nevada
AR	Arkansas	NH	New Hampshire
CA	California	NJ	New Jersey

Carl Sandburg Home National Historic Site
Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

CO	Colorado	NM	New Mexico
CT	Connecticut	NY	New York
DE	Delaware	NC	North Carolina
DC	District of Columbia	ND	North Dakota
FL	Florida	OH	Ohio
GA	Georgia	OK	Oklahoma
HI	Hawaii	OR	Oregon
ID	Idaho	PA	Pennsylvania
IL	Illinois	RI	Rhode Island
IN	Indiana	SC	South Carolina
IA	Iowa	SD	South Dakota
KS	Kansas	TN	Tennessee
KY	Kentucky	TX	Texas
LA	Louisiana	UT	Utah
ME	Maine	VT	Vermont
MD	Maryland	VA	Virginia
MA	Massachusetts	WA	Washington
MI	Michigan	WV	West Virginia
MN	Minnesota	WI	Wisconsin
MS	Mississippi	WY	Wyoming
MO	Missouri		
States of Mexico - only those actually used below are listed here			
Code	State	Code	State
AG	Aguascalientes	MX	Unspecified location in the country of Mexico
BN	Baja California Norte (Official code is BC. This conflicts with British Columbia, Canada, and is here replaced with BN.)	OA	Oaxaca
BS	Baja California Sur	PU	Puebla
CH	Chihuahua	QT	Queretaro
CL	Colima	SI	Sinaloa
CS	Chiapas	SL	San Luis Potosi
DF	Distrito Federal	SO	Sonora
DG	Durango	TM	Tamaulipas
JA	Jalisco	VE	Veracruz
ML	Morelos (The official code is MO, which conflicts with Missouri. We have replaced it here with ML.)		

Provinces of Canada			
Code	Province	Code	Province
AB	Alberta	NS	Nova Scotia
BC	British Columbia	NU	Nunavut
LB	Labrador (Politically, Labrador is part of Newfoundland. However, for biogeographic reasons, we list it separately here as LB.)	ON	Ontario
MB	Manitoba	PE	Prince Edward Island
NB	New Brunswick	QC	Quebec
NL	Newfoundland (This refers to the island portion of Newfoundland.)	SK	Saskatchewan
NT	Northwest Territories	YT	Yukon
Central American Countries			
BE	Belize	HO	Honduras
CR	Costa Rica	MR	Montserrat
GU	Guatemala	NI	Nicaragua

On-Line Resources

Much useful information incorporated into the tables below came from web sites maintained by various authorities. These include:

- Barber-James, H., M. Sartori, J.-L. Gattolliat, and J. Webb. 2013. World checklist of freshwater Ephemeroptera species. <http://FADA.biodiversity.be/group/show/35> Accessed on 17 December 2010.
- DeWalt, R. E., U. Neu-Becker and G. Stueber. 2010. Plecoptera Species File Online. Version 1.1/4.0. <http://Plecoptera.SpeciesFile.org> Accessed on 17 December 2010.
- Freshwater Animal Diversity Assessment (FADA) Project. 2010. <http://FADA.biodiversity.be> Accessed on 17 December 2010.
- McCafferty, P. W. (Editor). 2010. Mayfly Central. <http://www.entm.purdue.edu/mayfly/index.php> Accessed on 17 December 2010.
- Morse, John C. (Editor). 2010. Trichoptera World Checklist. <http://entweb.clemson.edu/database/trichopt/> Accessed on 17 December 2010.
- National Museum of Natural History, The Netherlands, <http://www.odonata.info/odonata/odonata/tree.html> Accessed on 17 December 2010.
- Oswald, J. D. (chief editor). Lacewing Digital Library. <http://lacewing.tamu.edu/> Accessed on 17 December 2010.

ORDER EPHEMEROPTERA HYATT & ARMS

MAYFLIES

Mayflies are cosmopolitan, being found on every continent except Antarctica. Slightly more than 3,300 species are known, distributed in 42 families, and more than 430 genera (Barber-James and others, 2008). The highest numbers of species are found in the Palearctic region (790), followed by the Nearctic (650), and the Neotropical (607). It is likely that the tropical component of the order is underrepresented in this compilation as a result of the historical bias in systematic surveys that have emphasized the Northern Hemisphere (Balian and others, 2008). In the Western Hemisphere, mayflies are found from near the Arctic Circle south through Mexico, and on into Central and South America. With approximately 650 species in 20 or more families and more than 100 genera in North America (Canada, the United States, and the non-tropical portions of Mexico), the Nearctic has one of the richest faunas described to this point. During this survey, we found 163 species in 50 genera and 14 families. In BLRI, we found 70 species in 32 genera and 11 families.

Mayfly adults are delicate, small to medium size, two or four winged insects with two or three long caudal filaments (tails), and, usually, with long legs. Adults often are seen flying about streams, rivers, ponds, and lakes. Mayflies are unable to fold their wings, which, therefore, are held vertically over the insect's back when at rest. Many species have sexually dimorphic eyes, with the males having the upper facets enlarged, sometimes extremely so, and differently colored than the lower facets. Females never have the eyes modified in this manner. The larvae are aquatic and live in the habitats near where the adults are seen flying. Like the adults, the larvae have two or three caudal filaments, although the larva may have three while the adult of the same species has only two. The larval stage may last 3-4 weeks, or as long as 2½ years, but typically lasts one year. Mayflies grow through a process called hemimetabolous development, which means that they do not pass through a pupal stage before becoming an adult. This type of development is found in many groups of insects including the Odonata and Plecoptera, which are also aquatic insects and are considered below. Larvae pass through many instars (10-50) before finally emerging as a subimago (sub adult), a flying stage that exists between the larval and the full adult stages. Ephemeroptera are unique in that they are the only insects that have a flying stage before becoming sexually mature. The subimago stage may last from a few minutes to several days before molting to the reproductive imago (adult) stage. Subimagos are recognized by the opaque or cloudy condition of the wings, whereas the imago stage has transparent or hyaline wings. In a few species, the females mate and lay eggs as subimagos, and never molt to the true adult stage (Waltz and Burian, 2008). Approximately 50 species of mayflies are known to be parthenogenetic, although only about half a dozen are obligately so. In facultatively parthenogenetic species, fertilized eggs mature more quickly and more successfully than unfertilized eggs (Brittain, 1982). In obligately parthenogenetic species, eggs mature as rapidly and successfully as do fertilized eggs in sexual species. Mating normally occurs in the air, but a few species mate on a surface. Adults live just 1-2 hours or as long as 14 days. Adults do not feed. Eggs are always laid in water. Hatching may take place within minutes, or may be delayed for many months. Excellent general accounts of mayflies are found in Edmunds and others (1976), Brittain (1982), Unzicker and Carlson (1982), Berner and Pescador (1998), and Waltz and Burian (2008).

Mayflies play essential roles in aquatic ecosystems. Many species are herbivores or detritivores as nymphs, converting energy captured by plants and fungi into animal biomass, and they themselves are an important food source for other animals, both invertebrates and vertebrates. A few genera have carnivorous species that feed on small, soft-bodied invertebrates. Feeding usually stops in the penultimate (next to last) instar. Many mayflies are highly intolerant of human-caused pollutants and habitat disturbance, which makes them valuable indicators of the health of aquatic ecosystems.

Suborder Furcatergalia Kluge forked-gill mayflies

Infraorder Lanceolata McCafferty pronggills

Family Leptophlebiidae Banks pronggills

This is one of the largest families of mayflies, having more than 600 species in more than 130 genera throughout the world (Barber-James and others, 2008). In North America 87 species in 10 genera are known. We found 12 species in five genera in the study area. As the common name suggests, the larvae are characterized by having the abdominal gills variously divided into forks or prongs, either simply or elaborately but always distinctively.

Genus *Habrophlebiodes* Ulmer - [Habitat — Lotic erosional and depositional: Habit — Swimmers, clingers, sprawlers: Trophic — Scrapers, Collectors-gatherers] The genus *Habrophlebiodes* contains four species each in the Oriental and Nearctic Realms. Three species occur in the Southeast, one of which was found in the parks. However, we found only an unidentifiable larva from CARL.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	--------------------	----------	--------------------	--------------

Comments — We found a single female of this genus from the CARL duck pond.

Genus *Leptophlebia* Westwood - [Habitat — Lotic erosional (sediments and detritus): Habit — Swimmers, clingers, sprawlers: Trophic — Collectors-gatherers (fine particles)] The genus *Leptophlebia* contains 10 species in North America, and approximately three in the Oriental and two in the Palearctic Realms. Berner (1975) reported six species from the Southeast, and two species were found in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Leptophlebia johnsoni</i> McDunnough, 1924	BLRI, CARL , GRSM ⁽¹⁾ , NISI	CT, MA, ME, NB, NC, NF, NH, NJ, NS, NY, OH, ON, PA, QC, SC, VA	150-1042 m	G4, NCS2, VAS1	6.2	n/a

Comments — This species is considered imperiled in North Carolina, and critically imperiled in Virginia. Larvae often are found sympatric with those of *L. cupida*. Larva up to 7.5 mm in length, female forewing up to 6.5 mm, male forewing up to 6 mm. We have 5 collections and 14 specimens of this species. We found a single larva in the Front Lake spring near the parking lot, and one below the Trout Pond in CARL.

Infraorder Pannota McCafferty & Edmunds fused-back mayflies

Family Caenidae Newman small squaregills

This is a cosmopolitan family of approximately 200 species in 17 genera found in every biotic realm (Barber-James and others, 2008). In North America, only four genera with fewer than 30 species recognized. Caenids are small mayflies generally, and may include the smallest of all species in the order. Specimens range from 1-7 mm in length McCafferty and Wang (2000). The common name refers to their small size and the fact that the first pair of gills is square. Little information is available on the biology of caenids, but most species probably have univoltine or possibly multivoltine life cycles.

Genus *Caenis* Stephens - [Habitat — Lotic depositional, lentic - littoral (sediments): Habit — Sprawlers, climbers: Trophic — Collectors-gatherers, scrapers] This one of the largest genera of mayflies, having about 130 species found in every biotic realm except Australia. Approximately 11 species are found in North America. Six species were collected in the parks. Provonsha (1990) revised the North American *Caenis* and provided keys to larvae and adults.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Caenis diminuta diminuta</i> Walker, 1853	CARL	AL, FL, GA, LA, ME, MI, MN, MS, NY, NC, NS, ON, SC, VA, WI	664-665 m	G5	7.4	19 Jun – 31 Aug (Feb – Oct)
Comments — Larvae occur primarily in lakes, ponds, and other lotic habitats in association with rich silt deposits and emergent vegetation. This species was found only at CARL, which is why it is on this list. We found 22 specimens from 2 locations in CARL.						
<i>Caenis punctata</i> McDunnough, 1931	CARL, NISI	AL, AR, CA, CT, FL, GA, IA, IN, KY, KS, ME, MI, MO, MS, NC, NL, NY, OH, OK, ON, SC, TN, TX, VA, WI	134-665 m	G5	7.4	4 May - 20 Jun (May – Aug)
Comments — Widespread, but only locally abundant. Larvae are found in lentic habitats with sand or fine gravel substrates (Provonsha 1990). Larva up to 6 mm in length, female up to 5 mm, male up to 4.4 mm. We collected more than 200 specimens of this species, including 27 specimens from Side Lake in CARL. This species is included here because it was found in just two parks.						

Family Ephemerellidae Klapálek

spiny crawlers

This moderately sized family of about 18 genera and 155 species is restricted to the Nearctic, Palearctic, and Oriental Realms. More than 70 species in about 10 genera are known from North America (Barber-James and others, 2008). The larvae are distinctive and often ubiquitous in streams in the study region, feeding as collector-gatherers or scrapers on detritus, algae, and diatoms. In a series of papers Jacobus and McCafferty (Jacobus, 2009, 2010; Jacobus and Fleek, 2010; Jacobus and McCafferty, 2000, 2001, 2003a, b, 2004; Jacobus and McCafferty, 2007, 2008; Jacobus and others, 2002) revised the family over the past decade, greatly enhancing understanding and identification of all life stages.

Genus *Dannella* Edmunds - [Habitat — Lotic erosional and depositional: Habit — Clingers, sprawlers: Trophic — Collectors-gatherers] This is a North American endemic genus having three species. All three were found in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Dannella lita</i> (Burks, 1949)	BLRI, CARL , CUGA, GRSM	AR, IA, IL, IN, NC, NY, OH, SC, VA, WI	520-1014 m	G5	0.0	(May)
Comments — Larva up to 8 mm in length. We have 9 collections and 82 specimens of this species, including 4 larvae from Side Lake in CARL.						

Suborder Pisciforma McCafferty

minnow, brush-legged, and flat-headed mayflies

Family Baetidae Leach

small minnow mayflies

This is the largest family of mayflies, having about 900 species in 100 genera worldwide (Gattolliat and Nieto, 2009). The greatest diversity of baetids occurs in the Afrotropical and Neotropical realms. Still, more than 150 species in more than 20 genera are known from the Nearctic. Most larvae are streamlined and are active swimmers, even in swift water. Most also are collector-gatherers, feeding on organic detritus. A limited number of species are carnivorous. A great deal of taxonomic work has been published over the past 30 years in North America, much of it by McCafferty and his students. At present, more than 60 species in at least a dozen genera are known from the study area. We found nearly half of those in the parks.

Genus *Procloeon* Bengtsson — [Habitat — Lotic depositional; lentic littoral: Habit — Swimmers, clingers: Trophic — Collectors-gatherers (detritus, diatoms); scrapers] A widespread genus found in the Nearctic (22 species), Oriental (5 species), Palearctic (10 species), and Afrotropical (3 species) Realms (McCafferty and Waltz, 1990).

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	-----------------	----------	-----------------	--------------

Comments — This taxon was represented at CARL by a single unidentified male from Side Lake.

Genus *Pseudocloeon* Klapálek — [Habitat — Lotic depositional (small streams and rivers): Habit — Burrowers: Trophic — Collectors-gatherers, passive filterers)] This widespread genus includes about 19 Afrotropical, 10 Australian, 6 Nearctic, 22 Oriental, and 6 Palearctic species. We found 2 species in the study area. According to Pescador and Richard (2004) “*Pseudocloeon* are found in lotic habitats ranging from small streams to large rivers. They can be collected in nearly all microhabitats including leaf packs, woody snags, root mats, and in vegetation.”

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	-----------------	----------	-----------------	--------------

Comments — Larvae up to 6 mm in length. We collected a single female from the Trout Pond at CARL.

Family Siphonuridae Ulmer big minnow mayflies

This is a small family of approximately 49 species that are restricted to the Western Hemisphere. Worldwide there are 4 genera. All 4 genera occur in North America, but only 1 genus was found in this study. The species live in cool water habitats, typically in pools near stream edges. Mature nymphs tend to prefer quite water (Burks, 1953).

Genus *Siphonurus* Eaton — [Habitat — Lentic littoral (vascular hydrophytes or sediments; lotic depositional: Habit — Swimmers, clingers: Trophic — Collectors-gatherers; predators (engulfers; especially *Tanytarsus* in pools; shredders herbivores?)] *Siphonurus* has approximately 40 species evenly divided between the Palearctic and Nearctic realms. We only encountered two in the parks. Life histories are not well known, but most species are likely to be univoltine. Some European species are known to overwinter as eggs.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — We collected 2 larvae from Side Lake in CARL.						

Family Heptageniidae Needham in Needham & Betten

flat-headed mayflies, or flatheads

The flat-headed mayflies are a large family of nearly 600 species. Half of all known species are found in the Palaearctic Region, about 140 species are found in the Oriental Region, and nearly as many are found in the Nearctic Region. About 20 species are known from the Afrotropical Region, fewer than 5 are known from the Neotropical Region, and none are known from Australia. In the Southeast, 67 species are known (McCafferty and others, 2010). We collected 41 species in 8 genera in the parks, including 23 species in 7 genera in BLRI.

As the common name implies, these insects are very flat dorsoventrally in the larval stages. This form allows the insects to live in very high current flows on substrates in riffles because they actually are within a narrow boundary layer of slow current that is formed when fast moving water flows over a solid substrate. The dorsoventrally compressed nature of their bodies, and the orientation of the legs out to the side of the body rather than underneath the body, gives them the freedom to move actively over the substrate without facing the strongest current just fractions of a millimeter above. In many streams in the study area, larvae of flatheads can be seen scooting rapidly about on rocks, even when the rocks have been just removed from the water. In certain genera, some species have the plate-like abdominal gills modified so that they form a disc-like attachment mechanism that further enhances their ability to live in fast currents.

Mature larvae are often quite large, up to 20 mm in length, excluding the caudal filaments. They feed by scraping diatoms, algae, and organic matter from the substrate surface.

Genus *Maccaffertium* Bednarik - [Habitat — Lotic and lentic erosional (depositional): Habit — Clingers (under loose cobbles and boulders): Trophic — Scraper; facultative collectors-gatherers] This is a Nearctic genus of 17 species, one of which extends into the Neotropics. For many years these species were treated as *Stenonema*, and many older records of *Stenonema* now refer to *Maccaffertium*.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Maccaffertium meririvulanum</i> (FC Carle & PA Lewis, 1978)	BISO, BLRI, CARL , GRSM ^(L)	AL, GA, KY, NC, NY, PA, SC, TN, VA, WV	295-1600 m	G5	0.3	1 Mar - 31 Jul (May - Jun)

Comments — This species is only found in riffles and pools of very small spring-fed streams (Carle and Lewis, 1978). Emergence of subimagos was observed to occur beneath the surface of the water. Larva up to 12.3 mm in length, female forewing up to 17.5 mm, male forewing up to 14 mm. We have 139 collections and 860 specimens of this species, including 4 specimens from Pasture Creek below Side Lake in CARL.

Genus *Stenacron* Jensen - [Habitat — Lotic and lentic erosional: Habit — Clingers: Trophic — Scrapers; facultative collectors-gatherers] This is a North American endemic genus of seven species. We found four species in the parks. *Stenacron* species are very sensitive to pollution, particularly acid mine drainage (Pond and others, 2008).

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — We collected a single adult female of <i>Stenacron</i> from Mountain Reservoir in CARL.						

Family Isonychiidae Burks brush-legged minnow mayflies

This is a widespread Northern Hemisphere family that consists of a single genus and about 40 species. The larvae are characterized by a double fringe of filtering setae on the front legs, which they use to strain particulate matter from the water current. They are, therefore, restricted to flowing water.

Genus *Isonychia* Eaton - [Habitat — Lotic erosional; Habit — Swimmers; clingers; Trophic — Collectors—filterers (very fine particles); predators (engulfers)] This genus consists of approximately 40 species, 27 of which are Nearctic. The rest are Palearctic, Oriental, or Neotropical (Kondratieff and Voshell, 1984). Larvae are fast-swimming, generally dark brown, medium-sized mayflies that feed by filtering particles from the water using the elongate setae on their front legs. All species in the genus are assigned a tolerance value of 3.5.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — We found a single adult female from Front Lake in CARL.						

ORDER ODONATA FABRICIUS

DRAGONFLIES AND DAMSELFLIES

The larvae are less well known than the adults, but are no less fascinating. All odonate larvae are predaceous, and have a unique “lower lip” (labium) that functions as a prey grabbing instrument. This lower lip is hinged and has highly modified components armed with teeth, spines, and setae. Larvae hunt either actively by climbing about looking for prey, or by hiding in the substrate and ambushing prey when they pass close by. When a larva attacks a prey item, it juts its labium forward toward the prey at great speed. The palps of the labium grab the prey, securing it with the spines and teeth, and then jerking it back to the mouth to be eaten. In some larvae the labium is flat and held under the head, whereas in others it is cupped and held in front of the face, resembling a toothed mask.

Odonata are integral parts of their ecosystems. In many habitats, the larvae are the top predators in freshwater ecosystems, feeding on virtually anything that moves and is smaller than they are. In turn, many fish feed on dragonfly and damselfly larvae. Larvae also have specific habitat requirements, and thus have the potential to be important indicator species. They are generally more tolerant of pollution and habitat disturbance than are mayflies, as is reflected in the tolerance values assigned in the tables below. As adults, dragonflies and damselflies are persistent predators of other adult aquatic and terrestrial insects, feeding frequently over an adult life span that may last many weeks. They also become the prey of larger hunters, such as birds.

Many field guides and books are available to aid in identifying odonates in both the larval and adult stages, and provide valuable information on habitats, habits, and other biological details. The following references were used in developing these tables: Abbott (2005), Beaton (2007), Huggins and Brigham (1982), Needham and others (2000), Tennessen (2008), Westfall and May (1996).

Muise and others (2007) published a checklist of odonates from GRSM, which includes a number of species not found in the other parks. The records in that list do not include data about elevations or flight dates. Therefore, many of the records below have n/a entries for those fields.

Suborder Anisoptera Selys

dragonflies

Adult dragonflies are easily distinguishable from adult damselflies by their larger size and stouter bodies; their close-set, very large eyes; and their broad hind wings that are shaped differently from the forewings. Dragonfly larvae are easily distinguished from damselfly larvae by the absence of three large, external gills at the end of the abdomen. Dragonflies have gills internally in the rectum, and live specimens can be seen “inhaling” and “exhaling” when observed carefully. If disturbed, the larvae can rapidly expel water from the rectum and jet away by the hydraulic force of this expulsion.

The taxonomic arrangement used here treats Corduliidae, Libellulidae, and Macromiidae as separate families. This differs from the treatment in Needham and others (2000), the most comprehensive manual for dragonfly identification for North America, in which Corduliinae and Macromiinae are considered as subfamilies of Libellulidae. The arrangement used here is followed by most North American workers today (Paulson and Dunkle, 2012).

During this study, we found 23 species, 18 genera, and 6 families of dragonflies in CARL. The 11 below are considered species of interest for this study.

Family Aeshnidae Rambur darners

Darners are cosmopolitan, and include some of the largest dragonflies in the study area. The adults have very large eyes that meet at the top of the head. Most species are quite colorful, having green, blue, red, and brown body markings. Adults tend to fly high above the ground or water when feeding. Some species are known to migrate, generally from northern areas southward as the days cool and shorten. The larvae are slender and have limited setae (hairs) on the body. They crawl about the habitat, climbing over vegetation and debris, looking for prey. Larger individuals will feed on smaller individuals of the same species. The labium is flat in all species, never cupped into a mask. Prey of aeshnids sometimes includes tadpoles.

Worldwide more than 430 species are known, representing more than 50 genera. Approximately 47 species of darners are found in the Nearctic, distributed among 13 genera (Kalkman and others, 2008). We found 7 species in 6 genera in the parks.

Genus *Anax* Leach -

Green Darners

[Habitat — Lentic, vascular hydrophytes: Habit — Climbers: Trophic — Predators (engulfers, stalk prey)] Globally, this genus contains about 28 species, and is nearly cosmopolitan. North America has four species, two of which were found in the parks. *Anax* species are active climbers, crawling among aquatic vegetation and debris searching for food. They are found among plants growing in the littoral zone of lentic waters. The Green Darners have a genus-level tolerance value of 5.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Anax junius</i> (Drury, 1773) Common Green Darner	BLRI, CARL , GRSM ^(L)	Occurs in all 50 states and Puerto Rico, most of southern Canada, five provinces in Mexico, Cuba, Dominican Republic, Haiti, Jamaica, and the east coast of Asia.	275-987 m	G5	5.0	5-28 Aug (Year round in southern states)

Comments — This species oviposits while in tandem. They fly together over the surface of the water, searching out floating debris, aquatic plants, and algae, and land briefly on suitable clumps, where the female deposits eggs by dipping the tip of her abdomen under the water in the mass. This is one of the migratory species, although migrations are from north to south and do not seem to occur in the reverse direction (Huggins and Brigham, 1982). Larvae live in shallow near-shore habitats (see (Landwer and Sites, 2010). Adult up to 80 mm in length. This species is included in this table because it was found in only three parks. We have 9 collections and 29 specimens of this species, including 4 males from 2 sites in CARL.

Genus *Boyeria* McLachlan -

Spotted Darners

[Habitat — Lotic erosional and depositional (detritus, vascular hydrophytes): Habit — Climbers—sprawlers (clingers under rocks): Trophic — Predators (engulfers)] *Boyeria* is a northern genus. Two species are found in North America, and one each is found in Japan and Europe. We found both North American species in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Boyeria vinosa</i> (T Say, 1839) Fawn Darner	BISO ^(L) , BLRI, CARL , COWP, CUGA, GRSM ^(L) , GUCO, LIRI, MACA ^(L) , OBRI ^(L)	AL, AR, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NB, NC, NE, NH, NJ, NS, NY, OH, OK, ON, PA, PE, QC, RI, SC, TN, TZ, VA, VT, WI, WV	259-987 m	G5, NCS3	5.9	1-31 Aug (May - Oct)

Comments — Larvae live in small to medium-sized forested streams and in some localities are quite common in these habitats, hiding under rocks, logs, and similar large objects. It is ranked vulnerable in North Carolina. Larva up to 37 mm in length, adult up to 71 mm. We have 140 collections and 556 specimens of this species. We found 5 larvae from 3 locations in CARL.

Family Cordulegastridae Tillyard spiketails

This is a small family with about 50 species in 5 genera. Most species are found in the Oriental and Palaearctic realms. A single genus having 10 species is known from North America. The females of cordulegastrids have an obvious pointed ovipositor, which is the source of the common name.

Genus *Cordulegaster* Leach -

Spiketails

[Habitat — Lotic depositional (headwater streams, sand, silt, detritus): Habit — Climbers—Burrowers: Trophic — Predators (engulfers, await prey)] The genus *Cordulegaster* is found only in the Northern Hemisphere, with approximately 14 species known from the Palaearctic, and 10 found in the Nearctic. We identified five species in the parks. The larvae are found in small woodland streams, where they bury themselves in silt or sand in slow-flowing areas, leaving only the antennae, the eyes, and the terminal abdominal segment exposed. They wait in this position until a suitable prey item comes within reach. The adults are normally found flying along the same streams. Larvae of the different species are distinguishable. The genus has a moderate tolerance value of 5.7.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Cordulegaster bilineata</i> (FC Carle, 1983) Brown Spiketail	BLRI, CARL , GRSM ⁽¹⁾	AL, DE, GA, IL, IN, KY, LA, MD, MI, MS, NC, OH, PA, SC, TN, VA, WV	354-1042 m	G5, GAS3, KYS2	5.7	9-30 Jun (Mar - Jul)
Comments — This species is characteristic of small spring runs and spring-fed pools (Needham and others, 2000), usually in obviously flowing habitats, but sometimes in areas of imperceptible flow (Beaton, 2007). Adults patrol along these habitats, often stopping to hover. They perch low to the ground near the water. Ranked vulnerable in Georgia and imperiled in Kentucky. Adult up to 68 mm in length. We have 5 collections and 5 specimens of this species, including 1 male from the Trout Pond spring in CARL.						

Family Gomphidae Rambur clubtails

Clubtails are a large family, having well over 900 species worldwide in 92 genera. The largest numbers of species are found in the Oriental and Neotropical realms. In North America, approximately 100 species in 14 genera are recognized. We found 17 species in eight genera in the parks.

Adult gomphids often have the last segments of the abdomen noticeably expanded, giving it a club-like appearance that is the source of the family's common name. The eyes do not meet at the top of the head. Most clubtails perch horizontally on the ground or other substrate, rather than vertically or obliquely. Larvae of most gomphids are burrowers.

Genus *Arigomphus* Needham -

Pond Clubtails

[Habitat — Lentic littoral, some lotic — depositional (sediments, primarily silt): Habit — Burrowers: Trophic — Predators (engulfers)] Pond Clubtails are only found in North America. Seven species are known. One species was found in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — Larvae live on the bottom of ponds and lakes. This species is considered imperiled in GA and vulnerable in NC. Adult up to 58 mm in length. We collected one larva from Side Lake in CARL.						

Genus *Gomphus* Selys -

Common Clubtails

[Habitat — Lotic depositional, lentic littoral (sediments, primarily silt): Habit — Burrowers: Trophic — Predators (engulfers)] *Gomphus* is Holarctic, with about 100 described species. About 40 species occur in North America. We found six in the study area. Species of *Gomphus* are assigned a genus-level tolerance value of 5.8.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Gomphus exilis</i> Selys, 1854 Lancet Clubtail	CARL, GRSM ^(L) , OBRI ^(L)	AL, AR, CT, DE, FL, GA, IA, IL, IN, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NH, NJ, NS, NY, OH, ON, PA, QC, RI, SC, TN, VA, VT, WI, WV	275-518 m	G5	5.8	22 Mar – 19 Jun (Mar - Jul)

Comments — This species prefers ponds and lakes, but may also be found along streams. “This species is apparently associated with soft sediments” (Louton 1982). Larva up to 25.1 mm in length, adult up to 48 mm. This species is included in this table because it was found in only three parks. We found 17 adults from CARL.

Genus *Lanthus* Needham -

Pygmy Clubtails

[Habitat — Lotic erosional and depositional (sand and detritus in spring streams): Habit — Burrowers (active): Trophic — Predators (engulfers)] This genus of two species is restricted to North America. Larvae live in spring-fed brooks, burrowing in sandy places. Carle (1980) suggested both species have semivoltine life cycles of two years. Both species were found in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Lanthus vernalis</i> FC Carle, 1980 Southern Pygmy Clubtail	BISO ^(L) , BLRI, CARL, GRSM ^(L) , OBRI ^(L)	CT, GA, KY, MA, MD, ME, NC, NJ, NY, OH, PA, RI, SC, TN, VA, VT, WV	270-1480 m	G4, GAS3, KYS2	1.8	1-31 Jul (May - Jul)

Comments — Very common in small, rocky, mountain streams. Ranked vulnerable in GA and imperiled in KY. Larva up to 21 mm in length, adult up to 40 mm. We found one adult female at Mountain Reservoir in CARL.

Family Corduliidae Kirby emeralds, green-eyed skimmers

This family is cosmopolitan, with nearly 250 described species in 44 genera. In North America there are about 50 species in 7 genera (Paulson and Dunkle, 2012). The taxonomy of the family is not settled, as some workers place the family Macromiidae as a subfamily within the Corduliidae, while others treat the emeralds as a subfamily within the Libellulidae (Garrison and others, 2006). We consider Corduliidae separate from Macromiidae.

Genus *Epitheca* Burmeister -

Baskettails

[Habitat — Lotic depositional, lentic littoral (pond margins in detritus), lotic depositional (detritus): Habit — Climbers—sprawlers: Trophic — Predators (engulfers)] This genus has 12 species, 10 of which occur in the Nearctic. The subgenera *Epicordulia* Selys and *Tetragoneuria* Hagen have sometimes been treated as separate genera, but most workers prefer the subgenus status.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Epitheca cynosura</i> (T Say, 1839) Common Baskettail	BISO, BLRI ^(L) , CARL	AL, AR, CO, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NB, NC, NE, NH, NJ, NS, NY, OH, OK, ON, PA, QC, RI, SC, SD, TN, TX, VA, VT, WI, WV	458-1042 m	G5	8.5	9 May - 23 Jun (Mar - Aug)

Comments — Eggs are deposited in a gelatinous string attached to a solid underwater object. The eggs begin hatching 14 days after oviposition. Larvae pass through 12 instars. Most individuals are univoltine, but in some populations, a small proportion may be semivoltine (see Landwer and Sites 2010). Martin and others (1991) demonstrated that without potentially deleterious biotic interactions (the presence of predators), most larvae had a univoltine life cycle; but in the presence of predators, larvae grew more slowly and a larger proportion of the population developed as semivoltine. Lutz (1974) found that the autumnal equinox is a crucial mechanism for *E. cynosura* larvae for synchronizing the molt to the final instar, while water temperatures served as a secondary synchronizing element. Larva up to 19.7 mm in length, adult up to 43 mm. This species is included in this table because it was found in just three parks. We have 9 collections and 10 specimens of this species, including 5 specimens from 4 locations in CARL.

Family Libellulidae Rambur skimmers, meadowhawks

This is the largest family of dragonflies, with more than 1,200 species and nearly 90 genera. It is cosmopolitan. The principal source used for this report, Needham and others (2000) and the more recent Garrison (2010), treat the Emeralds and the Cruisers as subfamilies Corduliinae and Macromiinae, respectively, along with the subfamily Libellulinae. Other sources also consulted treat these groups as separate families (Beaton, 2007, Kalkman and others, 2008, Tennessen, 2008, Paulson and Dunkle, 2012). Ultimately, the placement of these groups as three separate families or as three subfamilies within a single larger family is of little consequence to people other than those concerned with the phylogenetics of Odonata.

Genus *Celithemis* Hagen -

Small Pennants

[Habitat — Lentic vascular hydrophytes: Habit — Climbers: Trophic — Predators (engulfers)] This genus is restricted to eastern North America. Eight species are known. Two were found in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Celithemis elisa</i> (HA Hagen, 1861) Calico Pennant	BLRI, CARL , CUGA	AL, AR, CT, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NB, NC, NE, NH, NJ, NS, NY, OH, OK, ON, PA, PE, QC, RI, SC, TN, TX, VA, VT, WI, WV	381-1080 m	G5	9.0	20 Jul - 28 Sep (Apr - Nov)
Comments — Most populations studied are univoltine, but have extended, asynchronous emergence (see Landwer and Sites 2010). Adult up to 36 mm in length. This species is included in this table because it was found in only three parks. We have 3 collections and 4 specimens of this species, including one female from Side Lake in CARL.						
<i>Celithemis fasciata</i> Kirby, 1899 Banded Pennant	CARL , GRSM ^(L)	AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MD, MI, MO, MS, NC, NJ, NY, OH, OK, ON, RI, SC, TN, TX, VA, WI, WV	665 m	G5	9.0	31 Aug (Apr - Oct)

Comments — This species is widespread in the study area despite having been found in just two parks in this study.

Genus *Ladona* Needham -

Skimmers

[Habitat — Lentic — littoral (sediments in ponds); Habit — sprawlers: Trophic — predators (engulfers)] This genus consists of about 6 species. Three species occur in North America, the others occur in Europe. Larvae normally occur in ponds and lakes.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Ladona deplanata</i> (Rambur, 1842) Blue Corporal	CARL , GRSM ^(L)	AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MAD. MA, MS, MOM NJ, NY, NC, OH, OK, SC. TN. KX. VA	665 m	G5	n/a	22 Mar (Jan (FL), Mar – Jul)

Comments — This species is included because it was found in just 2 parks. We collected 2 males from Side Lake in CARL.

Genus <i>Libellula</i> Linnaeus -						Skimmers
[Habitat — Lentic littoral (silt and detritus, vascular hydrophytes), lotic depositional (sediments): Habit — Sprawlers: Trophic — Predators (engulfers)] This is a genus of less than 30 species, 18 of which occur in North America. We found eight in the parks. <i>Libellula</i> species are assigned a tolerance value of 9.6.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Libellula pulchella</i> Drury, 1773 Twelve-spotted Skimmer	BLRI, CARL , GRSM ^(L)	Found in 8 Canadian provinces and all 48 contiguous states.	275-987 m	G5	9.6	5 Jun - 23 Sep (Apr - Oct)
Comments — <i>Libellula pulchella</i> is a migratory species that might appear in some localities without establishing breeding populations (Roble and others, 2009). Adult up to 57 mm in length. This species is included in this table because it was found in only three parks. We have 5 collections and 8 specimens of this species, including a single larva from the cement pond in front of the house at CARL.						
Family Macromiidae Tillyard & Fraser						
cruisers						
More than 120 species of cruisers are recognized globally distributed among 4 genera Kalkman (Kalkman and others, 2008). Two genera are found in North America, <i>Didymops</i> Rambur with 2 species, and <i>Macromia</i> Rambur with 7. Larvae have long legs splayed outward from the somewhat flattened body. They sprawl on the bottom in lakes, ponds, and shallows of larger rivers where they await prey to pass close by. The adults are among the largest dragonflies to be encountered in the study area.						
Genus <i>Macromia</i> Rambur –						River Cruiser
[Habitat — Lentic littoral (sand and silt), lotic depositional: Habit — Sprawlers: Trophic — Predators (engulfers, await prey)] Worldwide, approximately 75 species are known. Four species occur in the southeastern United States, and we found all four species in the parks. <i>Macromia</i> has a genus tolerance value of 6.2.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Macromia alleghaniensis</i> Williamson, 1909 Allegheny River Cruiser	BISO, CARL , GRSM ^(L)	AL, AR, FL, GA, IL, KY, MD, MS, NC, NJ, OH, PA, SC, TN, VA, WV	228-662 m	G4, GAS2, VAS2	6.2	9 Jul (Jun - Sep)
Comments — Larvae occur in marginal debris in cool streams. This species is considered imperiled in Georgia and Virginia. Larva up to 28 mm in length, adult up to 72 mm. We collected a single larva of this species from Pasture Creek below Side Lake in CARL.						

Suborder Zygoptera Selys damselflies

Damselflies are delicate and small in comparison with their robust and large cousins, the dragonflies. Their bodies, in both larval and adult stages are elongate and slender. The larvae generally have long legs that in some groups are stilt like. The wings are narrow at the bases and the front and hind wings are similar in shape, in contrast with those of dragonflies. Like dragonflies, the damselflies are carnivorous. The larvae have a hinged labium with a grasping mentum and palps for securing prey. Unlike dragonflies, they breathe with the aid of three external bladelike caudal gills. The gills make an excellent character for the recognition of damselfly larvae in the field. They are variable among and within groups, and often are very helpful in identification. The heads of adults are transverse, with prominent eyes. Many species are beautifully marked with bright, sometimes metallic colors. In some species the wings may be banded or have other markings. We found 15 species in 6 genera and 3 families in CARL. The following species are considered species of concern for this study.

Family Coenagrionidae Kirby pond damselflies

The Coenagrionidae, or pond damselflies, is the largest family of Odonata, consisting of nearly 1,100 species in 90 genera distributed in every biogeographic realm outside of Antarctica. More than 100 species are known from the Nearctic in 15 genera. During this survey, we found 23 species in 6 genera in the parks, and 14 species in 4 genera in BLRI. The smallest damselflies in the study area are found among the coenagrionids. Larvae are found in running as well as still water habitats.

Genus *Chromagrion* Needham -

Aurora Damsels

[Habitat — Lotic—erosional (detritus) and depositional (detritus and vascular hydrophytes in small spring streams): Habit — Climbers: Trophic — Predators (engulfers)] This monotypic genus and species is restricted to the Eastern United States.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Chromagrion conditum</i> (Selys, 1876) Aurora Damsel	CARL, GRSM	AL, AR, CT, DC, DE, GA, IL, IN, KY, MA, MB, MD, ME, MI, MO, MS, NB, NC, NH, NJ, NS, NY, OH, ON, PA, PE, QC, RI, SC, TN, VA, VT, WI, WV	537-754 m	G5	2.0	22 Mar – 12 Jul (Apr – Jun)

Comments — This species is included because the tolerance value is reported as 2.0 (Arnwine, 2006). “Marshy or grassy wet areas, with or without flow, including vegetated seeps.” (Beaton, 2007). We have 35 specimens of this species, including 32 from 5 locations in CARL.

Genus <i>Enallagma</i> Selys -						Bluets
[Habitat — Lotic erosional and depositional (margins and detritus): Habit — Climbers: Trophic — Predators (engulfers)] <i>Enallagma</i> species are found worldwide, but the greatest number of species is in the Nearctic. There are approximately 37 species in North America. We found nine species in the parks. The North American larvae of most species are known, and keyed in Westfall and May (1996), but are difficult to distinguish. Bluets have a tolerance value of 8.9. Species included here are those found only in one or two parks.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Enallagma aspersum</i> (HA Hagen, 1861) Azure Bluet	CARL, GRSM	AL, AR, CT, DE, GA, IL, IN, IA, KS, KY, MD, ME, MA, MI, MO, MS, NH, NJ, NY, NC, OH, OK, ON, PA, QC, RI, SC, TN, TX, VA, WV, WI	542-665 m	G5	8.9	22 Mar – 20 Jul (Apr - Aug)
Comments — This species is included in this table because it was found in just 2 parks. “Found only in shallow ponds or marshes, usually without fish” (Beaton, 2007). We collected 4 males from Side Lake in CARL.						
<i>Enallagma civile</i> (HA Hagen, 1861) Familiar Bluet	CARL, GRSM	AL, AR, AZ, BC, BN, CA, CH, CO, CT, CU, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, MT, NB, NC, ND, NE, NH, NJ, NL, NM, NO, NS, NV, NY, OH, OK, ON, PA, PE, QC, RI, SC, SD, SK, SO, TM, TN, TX, UT, VA, WI, WV, WY, Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, Bahamas, parts of South America	665 m	G5	8.9	6 Aug (Apr - Nov)
Comments — This species is included in this table because it was found in just 2 parks. However, it is so common and widespread that it likely occurs in all of the parks and states in the region. Beaton (2007) considers that this species can be found “at any still water habitat, especially ponds, even brackish,” and to occur uncommonly in slow streams and rivers. A lone female was found on Side Lake in CARL.						
<i>Enallagma daeckii</i> (Calvert, 1903) Attenuated Bluet	CARL	AL, AR, DE, FL, GA, IN, LA, MAD, MA, MS, NJ, NC, OK, PA, SC, TN, TX, VA	665 m	G5	8.9	19 Jun (Apr - Sep)
Comments — This species is included in this table because it was found in just 1 park. “Ponds and lakes, sometimes marshes or swamps” (Beaton, 2007). A single female was found on Side Lake in CARL.						
<i>Enallagma geminatum</i> Kellicott, 1895 Skimming Bluet	CARL, GRSM	AL, AR, CT, DE, FL, GA, IL, IN, IA, KS, KY, LA, ME, MA, MD, MN, MS, MO, ON, NE, NH, NJ, NY, NC, OH, OK, ON, PA, QC, RI, SC, TN, TX, VA, WV, WI	665 m	G5	8.9	22 Mar – 19 Jun (Mar - Nov)
Comments — This species is included in this table because it was found in just two parks. It is common at “lakes, ponds, and swamps, rarely found on slow rivers, almost always with fish” (Beaton, 2007). We collected 2 females and 2 males along Side Lake in CARL.						
<i>Enallagma traviatum</i> Slender Bluet	CARL	AL, AR, CT, DE, DC, FL, GA, IL, IN, KS, KY, LA, MD, MA, MI, MS, MO, NH, NJ, NY, NC, OH, OK, PA, SC, TN, TX, VA, WV, WI	661 m	G5	8.9	(Apr - Aug)
Comments — This species is included in this table because it was found in just 1 park. It lives on “edges of lakes and ponds, found more often where there is emergent vegetation” (Beaton, 2007). We found a female and a male on the shore of Front Lake in CARL.						

Family Lestidae Calvert spreadwings

This family is worldwide in distribution, and has 152 species in nine genera. In North America, there are 19 species in two genera. Only one genus was found in the parks. When lestid damselflies perch they sit with the wings half-spread. This posture is characteristic of the family and gives them their common name of Spreadwings. Other damselflies perch with their wings held together over the back. This posture, the narrow base of the wings (petiolate), and their generally large size make lestid adults readily recognizable in the field. Identification to species is more difficult, and may require close examination to be certain.

Genus *Lestes* Leach -

Red Damsels

[Habitat — Lentic vascular hydrophytes, lotic depositional (vascular hydrophytes): Habit — Climbers: Trophic — Predators (engulfers)] This is the largest genus in the family, with more than 80 species having a cosmopolitan distribution. Larvae are virtually restricted to lentic waters, usually with emergent vegetation.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Lestes vigilax</i> HA Hagen in E Selys, 1862 Swamp Spreadwing	BLRI, CARL , GRSM ^(L)	AL, AR, CT, DE, FL, GA, IA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MS, NB, NC, NH, NJ, NS, NY, OH, OK, ON, PA, QC, RI, SC, TN, TX, VA, WI, WV	982-1024 m	G5	9.4	11 Jun - 22 Aug (Apr - Nov)

Comments — This species is included in this table because it was found in only three parks. Adult up to 55 mm in length. Found along the edges of marshes, ponds, and lakes (Beaton 2007). We have 4 collections and 13 specimens of this species, including 2 larvae from Front Lake in CARL.

ORDER PLECOPTERA BURMEISTER

STONEFLIES

The stoneflies, Order Plecoptera, are hemimetabolous aquatic insects distributed worldwide. Approximately 3,500 species are known, distributed among 16 families and about 270 genera. As with virtually all insects, much more study has occurred in the Northern Hemisphere than in the Southern Hemisphere and more in the Temperate than in the Tropical realms. This, therefore, considerably biases our knowledge and understanding of the distribution, ecology, and biology of stoneflies. Current information indicates that stoneflies are largely restricted to cold, running waters. Only a relative handful is found in lakes or other lentic waters, and arid lands are virtually devoid of stoneflies (Fochetti and Tierno de Figueroa, 2008). Stoneflies are weak fliers and poor dispersers—some adults lack functional wings—and coupled with their ecological limitations, tend to be highly restricted in distribution and to display a relatively high degree of endemism. Very few species are found on more than one continent or biogeographic region, and within regions, distributions often are restricted to smaller geographic subdivisions. The greatest numbers of species are found in Asia (approximately 1,500 species [Fochetti and Tierno de Figueroa, 2008]), the Nearctic (650 species), and Europe (420 species). It is likely that further study in the coming decades will almost double the number of known species of Plecoptera, with very many new taxa to be found in the tropical regions of the world (Fochetti and Tierno de Figueroa, 2008).

The higher taxonomy of Plecoptera, like that of most insect groups, is not resolved to everyone's satisfaction. The taxonomy used here is the most widely accepted and is based on Zwick (2000), as reflected in Stewart and Stark (1988). Two suborders are recognized, the Northern Hemisphere Arctoperlaria Zwick, and the Southern Hemisphere Antarctoperlaria Zwick. Only the former is found in North America. The Arctoperlaria is subdivided into two groups, the Euholognatha Zwick and the Systellognatha Enderlein.

About 650 species of stoneflies are found in North America, in 9 families and around 100 genera. In this study, we found 136 species in 34 genera and all 9 families. North American stonefly larvae can be identified to genus, and in some genera, many species are identifiable, as well. Indispensable resources for stonefly larval taxonomy include Stewart and Stark (1988, 1993, 2008). A new series of publications on adult taxonomy, which includes keys to species, is the "Stoneflies (Plecoptera) of Eastern North America," volumes 1 and 2 (Stark and Armitage, 2000, 2002).

Most North American Plecoptera species have univoltine (1-year) or semivoltine (2-year) life cycles (Stewart and Stark, 1988). A small number of species from northern latitudes may have 3-year life cycles. Species that have univoltine life cycles are characterized as being either fast or slow. A fast, univoltine population is one in which a significant amount of time is spent resting in the egg and (or) larval stage without hatching or with no appreciable growth occurring. In these populations, growth occurs very quickly over just a few months. A slow, univoltine life cycle is one in which there is no stasis during growth, which occurs steadily, if not uniformly, over most of the year. Larvae pass through numerous instars, 10 to 20+, although it is virtually impossible to be precise and the number of instars may vary depending on environmental factors (Stewart and Stark 1988). Stonefly larvae have a wide range of feeding and habitat requirements (Stewart and Stark 1988), and the broad generalizations provided in Merritt and others (2008) are viewed with caution. Many larvae are shredders/herbivores, others are carnivores, some are omnivores, and many begin feeding in one manner as early instars before switching to a different manner of feeding as they mature. Habitat requirements are more stable over the life of larvae, and most species can be characterized as preferring a particular type of stream based on size, temperature, gradient, permanency, or other criteria. Many species have specific microhabitat requirements within a water body. One species is only known from depths of 40–60 m in Lake Tahoe; another, from the study area is found only in root mats in undercut banks of Appalachian streams. Some of the leaf shredder species can be reliably found in accumulations of leaves and other coarse organic matter.

Stonefly adults rarely feed, and in fact, have only poorly developed mouthparts. The function of the adults is to reproduce, and consequently adults are short lived. Among the Arctoperlaria families, an intriguing mating behavior exists that is not found among the Antarctoperlaria. Many species across many families use vibrational communication (drumming) that allows males and females to locate each other (Stewart and Sandberg, 2006). In this behavior, among aggregations of individuals following emergence from the larval habitat, males will signal to potential mates in one of four ways: (1) by tapping the substrate

with his abdomen, which may have a specialized structure called a hammer; (2) scratching or scraping the substrate; (3) by rubbing the substrate with the abdomen; (4) by tremulation or shaking of the substrate. Species specific patterns of vibration using one of these methods allow females within range to distinguish potential mates, and the females will then respond to the males with their own drumming pattern, almost always produced by tapping or by tremulation. Laboratory studies have demonstrated that individuals can detect each other as far as 8 m apart. When a potential mate has been detected, they establish a duet pattern of drumming. When the pair has decided the potential for mating with an individual of the same species exists, the male begins moving toward the female by orienting in response to her vibrational communications until he locates her and mating ensues. Stoneflies are believed to have the most complex form of vibrational communication among insects.

Stark and others (1998, 2012) established common names for about 620 species of Nearctic stoneflies. Each family is given a name, and every species in the family has a name that incorporates the family name. For example, the family Capniidae is called the Snowflies, and the species *Allocapnia formosa* Ricker, 1952, is called the Smokies Snowfly. Family and species names based on this system are used below.

Suborder Arctoperlaria Zwick

Group Euholognatha Zwick

Family Capniidae Klapálek

snowflies

This is one of the families of winter stoneflies, so called because the adults emerge in the winter months, principally from Nov through March. The family contains more than 310 described species in 17 genera worldwide, and of those, the majority is found in the Nearctic. More than 150 species in 10 genera are found in North America. We collected 9 species in 2 genera in the parks, but only 1 species in the two genera in BLRI. Male snowflies are commonly brachypterous (short-winged) while the females have wings longer than the abdomen (macropterous). Adults are dark brown to black, and may be seen crawling about on snow after emergence, accounting for the common name.

Genus *Allocaupnia* Claassen - [Habitat — Lotic erosional (coarse sediments, wood, leaf packs) and depositional: Habit — Clingers: Trophic — Shredders detritivores] Approximately 40 species of *Allocaupnia* are known from North America, and we found eight species in the parks. Males of most species have the wings shorter than the body, at least in some specimens, and sometimes males may be wingless. Females have fully developed wings that extend beyond the end of the abdomen. Snowflies often are found in springs including those that frequently are dry a short distance from the source (Grubbs, 2008). Bouchard and others (2009) have shown that two species of *Allocaupnia* (*A. granulata* and *A. pygmaea*), despite being winter stoneflies often found on snow, are not freeze tolerant. This finding may explain why adults are more commonly found in late winter and early spring. Larvae of *Allocaupnia* cannot be identified to species at present, so the genus has been assigned a tolerance value of 2.5.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Allocaupnia aurora</i> Ricker, 1952 Aurora Snowfly	CARL, GRSM ⁽¹⁾	AL, CT, DC, DE, GA, IL, IN, KY, LA, MA, MD, ME, MS, NC, NH, NS, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	266–895 m	G5	2.5	25 Oct - 1 Jan (Nov - Apr)
Comments — According to Ross and Ricker (1971), “this species occurs in moderately large, fast, rocky, cool streams.” We found adults in the Duck Pond and the Mountain Reservoir in CARL.						
<i>Allocaupnia recta</i> (Claassen, 1924) Eastern Snowfly	BLRI, CARL, GRSM ⁽¹⁾ , LIRI, OBRI	AL, CT, DC, DE, GA, IL, IN, KY, LA, MA, MD, ME, MS, NC, NH, NS, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	266–895 m	G5	2.5	25 Oct - 1 Jan (Nov - Apr)
Comments — “This species occurs in fairly rapid, clear, cool streams with a gravel or rocky bottom and is more common than most species of the genus in very small spring-fed brooks.” (Ross and Ricker, 1971). Larva up to 7.5 mm in length, adult up to 6 mm. We collected 2 specimens from the Mountain Reservoir in CARL.						

Family Leuctridae Klapálek

needleflies

This family has just over 320 species worldwide, with about 60 known from North America. The common name is in reference to the very slender appearance of the adults, in which the wings are “rolled” around the sides of the body when at rest. Larvae are primarily detritivores. In the study region, these are very common and often very abundant species in small, cold streams.

Subfamily Leuctrinae Klapálek

Genus *Leuctra* Stephens - [Habitat — Lotic erosional and depositional: Habit — Sprawlers clingers: Trophic — Shredders detritivores] This genus includes about 200 species worldwide, with nearly 30 species in North America. We found 17 species in the parks. Larvae are inseparable at this time; species have been assigned a genus-level tolerance value of 2.5.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Leuctra biloba</i> Claassen, 1923 Two-lobed Needlefly	BLRI, CARL , GRSM	AL, GA, NC, ON, TN, VA, WV	594-1944 m	G5	2.5	3 Feb - 28 Jul
Comments — We have 26 collections and 122 specimens of this species, including 12 specimens from the Mountain Reservoir at CARL.						
<i>Leuctra carolinensis</i> Claassen, 1923 Carolina Needlefly	BISO, BLRI, CARL , GRSM	MD, NC, TN, VA, WV	295-1944 m	G4	2.5	1 May - 31 Jul
Comments — We have 16 collections and 86 specimens of this species, including 11 specimens from the Duck Pond and the Trout Pond at CARL.						
<i>Leuctra ferruginea</i> (Walker, 1851) Eastern Needlefly	BLRI, CARL , COWP, CUGA, GRSM ^(L) , LIRI	AL, CT, DE, FL, KY, MA, MD, ME, MI, MN, MS, NB, NC, NE, NS, NY, OH, PA, QC, SC, SK, VA, WI, WV	274-1944 m	G5	1.5	1 Feb - 31 Nov (Jan - Dec)
Comments — Perhaps the most common stonefly in the study area. This species prefers small, cold streams, but can be found in a wide variety of habitats. Emergence occurs over an extended period, and adults can be found almost every month of the year in the study region. Development seems strongly influenced by stream temperatures, with each stage of development taking longer at lower temperatures. In Prince Edward Island, Dobrin and Giberson (2003) reported a two-year life cycle, similar to the life cycle reported for Ontario populations. Harrison and Stark (2010) described two new species from Mississippi that previously would have been called <i>L. ferruginea</i> . It is possible that either or both of these newly recognized species eventually will be found in the parks. Larva up to 7 mm in length, adults up to 8.5 mm. We have 100 collections and 829 specimens of this species, including one male from Mountain Reservoir in CARL.						
<i>Leuctra tenella</i> Provancher, 1878 Broad-lobed Needlefly	CARL , GRSM ^(L) , KIMO	CT, LB, MA, MD, ME, MN, MS, NB, NJ, NS, NY, ON, PA, QC, WI, WV	214-1424 m	G5	1.5	16 May - 26 Aug (Jul - Aug)
Comments — Giberson & Garnett (1996) found this species emerged from July through September in New Brunswick, and Masteller (1983) reported that it emerged June to August in Pennsylvania. Larva up to 7 mm in length, adult up to 8 mm. We have 13 collections and 161 specimens of this species. In CARL, we found an adult male from the Trout Pond spring.						

Family Taeniopterygidae Klapálek willowflies

This family of winter stoneflies is found in North America, Eurasia, and northern Africa (Hitchcock 1974). Globally it has 12 genera and just over 100 species.

Subfamily Brachypterainae Zwick

Genus *Oemopteryx* Klapálek - [Habitat — Generally lotic erosional (coarse sediments, debris jams, leaf packs) and depositional margins: Habit — Generally sprawlers, clingers: Trophic — Generally shredders detritivores, facultative collectors gatherers and scrapers] This genus is Holarctic, with one rare western Palearctic species and five North American species. We found a single species in this survey. The genus has a tolerance value of 0.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Oemopteryx contorta</i> (JG Needham & Claassen, 1925) Dark Willowfly	BLRI, CARL , GRSM ^(L) , LIRI, OBRI	CT, KY, MA, MD, ME, NC, NH, PA, TN, VA, WV	266–1757 m	G4	0.0	1 Feb - 29 Apr (Apr - May)

Comments — The life history of this species was studied by Nelson (1982) in GRSM. Larval growth occurred from October to April, passing through five instars. Emergence of adults was from April to May. The species is univoltine. Larva up to 10.5 mm in length, adult up to 11.5 mm. We have 14 collections and 38 specimens of this species, including 3 specimens from the Duck Pond and Mountains Reservoir in CARL.

Subfamily Taeniopteryginae Zwick

Genus *Taeniopteryx* Pictet — [Habitat — Lotic erosional (coarse sediments, wood, leaf packs) and depositional at margins: Habit — Sprawlers clingers: Trophic — Shredders detritivores, facultative collectors gatherers (scrapers)] Fullington and Stewart (1980) presented a key to the larvae of this genus. These are assigned a tolerance value of 5.4. We collected a single larva that could not be determined to species from the mouth of Ridley Cave in RUCA.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Taeniopteryx burksi</i> Ricker & Ross, 1968 Eastern Willowfly	CARL , GRSM ^(L) , OBRI	AL, AR, CO, CT, DE, FL, IA, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, NC, NE, NY, OH, OK, ON, PA, QC, SD, TN, TX, VA, WI, WV	266–363 m	G5	5.4	20–22 Feb (Dec - May)

Comments — Larva up to 12 mm in length, adult up to 15 mm. This species is included in this table because it was found in only 3 parks. We have 7 collections and 49 specimens of this species, including 3 females from Front Lake in CARL.

Suborder Arctoperlaria Zwick

Group Systellognatha Enderlein

Family Chloroperlidae Okamoto

Sallflies

There are more than 150 known species in 19 genera of sallflies, primarily found in the Holarctic regions (Fochetti and Tierno de Figueroa, 2008). Ten genera and nearly 80 species are found in North America (Stewart and Stark, 1988). We found 13 species in 5 genera in the parks.

Genus *Alloperla* Banks - [Habitat — Lotic erosional: Habit — Clingers: Trophic — Predators (engulfers), scrapers, collectors gatherers] There are more than 150 known species in 19 genera of sallflies, primarily found in the Holarctic regions (Fochetti and Tierno de Figueroa, 2008). Ten genera and nearly 80 species are found in North America (Stewart and Stark, 1988), and we found 6 species in the parks, 2 in BLRI.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Alloperla nanina</i> N Banks, 1911 Swannanoa Sallfly	CARL, GRSM	GA, NC, NY, TN, VA	656-1097 m	G4	1.2	1 May – 4 Jun (May)

Comments — Adults 5.0-5.5 mm long. We found 2 males at the Duck Pond in CARL.

Genus *Haploperla* Navás - [Habitat — Lotic erosional: Habit — Clingers: Trophic — Predators (engulfers; Chironomidae), facultative collectors gatherers and scrapers] This genus contains approximately 9 species. Three species are found in eastern Siberia (Zhiltzova, 2010), and six are found in North America. A tolerance value of 1.0 has been assigned to *H. brevis*.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Haploperla brevis</i> (N Banks, 1895) Least Sallfly	BISO, BLRI, CARL, COWP, GRSM ⁽¹⁾ , LIRI, SHIL	AB, AL, AR, BC, CT, DE, GA, IL, IN, KY, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NH, NJ, NS, NY, OH, OK, ON, PA, PE, QC, SC, SK, TN, VA, VT, WI, WV	124-1480 m	G5	1.0	1 May - 30 Jul (Apr - Oct)

Comments — A common, abundant, and widespread species that is often overlooked because of its small size. Larva up to 7 mm in length, adult up to 9 mm. We have 62 collections and 179 specimens of this species. We found a single specimen from the Duck Pond in CARL.

Genus *Sweltsa* Ricker - [Habitat — Lotic erosional: Habit — Clingers: Trophic — Predators (engulfers; Chironomidae, Simuliidae)] *Sweltsa* contains about 40 species distributed in the Oriental, Palaearctic, and Nearctic Realms, with 30 species known from North America. Nine species are found in the East, and we collected four in the parks. These insects are highly sensitive to disturbance, and are assigned a genus-level tolerance value of 0.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Sweltsa lateralis</i> (N Banks, 1911) Curved Sallfly	BLRI, CARL , GRSM ^(L)	CT, GA, MA, MD, ME, NB, NC, NH, NY, OH, PA, QC, SC, TN, VA, VT, WV	522-1944 m	G5	0.0	1 May - 26 Jun (Apr - Jul)

Comments — Adult up to 13 mm in length. We have 25 collections and 80 specimens of this species. We found a single female from Trout Pond spring in CARL.

Family Peltoperlidae Claassen roachflies

The peltoperlids consist of about 55 species and 11 genera. Approximately 22 species in 6 genera are found in North America, and 24 species in about 5 genera in east Asia. The common name, roachflies, is derived from the general resemblance of specimens to cockroaches.

Genus *Tallaperla* Stark and Stewart - [Habitat — Lotic erosional and depositional (leaf litter): Habit — Sprawlers clingers: Trophic — Shredders (leaf litter)] This genus (Stark and Stewart, 1981) is found only in eastern North America and contains 6 species (Stark, 1983). Larvae are common inhabitants of cold, forested streams in the Southeast, and can be found in high densities in leaf packs and detritus (Stewart and Stark, 1988). Larvae cannot be identified to species at this time. Stark (1983) provided keys to males and females. The genus has been assigned a tolerance value of 1.2.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Tallaperla anna</i> (JG Needham & Smith, 1916) Piedmont Roachfly	BLRI, CARL , GRSM ^(L) , KIMO	GA, NC, SC, VA	211-1409 m	G4	1.2	3 May - 25 Jul

Comments — We have 15 collections and 30 specimens of this species, but only 1 specimen from CARL, at the Trout Pond.

Family Perlidae Latreille

stones

This is the largest family of stoneflies, having approximately 50 genera and more than 1,000 species worldwide (Fochetti and Tierno de Figueroa, 2008). The family occurs in the Nearctic, Neotropical, Palearctic, Oriental, and Ethiopian Realms. In eastern North America, 15 genera and nearly 80 species are known. Most species appear to be univoltine, but some are known to have bivoltine populations, and trivoltine life cycles have been suggested for others (Peckarsky, 1979). Larvae live in heterogeneous rocky substrates. Certain species are known to prefer a particular range of substrate particle sizes to others (Peckarsky, 1979). Larvae of Perlidae are carnivorous and feed on a wide range of prey species, but seem to prefer baetid mayflies to other prey.

Subfamily Acroneuriinae Klapálek

Genus *Acroneuria* Pictet - [Habitat — Lotic and lentic erosional: Habit — Clingers: Trophic — Predators (engulfers; Chironomidae, Trichoptera, Ephemeroptera, Plecoptera)] This is a modestly sized Holarctic genus of about 34 species distributed in North America (18 species), and the Palearctic and Oriental regions. We found five species in BLRI. Claire and Phillips (1968) documented one western US species feeding on trout eggs, and Mathews (1982) reported larvae of an unspecified species of *Acroneuria* killing and feeding on immature specimens of *Desmognathus marmoratus* (Moore, 1899), the Shovel-nosed Salamander, in a laboratory setting. Such behavior has not been reported from field observations.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Acroneuria abnormis</i> (Newman, 1838) Common Stone	BISO ^(L) , BLRI, CARL , CUGA ^(L) , GRSM ^(L) , KIMO, LIRI, OBRI ^(L)	AB, AL, CO, CT, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MB, MD, ME, MI, MN, MS, MT, NB, NC, ND, NE, NF, NM, NY, OH, ON, PA, QC, SC, SD, SK, TN, UT, VA, WI, WV, WY	200-1307 m	G5	2.1	1 May - 31 Aug (May - Sep)

Comments — Larvae occur in streams, creeks, and rivers. They are normally found under large rocks and boulders. The presence of larvae of various sizes at any one time in a population indicates that *A. abnormis* likely takes up to three years to develop (Doddall and Lehmkuhl, 1979). In Quebec, Steffan (1965) found that 83% of phoretic chironomid larvae were found on *A. abnormis* larvae, but in Saskatchewan phoretic chironomids are not found on *A. abnormis* but they are found on other *Acroneuria* larvae (Doddall and Lehmkuhl, 1979). Genito and Kerans (1999) found *A. abnormis* preferentially fed on different prey species on a seasonal basis. They concluded that the shifts in preference were likely due to shifting abundances of the prey species. Larva up to 26.1 mm in length, female forewing up to 33 mm, male forewing up to 25 mm. We have 397 collections and 4,174 specimens of this species. We collected only 2 females of this species from CARL.

Genus *Beloneuria* Needham & Claassen - [Habitat — Lotic and lentic erosional: Habit — Clingers: Trophic — Predators (engulfers)] This genus, which consists of three species, is endemic to the southern Appalachians. We found two species in the parks.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Beloneuria georgiana</i> (N Banks, 1914) Georgia Stone	CARL , GRSM	GA, NC	472-1164 m	G2	0.0	17 Jun – 13 Aug (May - Jun)
<i>Beloneuria stewarti</i> BP Stark & SW Szczytko, 1976 Piedmont Stone	BLRI, CARL , GRSM	GA, NC, SC, TN	559-1786 m	G3	0.0	7 Jun - 18 Jul (May - Jun)

Comments — Morse and others (1997) treat this species as rare and vulnerable. It is common at low elevation seeps in its range, but at low densities. It is considered vulnerable globally. Female forewing up to 15 mm in length, male forewing up to 13 mm. We have 6 collections and 13 specimens of this species, including a male and a female from Mountain Reservoir in CARL.

Genus *Perlesta* Banks - [Habitat — Lotic erosional and depositional (in detritus): Habit — Clingers: Trophic — Predators (engulfers; Chironomidae, Simuliidae, Ephemeroptera, Trichoptera), facultative collectors gatherers (especially in early instars)] This genus might be an eastern Nearctic endemic, but two species from China are currently placed in this genus. Seventeen species are presently known from North America, but several undescribed species are known from the study area and from several of the parks. Many species of *Perlesta* are assigned a tolerance value of 4.7.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	-----------------	----------	-----------------	--------------

Comments — This record is included here because it represents the only records of this genus from the park. We collected 5 specimens from Memminger Creek below Front Lake in CARL.

Family Perlodidae Klapálek

stripetails, springflies

This is a cosmopolitan family of nearly 300 species in 51 genera. The North American fauna consists of about 125 species 30 genera. In the study area, we found 26 species in 10 genera.

Subfamily Isoperlinae Frison

stripetails

Genus *Isoperla* Banks - [Habitat — Lotic erosional and depositional, large cold lake: Habit — Clingers sprawlers: Trophic — Predators (engulfers; Chironomidae, Simuliidae, Ephemeroptera, Plecoptera), facultative collectors gatherers] This is a large, Holarctic genus of more than 125 species, including a number of undescribed species from the study area. We found 11 named species in the parks. Many new species recently been described in this genus.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	-----------------	----------	-----------------	--------------

Comments — This is included here because it represents records of this genus from CARL. We collected more than 200 unidentified *Isoperla* specimens altogether, including 14 specimens from 5 locations in CARL.

ORDER TRICHOPTERA KIRBY

CADDISFLIES

Trichoptera is the largest of the predominately aquatic insect orders, with approximately 15,000 described species in 600 genera and 47 families (Holzenthal and others, 2007). The majority of Trichoptera have aquatic larvae, with only a small number having semi-terrestrial or terrestrial larvae. Caddisflies are found in virtually all freshwater habitats throughout the world, except Antarctica. A small number of species is found in brackish and marine habitats. The majority of larval caddisflies make cases or fixed retreats, which play roles in larval feeding, respiration, and camouflage. Those species that do not make cases or fixed retreats are free-living. Trichoptera are most closely related to the order Lepidoptera, the moths, skippers, and butterflies. Adult caddisflies, in fact, closely resemble moths. Adult caddisflies range in size from about 1.5 to 43 millimeters. Like Lepidoptera, Trichoptera undergo complete metamorphosis, progressing from egg to larva to pupa to adult. Most caddisflies have a 1-year or univoltine life cycle, although bi- and multivoltine life cycles are known. The majority of species are nocturnal as adults; only a relatively few species are day-active.

The use of silk for case making, net spinning, and other functions is one of the defining characteristics of Trichoptera, and is one of the significant factors responsible for the ecological success of the order. Wiggins and Mackay (1978) list five general categories of uses that allow caddisfly larvae to exploit their aquatic habitats: (1) constructing fixed retreats with feeding nets, (2) making fixed tubular retreats from which the larvae extend to feed on surrounding substrates or passing prey items, (3) building portable cases for protection while moving about and grazing on the substrate in exposed situations, (4) fashioning tubular cases or retreats to maintain or enhance current flow over the body, (5) providing a safety line that provides security for free-living larvae searching for prey in strong currents. In addition, the use of silk has also been considered to increase the stability of gravel substrates in streams, and thus has the potential to reduce the effects of flooding in areas with high densities of filter-feeding caddisflies (Cardinale and others, 2006; Statzner and others, 1999).

Suborder “Spicipalpia” Weaver

The phylogenetic placement of the first four families is not resolved and represents one of the most debated issues in Trichoptera phylogeny. Some authors treat them as a separate suborder, Spicipalpia (Wiggins and Wichard, 1989; Frania and Wiggins, 1997). Others consider that arrangement to be paraphyletic (that is, artificial) and consider their phylogenetic placement, based on molecular as well as morphological data, to be unresolved (Morse, 1997; Kjer and others, 2001, 2002; Holzenthal and others, 2007; Malm and others, 2013). “Spicipalpia” is used here merely for convenience in grouping and not as a statement of support for any particular phylogenetic arrangement.

Family Glossosomatidae Wallengren

saddle-case making caddisflies

The Glossosomatidae are a cosmopolitan family with approximately 660 species worldwide (Holzenthal and others, 2007). The larvae are characterized by their distinctive stone cases that resemble turtle shells. The larva is hidden within its case by a dome of sand and gravel and with a ventral strap or “plastron” of small sand grains, leaving an opening at either end. The larva can extend its head out of either opening while its posterior end extends out the opposite opening. They feed by scraping diatoms, algae, and other organic material from the surface of rocks in clean flowing water. Some species of *Glossosoma* feed on detritus, as well. When the larval glossosomatid is ready to pupate, it cuts away the ventral strap and fastens the dome portion of the case to the substrate, and forms a cocoon within which it pupates. Adult glossosomatids are generally brown to black with few markings, however, *Padunia* and *Protoptila* have a light transverse bar in the forewing. The species in the Southeast range in size from 2.4 to 8.5 mm in length as adults. Glossosomatids are usually univoltine, taking one year to complete their life cycle; however, some populations produce two or three generations per year (Jin and Ward, 2007). Some species of *Agapetus* in Great Britain have been inferred to have two generations per year (Crichton and Fisher, 1978).

Subfamily Agapetinae Martynov

Genus *Agapetus* Curtis - [Habitat - Lotic erosional: Habit - Clingers (laterally compressed turtle shell case, mineral): Trophic - Scrapers, collectors - gatherers] This genus consists of more than 200 species worldwide, but is absent from the Neotropics. In North America, there are 42 described species with 29 known from the Southeast. Several recently described species were collected during this survey, and some type localities are in the parks of the monitoring networks (Etnier and others, 2010). In that paper, the authors suggest that *Agapetus* species are among the most sensitive caddisflies to human caused disturbance, particularly sedimentation and similar habitat alterations. Human activity that alters streams by eliminating the canopy and increasing the amount of sediment in streams eliminates *Agapetus* species from otherwise suitable habitat. We have observed that healthy populations of *Agapetus* can be found in National Forest and National Park lands while private lands in the vicinity of those protected areas will have few if any populations (Etnier and others, 2010). This is reflected in the tolerance value of 0.0 assigned to all *Agapetus* species. Bonada and others (2004), on the other hand, found larvae of *Agapetus* in Spain living in semiarid regions with relatively low water quality, and assigned the genus a high tolerance value.

At least one European species is known to have 6–7 larval instars in certain populations; however, of those North American species whose life histories have been investigated, larvae have 5 instars. Larvae are not identifiable at present.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Agapetus jocassee</i> JC Morse, 1989	CARL, GRSM	GA, NC, SC, TN	754 m	G2	0.0	7 Jun (Apr - Jul)
Comments — Restricted to mountain streams in the study area. This species is considered imperiled globally. We collected a single female from the Mountain Reservoir in CARL.						

Subfamily Glossosomatinae Wallengren

Genus *Glossosoma* Curtis - [Habitat - Lotic erosional (including large alpine rivers): Habit - Clingers (turtle shell case, mineral): Trophic - Scrapers] This genus consists of more than 120 species from the Holarctic and Oriental biogeographic regions. In the Southeast, three species are known, one of which is common and widespread in the region. Wymer and Morse (2000) provided a recent redescription of all stages of *G. nigrrior*, and keys to the Eastern species.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Glossosoma nigrrior</i> N Banks, 1911	BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM ^(L) , KIMO, LIRI, MACA, OBRI, RUCA, SHIL	AL, CT, DE, GA, IN, KY, LB, MA, MD, ME, MI, MN, NC, NF, NH, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	112-1480 m	G5	1.5	3 Mar - 15 Dec (Mar - Sep)

Comments — Adults have been collected in every month except January and February, but greatest adult emergence is through the summer months. Georgian and Wallace (1983) found *G. nigrrior* to be bivoltine in North Carolina. Trapp and Hendricks (1984) found two populations to be bivoltine and one population to be univoltine in Giles County, Virginia. The difference was attributed to cooler stream temperatures at the site with the univoltine population compared with the other two sites. Jin and Ward (2007) report that two populations they studied in Alabama were trivoltine, which they attributed to warmer stream temperatures than those found in streams that are more northern. Larvae grazed mostly on algae (50% of gut contents) and detritus (40%). We found *G. nigrrior* in 436 collections totaling 2,608 specimens from 13 parks during this study, which indicates that it is not at risk regionally. In CARL, we found 9 specimens from 9 locations.

Subfamily Protoptilinae Ross

Genus *Protoptila* Banks - [Habitat - Lotic erosional: Habit - Clingers (laterally compressed turtle shell case, mineral): Trophic - Scrapers] This genus is similar to *Matrioptila* in its preference for larger rivers. It has more than 100 described species in North and South America, but only 13 species are found in North America, and seven species are found in the southeastern United States. Two widespread species have been collected in this survey. *Protoptila* larvae are inseparable at present, so species are assigned a genus tolerance value of 2.8.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — This is included here because it represents the only record of this genus from CARL. We found a single female from Front Lake near the parking lot in CARL.						

Family Hydroptilidae Stephens

microcaddisflies

The family Hydroptilidae is commonly known as the micro-caddisflies due to their small size. Mature larvae range in size from 1.5 to 7.0 mm (Marshall, 1979). However, Hydroptilidae is the largest family of Trichoptera in terms of the number of described species, with about 2,000 species known worldwide (Holzenthal and others, 2007). In North America, approximately 19 genera are recognized which contain more than 200 species (Wiggins, 1996). In the Southeast, approximately 19 genera containing 173 species are known, many of them having been described within the past 30 years. Little is known of hydroptilid biology because of their small size. Hydroptilids are unique among caddisflies in that the first four instars are free living and only the final fifth instar builds a case. The final instar also is morphologically very different from the earlier instars, as they go through a process called hypermetamorphosis at the final molt. Much of our current understanding of hydroptilid biology is based on laboratory studies by Nielsen (1948). More recently, Resh and Houpp (1986) and Keiper and others (Keiper, 1999; Keiper, 2002; Keiper and Bartolotta, 2003; Keiper and Foote, 2000; Keiper and Harris, 2002; Keiper and Walton, 1999, 2000) have published studies of hydroptilid biology. As a generalization, hydroptilid larvae feed on diatoms and algae. Some species feed by piercing individual cells of algae and eating the contents. Others eat strands of algal filaments, or scrape diatoms from various substrates. Some species have feeding strategies that vary with instar. Most species are univoltine, although two generations per year have been reported in a few species (Nielsen, 1948; Unzicker and others, 1982). Larval cases are diverse within the family, but many species make a case type referred to as a “purse” case. These cases consist of two valves of silk attached along the upper and lower margins, and having the anterior and posterior ends open. The valves may be made entirely of silk, or may be covered with sand grains or incorporate algae, diatoms, or other materials. The larva can turn around inside the case and have its head extended from either end as it chooses. When not actively crawling about, the larva may attach the case to the substrate with silk. At pupation, the larva firmly affixes the case to the substrate and pupates within. Some genera have very different case types, which will be mentioned below. Larvae are indistinguishable at present.

Genus *Hydroptila* Dalman - [Habitat - Lotic erosional and depositional (including seeps): Habit - Clingers (purse-type case of silk and fine mineral): Trophic - Piercers herbivores, scrapers] This is the largest genus in the family, having approximately 440 described species (Holzenthal and others, 2007). In North America, more than 100 species are currently known, with a number of undescribed species also known, including several found during this study. Final instar larvae make the typical purse case, usually made of silk with a coating sand grains, but sometimes with diatoms or algal filaments incorporated (Wiggins, 1996). Of the 28 species encountered during this study, only nine have a global or state rarity ranking. Also, because it is not yet possible to identify *Hydroptila* larvae to species, the listed tolerance value (TV = 6.2) is based on evidence that at least some species are relatively tolerant of pollution. The status of *Hydroptila* species in terms of conservation needs is not well advanced.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Hydroptila coweetensis</i> AD Huryn, 1985	BLRI, CARL , GRSM ^(L) , MACA	AL, KY, NC, VA	177-1551 m	G1, ALS1, NCS1	6.2	5 Jun - 28 Jul (May - Jun)

Comments — Considered critically imperiled globally and in Alabama and North Carolina. Morse and others (1997) consider it rare and vulnerable. Narrowly endemic in the mountains of the southern Appalachians. Larvae are found in madicolous habitats having cold water washing over bare rocks. The pupal stage may last at least 45 days. Adult up to 3 mm in length. We have 6 collections and 11 specimens of this species, including 2 males from Mountain Reservoir in CARL.

Genus *Oxyethira* Eaton - [Habitat — Lentic vascular hydrophytes (with filamentous algae): Habit — Climbers (purse-type case, flat, flask-shaped, open at back, primarily of silk): Trophic — Piercers herbivores, collectors gatherers, scrapers?] With about 200 known species, *Oxyethira* is cosmopolitan in distribution. In North America about 50 species are known, with more than 30 found in the Southeast. Larvae make very distinctive cases of silk that resemble a flattened flask with a narrow neck at the anterior end and with a slit opening at the posterior end. Larvae prefer lakes, ponds, or the slow moving portions of flowing waters. They are found among submerged aquatic plants where they feed on algae (Nielsen, 1948). Species of *Oxyethira* are assigned a genus tolerance value of 5.6. We collected 4 species in LIRI, including the following.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Oxyethira dualis</i> Morton, 1905	CARL	AL, AR, AZ, CA, CO, IL, IN, KS, MO, MT, NH, NM, NY, OH, OK, OR, PA, SC, TN, TX, UT, VA, VT, WA, WY	656-754 m	G5	2.2	1 Jan – 25 Oct (Jan - Oct)
Comments — Despite its transcontinental distribution, we only found <i>O. dualis</i> in a single park in this study. Adult up to 3.1 mm in length. We have 22 collections and 711 specimens of this species, including 590 specimens from 11 locations in CARL.						
<i>Oxyethira forcipata</i> ME Mosely, 1934	BISO, BLRI, CARL , CUGA, LIRI ^(L) , NISI	AL, AR, CT, GA, KY, IL, ME, MI, MN, MO, NC, NH, NY, OH, OK, ON, PA, QC, SC, TN, VA, WI	135-1080 m	G5	2.2	1 Jan - 30 Sep
Comments — Adult up to 3.1 mm in length. We have 22 collections and 711 specimens of this species, including 590 specimens from 11 locations in CARL.						
<i>Oxyethira janella</i> Denning, 1948	CARL	AL, AR, FL, GA, LA, MS, NC, OK, SC, VA, Antilles, Costa Rica, Cuba, Dominican Republic, Grenada, Haiti, Panama	661 m	G5	2.2	30 Aug
Comments — A very widespread species found from Panama to the Antilles and from Florida to Oklahoma. We collected a single specimen from CARL at the Front Lake parking area.						
<i>Oxyethira michiganensis</i> ME Mosely, 1934	BLRI, CARL , GRSM	AL, BC, CT, GA, ME, MI, MN, NC, NH, NY, OH, PA, QC, SC, TN, VA, WI	749-1041 m	G5, ALS1	2.2	12 Jun - 28 Jul (Aug – Sep)
Comments — In AL, this species is considered critically imperiled. We have 31 specimens from 6 locations in CARL.						
<i>Oxyethira pallida</i> (N Banks, 1904)	BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM, LIRI, MACA, NISI, OBRI, SHIL, STRI	AL, AR, AZ, CA, CO, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MD, ME, MI, MN, MO, MS, NB, NC, NE, NH, NY, OH, OK, MA, QC, SC, TN, TX, VA, WI, WV, WY	105-665 m	G5	2.2	1 Jan – 30 Aug
Comments — Another transcontinental species of which we found in 14 parks. We have 24 specimens from 3 locations in CARL.						
<i>Oxyethira rivicola</i> RL Blickle & WJ Morse, 1954	BISO, CARL , LIRI ^(L) , OBRI	AL, AR, GA, ME, MN, NH, PA, QC, SC, TN, VA, WI	260-468 m	G5	5.6	7 May - 6 Oct (Jun)
Comments — We have specimens from 2 locations in CARL.						

Family Ptilocolepidae Martynov

liverwort-case-making microcaddisflies

Until recently, most Trichoptera workers, especially those in North America, placed this genus in the subfamily Ptilocolepinae, within the family Hydroptilidae. Malicky (2001) argued that the original placement of the nominal genus, *Ptilocolepus*, in the family Glossosomatidae based on adult characters, and its subsequent transfer from Glossosomatidae to Hydroptilidae, based on larval characters, were both incorrect based on an evaluation of the adult and larval characters simultaneously, and he instead believes the correct solution for these unusual insects is to place them in their own family, Ptilocolepidae Martynov. The Trichoptera World Checklist (Morse, J.C. (ed.) 2013. Trichoptera World Checklist. <http://entweb.clemson.edu/database/trichopt/index.htm> [Accessed 14 August 2013.]) has followed this arrangement, so we have taken this position here, as well. Ptilocolepidae consists of two genera and 16 species, with only the genus *Palaeagapetus* found in North America.

Genus *Palaeagapetus* Ulmer - [Habitat - Lotic erosional (cold springs and seeps): Habit - Sprawlers (purse-type case of small leaf fragments, especially liverworts): Trophic - Shredders detritivores] This genus has about nine species, with three species in North America and six in Asia. The larvae live in cold springs that have liverworts growing on the rocks in and near the water. The larvae feed on liverworts, and make their cases of silk with pieces of liverworts attached. The cases are very much like the purse cases of many Hydroptilidae, but the cases in *Palaeagapetus* are carried horizontally rather than on edge as is normally done by hydroptilids. In studies of species in Japan, Ito (1997) found that females oviposit directly onto liverwort fronds, depositing one to several eggs per frond. Different species of *Palaeagapetus* preferred to oviposit on particular species of liverwort. Larvae hatched from eggs laid on a non-preferred liverwort would not feed, and in the laboratory starved to death in the absence of the preferred species. In North America, only one species of *Palaeagapetus* occurs in the East.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Palaeagapetus celsus</i> HH Ross, 1938	BLRI, CARL , CUGA, GRSM ^(L)	ME, NB, NC, NH, OK, PA, QC, SC, TN, VA, VT, WV	428-1757 m	G5, NCS2	n/a	24 May - 13 June (May - Oct)

Comments — This species has a wide distribution but a very spotty occurrence, presumably due to the unusual nature of its habitat. We have 11 collections and 93 specimens of this species. It is considered imperiled in North Carolina. We collected 2 males from Mountain Reservoir in CARL.

Family Rhyacophilidae Stephens

free-living caddisflies

The Rhyacophilidae consists of more than 700 species in five genera, one of which, *Rhyacophila* Pictet, contains nearly 600 species (Schmid, 1970). Two genera occur in North America, but only the genus *Rhyacophila* occurs in the study area. Rhyacophilid larvae are free-living, without a case or a retreat. The larvae are predators that search their cold stream habitats for prey items, typically other caddisfly larvae, stonefly and mayfly nymphs, as well as many other organisms of the appropriate size. When larvae are ready to pupate, they construct a domelike rock shelter in a protected area on stable substrate in the water.

Genus *Rhyacophila* Pictet - [Habitat - Lotic erosional: Habit - Clingers (free ranging): Trophic - Predators (engulfers), a few scrapers, collectors gatherers, shredders herbivores (chewers)] More than 120 species are known from North America and we recorded 26 species in the parks. *Rhyacophila* larvae are restricted to well-oxygenated, cold-water streams. Most species apparently are univoltine. When a larva is ready to pupate, it finds a protected spot under or between rocks, or even within rotten wood, and builds a loose shelter of sand and gravel held together with silk. Pupation normally lasts several weeks (Manuel and Folsom, 1982), but we have found one species during this study that survives in an intermittent stream by remaining in its pupal cocoon for up to four months. Most *Rhyacophila* larvae in the parks can be identified with available literature (Flint, 1962a; Weaver and Sykora, 1979; Unzicker and others, 1982; Prather and Morse, 2001 as corrected by Stocks and Morse, 2005), but considerable uncertainty remains concerning some species, as noted below. Much of the information in the Comments below is from Flint (1962a).

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Rhyacophila carolina</i> N Banks, 1911	BISO, BLRI, CARL , CHCH, COWP, CUGA ^(L) , FODO, GRSM ^(L) , KIMO, LIRI, MACA, OBRI ^(L) , SHIL ^(L) , STRI	AL, CT, DE, FL, GA, KY, MA, ME, MO, NB, NC, NF, NH, NJ, NY, OH, ON, PA, QC, SC, TN, VA, VT, WV	114-1715 m	G5	1.0	21 Mar - 5 Nov (Apr - Sep)
Comments — Often found in small streams less than 5 m in width. In South Carolina, Manuel and Folsom (1982) found this species to be univoltine with an extended adult flight period, with reproduction extending into October. Larva up to 16 mm in length. We have 325 collections and 1,543 specimens of this species. We collected 7 specimens from 3 locations in CARL.						
<i>Rhyacophila glaberrima</i> G Ulmer, 1907	BISO, BLRI, CARL , CHCH, CUGA ^(L) , FODO, GRSM ^(L) , LIRI, MACA, OBRI, RUCA, SHIL ^(L)	AL, AR, CT, GA, IL, IN, KY, MA, ME, MO, MS, NC, NH, NS, NY, OH, PA, QC, SC, TN, VA, VT, WV	125-1694 m	G5, ALS2	4.3	20 Mar - 6 Nov (Jul - Oct)
Comments — Despite being very widespread and being found in 10 parks, <i>R. glaberrima</i> is ranked S2 in Alabama. At LIRI, we discovered <i>R. glaberrima</i> pupae in mosses along the edge of an intermittent stream, Laurel Creek, after it had dried up at the start of the summer. We brought some of these pupae back to the lab for rearing, and adults emerged up to four months later. This extended pupal diapause has not been reported previously in <i>R. glaberrima</i> . The larvae of <i>R. glaberrima</i> cannot be distinguished from those of <i>R. montana</i> . We have never collected adults of these two species from the same location, although both occur in high elevation springs and seeps of BLRI. <i>Rhyacophila montana</i> is restricted to higher elevations (610-1850 m), while <i>R. glaberrima</i> is found at lower elevations (125-1694 m). Larva up to 12 mm in length. We have 198 collections and 746 specimens of this species, including 124 specimens from 7 locations in CARL.						
<i>Rhyacophila mycta</i> HH Ross, 1941	BLRI, CARL , GRSM ^(L)	NC, TN, VA	594-1960 m	G3	1.0	5 May - 15 Aug (May - Aug)
Comments — A southern Appalachian Mountains endemic. Morse and others (1997) considered <i>R. mycta</i> rare and vulnerable because it was known only from three locations. We now know of at least 17 localities. We have 31 collections and 135 specimens of this species. In CARL we collected 43 specimens from Mountain Reservoir and 1 from Duck Pond.						

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Rhyacophila nigrita</i> N Banks, 1907	BISO, BLRI, CARL , GRSM ^(L) , GUCO	AL, GA, KY, MA, ME, NC, NF, NH, NJ, NY, ON, PA, QC, SC, TN, VA, VT, WV	317-1818 m	G5, ALS2	1.0	5 Aug - 1 Dec (May - Aug)
Comments — The status of this species is unresolved, as different forms seem to occur in different locations, and new species in this group have been described recently (Etnier and others, 2004), and at least one potential new species has been collected from BLRI and GRSM. Further research is required to clarify the taxonomic status of this group. Manuel and Folsom (1982) found <i>R. nigrita</i> to be univoltine with extended adult emergence in South Carolina. Overwintering larvae were primarily late instars. Alabama considers it imperiled. Larva up to 14 mm in length. We have 292 collections and 1,228 specimens of this species. We tallied 47 specimens from Mountain Reservoir in CARL.						
<i>Rhyacophila torva</i> HA Hagen, 1861	BISO, BLRI, CARL , COWP, CUGA ^(L) , GRSM ^(L) , KIMO, LIRI, MACA, OBRI	AL, CT, DC, DE, KY, MA, ME, NC, NF, NH, NJ, NS, NY, OH, PA, QC, SC, TN, VA, VT, WI, WV, WY	177-1757 m	G5, ALS2	1.59	23 Feb - 21 Sep (Feb - Sep)
Comments — The preferred habitat seems to be small streams up to 6 m in width. Considered imperiled in Alabama. Larva up to 24 mm in length, adult up to 10 mm. We have 135 collections and 357 specimens of this species, of which 17 specimens were collected from 3 locations in CARL.						

Suborder Annulipalpia Martynov

There is little argument about the monophyly of the Annulipalpia, although there is some disagreement about exactly which families to recognize. However, there is no dispute that the five families from the study area are annulipalpians. Annulipalpia are characterized by making fixed nets that they use to capture particles from the water column. The form of nets and retreats made are characteristic not only of the families, but also of the genera and sometimes the species. The requirements of net construction and maintenance dictate that larvae live in flowing, or at least moving water—some are found in lakes that have enough wave action to support a net.

Family Dipseudopsidae Ulmer dipseudopsid caddisflies

Dipseudopsidae is a small family of fewer than 200 species worldwide. A single genus is recognized from North America, *Phylocentropus* Banks, which has five species in North America and five species in Asia.

Genus *Phylocentropus* Banks - [Habitat - Lotic depositional (sand, headwater streams): Habit - Burrowers (branched, silk, buried tubes): Trophic- Collectors filterers] The five North American species of this genus are eastern and well represented in the study area. The larvae inhabit sandy/silty depositional areas of streams and lakes, where they make a retreat composed of silk and coated with sand grains and other fine particles, which is buried in the soft sediment of the stream except for a small turret that extends into the water column. The buried portion of the retreat is branched, with a small fine-mesh capture net in one of the branches that leads back to the surface of the substrate. Water flows downwards through the first turret, aided as needed by undulations of the larva's body, through the capture net, then out the second turret (Fig. 5.1, Wiggins 1996). Small particles suspended in the water are trapped by the net. The larva periodically grazes from the net, eating the desirable food matter and disposing of inedible matter via a small space in the net. Pupation occurs in the tube. *Phylocentropus* larvae may grow to 20 mm in length, while the tube may reach a length of 16 cm (Wiggins 1996). Sturkie and Morse (1998) provided descriptions and a key to the larvae of three *Phylocentropus* species. *Phylocentropus* species have a genus tolerance value of 5.6. We found three species in the parks, however only two are of potential concern.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Phylocentropus auriceps</i> N Banks, 1905	BLRI, CARL, GRSM ^(L)	GA, NC, SC, VA	739-1433 m	G3, VAS1	5.6	17 May - 19 Jul (May - Jun)
Comments — Endemic to mountainous regions of the study area. Larvae are unknown. <i>Phylocentropus auriceps</i> is considered vulnerable globally and critically imperiled in Virginia. We have 8 collections and 22 specimens of this species, including 5 females and 3 males from the Trout Pond spring in CARL.						

Family Hydropsychidae Curtis

retreat-making caddisflies

Hydropsychidae is the third largest family of caddisflies, with over 1,500 described species (Holzenthal and others, 2007) in five subfamilies, four of which occur in the study area. The taxonomy of the family is in a state of flux. Some authors have treated one of the subfamilies as a separate family Arctopsychidae: (Nimmo, 1987; Schmid, 1998). Other authors split the large genus *Hydropsyche* into two or more genera. Recent studies using molecular and (or) morphological analyses find little support for splitting the Arctopsychinae from the larger family. Recent evidence also finds little support for splitting out the genera *Ceratopsyche* and *Symphitopsyche* from *Hydropsyche*. We have adopted the more conservative approach here: among the hydropsychids found in this survey, we recognize the subfamilies Diplectroninae, Hydropsychinae, and Macronematinae; and we recognize the genus *Hydropsyche* without subgenera.

The nets and retreats made by the larvae have attracted a good deal of ecological and evolutionary study (Alstad, 1982; Edler and Georgian, 2004; Georgian and Wallace, 1981; Loudon and Alstad, 1990; Miller, 1984; Thorp, 1983, 1984; Thorp and others, 1986; Wallace and Merritt, 1980; Wallace and Sherberger, 1975). Each subfamily, genus, and species tends to have characteristic retreat and net structure, and a consistent net mesh size, which have led to considerable investigation into the mechanisms by which the larvae partition the stream resources of space, current speed, and drifting particulate matter. All larvae of Hydropsychidae have a scraper and file feature that permits them to make sounds. This has been demonstrated in *Cheumatopsyche* and *Macrostemum*, but has been best studied in *Hydropsyche* and is discussed under that genus.

Subfamily Arctopsychinae Martynov

Genus *Parapsyche* Betten - [Habitat - Lotic erosional: Habit - Clingers (net spinners, fixed retreats): Trophic - Collectors filterers (coarse particles)] This genus is known from Asia including the Himalayas, as well as from North America. Approximately 20 species are known, but only seven from North America, and only two from the study area. Larvae make retreats similar to those of *Arctopsyche* on rocks in strong currents in mountain streams. *Parapsyche* larvae are smaller than *Arctopsyche* larvae and subsequently make nets with smaller mesh sizes than *Arctopsyche* nets. Flint (1961) provides descriptions and keys for the species in the study area.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Parapsyche cardis</i> HH Ross, 1938	BLRI, CARL , GRSM ^(L)	GA, NC, SC, TN, VA	370-1786 m	G4	n/a	29 Apr - 9 Oct (May - Sep)

Comments — Endemic to the Appalachian Mountains portion of the study area. Habits and habitat very similar to *P. apicalis*; we often collected both species at the same location. Benke and Wallace (1980) studied the life history of *P. cardis* in Georgia. Pupation takes place in May and early June, and first instars were most abundant in July, although they were found through September. Larvae overwinter as instars II-V. Larvae of *Parapsyche* consume a high percentage (62%) of animal material, although less than *Arctopsyche* larvae. In a study in two streams in North Carolina, Gurtz and Wallace (1986) found that *P. cardis* strongly preferred moss-covered rock face habitats over cobble or gravel riffles or sandy reaches of both streams. The life cycle is univoltine. It is very likely that *P. cardis* is highly intolerant, as is *P. apicalis*. Larva up to 20 mm in length. We have 244 collections and 2,207 specimens of this species. We found 3 specimens in **CARL**.

Subfamily Diplectroninae Ulmer

Genus *Diplectrona* Westwood - [Habitat - Lotic erosional (headwater streams): Habit - Clingers (net spinners, fixed retreats): Trophic - Collectors filterers (coarse particles, especially detritus)] This genus has about 100 species worldwide, but is absent from Africa and most of South America (Flint and others, 2004). Atypically among hydropsychids in North America, adult genitalia are of little use in distinguishing species, so characters of the head of adults are given more weight. Larvae seem to hold more promise for species discrimination, so an approach that relies on larval characters and molecular analyses is being used to clarify what is likely a complex of several species instead of the two listed here (Harvey and others, 2012). Because the adults are so unreliably identified, we do not present flight dates from our data, but instead only provide flight dates based on published information.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Diplectrona modesta</i> N Banks, 1908	BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM ^(L) , GUCO, KIMO, LIRI, MACA, OBRI, SHIL	AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, ME, MI, MO, MS, NC, NF, NH, NS, NY, OH, OK, ON, PA, QC, SC, SD, TN, VA, VT, WI, WV	112-1533 m	G5	2.2	(Mar - Sep)

Comments — This "species" is a complex of at least five forms (Harvey and others, 2012). These forms are distinct based on molecular analyses, and can be recognized as larvae, but not yet as adults. Several of these forms have been collected during this survey. Ongoing studies combining molecular and morphological methods are attempting to clarify this situation and determine which, if any, of the recognizable forms should be treated as separate species or other taxonomic categories. We labeled the adults as "*Diplectrona* species." We suggest that this species be considered of special interest because of the current taxonomic uncertainty. Studies of the biology of *D. modesta* in the literature indicate a univoltine life history (for example, Benke and Wallace, 1980), but all such information will need to be reevaluated when the current systematic studies are completed. We have 382 collections and 4,930 specimens of this species complex. We have 168 specimens from 10 locations in **CARL**.

Genus *Homoplectra* Ross - [Habitat - Lotic erosional (rock face springs and seeps): Habit - Clingers (net spinners, fixed retreats): Trophic - Collectors filterers] This is a North American genus with about a dozen species. Three are found in the study area, the rest are restricted to the West. Larvae make retreats in small, high gradient streams having gravel and cobble substrates. Kentucky {Kentucky Division of Water, 2009 #6646} has assigned *Homoplectra doringa* a tolerance value of 3.0, and we have assumed that value for all *Homoplectra* species.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Homoplectra doringa</i> (LJ Milne, 1936)	BISO, BLRI, CARL , CHCH, CUGA, GRSM ^(L) , LIRI, OBRI	AL, AR, IN, KY, MA, NC, NH, SC, TN, VA, WV	232-1944 m	G5, ALS1	3.0	20 March - 20 July (April - May)

Comments — The only relatively common and widespread species in the genus in the East. It is rated critically imperiled in Alabama. We have 22 collections and 82 specimens of this species. We collected 8 specimens from 2 locations in CARL

Subfamily Hydropsychinae Curtis

Genus *Cheumatopsyche* Wallengren - [Habitat - Lotic erosional (especially warmer streams and rivers): Habit - Clingers (net spinners, fixed retreats): Trophic - Collectors filterers (particles include algae, detritus, some animals)] A cosmopolitan genus of more than 250 species including more than 50 in North America (Gordon, 1974). It is absent from the Neotropics. Fifteen species were detected during this survey. Larvae prefer warmer streams, and build their retreats in more sheltered, slower current microhabitats than do *Hydropsyche*. At this time, *Cheumatopsyche* larvae can only be separated into broad groups. Mature larvae may be as much as 13 mm in length; adults range from 5 - 9 mm in length. The genus is considered to be more tolerant of pollution than many other caddisflies, with a genus tolerance value of 6.6. Betten (1934) reported that the larvae of one species, *C. analis* (which is extremely common in the study area), became pests when the larvae entered a fish hatchery in New York and began to make retreats that incorporated fish eggs. All of our records are based on adult males.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Cheumatopsyche ela</i> DG Denning, 1942	BLRI, CARL , CUGA, GRSM ^(L) , STRI	AL, DC, DE, GA, ME, NC, NY, ON, PA, QC, SC, TN, VA, WV	170-987 m	G5, ALS2	6.6	19 May - 16 Jul (Apr - Oct)

Comments — This species is relatively common and widespread in the East, found from Ontario and Quebec and south to Alabama and Georgia. However, in Alabama it is considered imperiled. We have 6 collections and 70 specimens of this species, including a single male from Side Lake at the dam in CARL.

Genus *Hydropsyche* Pictet - [Habitat - Lotic erosional: Habit - Clingers (net spinners, fixed retreats): Trophic - Collectors filterers (particles include diatoms, algae, detritus, animals)] Another very large genus having nearly 400 species in all biogeographic regions, but absent from the Neotropics. *Hydropsyche* larvae, as all larvae of Hydropsychidae, are able to make sounds by stridulating, a process in which a projection on the fore femur, the scraper, is stroked across a series of fine ridges, the file, on the underside of the head. Studies by Jansson and Vuoristo (1979) demonstrated that stridulation is primarily used as a defensive action by larvae in a retreat in response to another larva attempting to enter its retreat, and is normally successful more than 90% of the time in repelling the advancing larva. In order to stridulate successfully, larvae hold their forelegs steady by clinging to the net and moving their head. Matczak and Mackay (1990) report that *Hydropsyche* larvae respond to resource limitations (amount of food and amount of suitable substrate) by adjusting the size of their territories around their retreats, and by becoming more aggressive as resources become scarcer. This genus has been variously reshuffled, split, and recombined in different fashions for many years. Some North American workers still prefer to split the genus into *Hydropsyche sensu strictu*, also known as the *scalaris* species group, and *Ceratopsyche*. Others treat *Ceratopsyche* as a subgenus of *Hydropsyche*, or as the *morosa* species group of *Hydropsyche*. Because of the current lack of clarity, we prefer to treat all species as *Hydropsyche*, although in the Comments we indicate the species group for each species. Larvae of many species can be identified, with caution, using one of several resources: Schuster and Etnier (1978), Scheffer and Wiggins (1986), Unzicker and others (1982).

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Hydropsyche fattigi</i> HH Ross, 1941	CARL, COWP	AL, GA, NC, SC, TN, VA	289 m	G5	n/a	30 May - 21 Jun (May - Sep)
Comments — [<i>scalaris</i> species group] A southeastern endemic. Larvae remain undescribed. Adults 7-8 mm long. This species is included here because it was found in just two parks. We collected a single specimen from each park above.						
<i>Hydropsyche morosa</i> HA Hagen, 1861	BLRI, CARL, CUGA, GRSM, GUCO, OBRI	AB, AR, BC, CO, CT, DC, DE, GA, IA, ID, IL, IN, KS, KY, MA, MB, ME, MI, MN, MO, MT, NB, NC, ND, NH, NJ, NS, NT, NY, OH, OK, ON, PA, QC, SC, SK, TN, UT, VA, VT, WA, WI, WV, WY	218-1304 m	G5	2.3	13 May – 20 Dec
Comments — [<i>morosa</i> species group] This is a common and widespread species. We found 423 specimens from 6 parks, including 6 specimens from 2 locations in CARL.						
<i>Hydropsyche sparna</i> HH Ross, 1938	BISO, BLRI, CARL, CHCH, COWP, CUGA, GRSM, GUCO, KIMO, LIRI, MACA, NISI, OBRI, RUCA, SHIL	AL, CT, DE, GA, IL, IN, KS, KY, LB, MA, MB, MD, ME, MI, MN, MS, NB, NC, NF, NJ, NS, NY, OH, ON, PA, PE, QC, SC, TN, VA, VT, WI, WV	116-1929 m	G5	2.5	12 Apr – 27 Oct
Comments — [<i>morosa</i> species group] This species was collected from 15 parks, and was represented with 9,450 specimens. In CARL, 93 specimens were collected from 9 locations.						

Family Polycentropodidae Ulmer polycentropodid caddisflies

This cosmopolitan family has more than 650 described species in 15 (Chamorro and Holzenthal, 2011; Holzenthal and others, 2011) or 23 (de Moor and Ivanov, 2008) genera. The Oriental region has approximately 230 described species, the Neotropical realm has more than 170, the Palearctic has more than 100, while the Nearctic, Afrotropical, and Australian regions have less than 100 species each. In North America fewer than 80 species are known among 8 genera. We collected 30 species in 6 genera during this study. Larvae do not make cases; rather they make silken nets of several characteristic configurations. These are described for each genus. Many are filter feeders, however others are predators.

Genus *Cernotina* Ross - [Habitat – Lotic and lentic: Habit - Clingers (silk tube retreats): Trophic - Predators (engulfers)] Approximately 65 species are known in this genus, which is limited to the Western Hemisphere. It is primarily a Neotropical genus, with only about 7 species occurring in North America; two of those species are also distributed as far south as Central America. The larva of one species, *C. spicata*, has been described (Hudson and others, 1981). Larvae make retreats in shallow depressions on rock and log surfaces with the ends widely open, much like *Nyctiophylax* larvae. The larvae ambush small prey organisms from the retreat. They are found in both lentic and lotic habitats. They are sensitive to excessive silt (DeWalt and Olive, 1988), but are assigned a tolerance value of 6.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Cernotina spicata</i> HH Ross, 1938	BLRI, CARL , LIRI	AL, AR, CT, DE, FL, GA, IL, IN, KS, LA, MA, ME, MI, MS, NC, NH, OK, ON, SC, TN, TX, VA	183-664 m	G5	6.0	15 May - 30 Sep (May - Sep)
Comments — This widespread southern species likely will be found several additional parks. We collected 17 specimens in 12 samples, including 8 specimens from 3 locations in CARL.						

Genus *Holocentropus* McLachlan - [Habitat - Lotic erosional, lentic littoral: Habit - Clingers (silk tube retreats): Trophic - Predators (engulfers), collectors filterers, shredders herbivores] *Holocentropus*, as defined by Chamorro and Holzenthal (2011), is a genus of the Northern Hemisphere having approximately a dozen species. In North America, 5 species are known. Few larvae have been described, and even fewer have been studied ecologically. Larvae cannot be distinguished at this time. North Carolina (Biological Assessment Unit, 2006) and Tennessee (Arnwine, 2006) assign *Holocentropus* (as *Polycentropus*) larvae a genus-level tolerance value of 3.5.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
---------	-------	--------	-----------------	----------	-----------------	--------------

Comments — This genus is represented in CARL by a single female collected at Side Lake.

Genus *Nyctiophylax* Brauer - [Habitat - Lotic erosional and depositional, lentic littoral: Habit - Clingers (silk tube retreats): Trophic - Predators (engulfers), collectors filterers, shredders herbivores] More than 100 species have been described in this genus, from most regions of the world. The majority of species are found in the Oriental, with about 12 species known from North America. We collected 9 species during this survey, of which 6 were found in BLRI. Larvae are predators that make retreats in substrate depressions that are very similar to those made by *Ceratomyza*. Life history is generally unknown for *Nyctiophylax* species, but probably is univoltine for most (Unzicker and others, 1982). A genus level tolerance value of 0.9 has been assigned.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Nyctiophylax affinis</i> (N Banks, 1897)	BISO, BLRI, CARL , CUGA, GRSM, LIRI, NISI, SHIL, STRI	AL, AR, BC, CT, DE, FL, GA, IL, IN, KS, KY, LA, MA, MB, ME, MI, MN, MO, MS, MT, NC, ND, NE, NH, NJ, NS, NY, OH, OK, ON, PA, PQ, SC, SD, SK, TN, TX, VA, VT, WI, WV, WY	129-1080 m	G5	0.9	28 May - 1 Aug (Jun - Sep)

Comments — We have 30 collections and 147 specimens of this species, including 3 adults from Memminger Creek below Front Creek in CARL.

Genus *Plectrocnemia* Stephens - [Habitat - Lotic erosional, lentic littoral: Habit - Clingers (silk tube retreats): Trophic - Predators (engulfers), collectors filterers, shredders herbivores] This genus contains 91 species (Chamorro and Holzenthal, 2011), with about a dozen known from North America. For many years, North American workers have included this genus as a part of the genus *Polycentropus*, along with the genus *Holocentropus* McLachlan. Chamorro and Holzenthal (2011) restored both groups to genus level following their phylogenetic analysis of the family Polycentropodidae. We use their treatment here. Larvae build sac-like nets with a small tubular dwelling chamber (Lepneva, 1964).

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Plectrocnemia cinerea</i> (HA Hagen, 1861)	BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM ⁽¹⁾ , KIMO, LIRI, MACA, OBRI, SHIL, STRI	AB, AK, AL, AR, BC, CO, CT, DC, DE, FL, IA, ID, IL, IN, KS, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, MT, NB, NC, ND, NE, NH, NS, NT, NY, OH, OK, ON, OR, PA, QC, SC, SD, SK, TN, TX, UT, VA, VT, WA, WI, WV	114-1660 m	G5	2.0	30 Mar - 11 Oct (Mar - Oct)

Comments — This is a very common and widespread species, known in 13 parks and likely to occur in all parks in the study area. We have 157 collections and 769 specimens of this species, but only one male specimen from Trout Pond in CARL.

Genus *Polycentropus* Curtis - [Habitat - Lotic erosional, lentic littoral: Habit - Clingers (silk tube retreats): Trophic - Predators (engulfers), collectors filterers, shredders herbivores] *Polycentropus*, as defined by Chamorro and Holzenthal (2011), is a cosmopolitan genus of at least 165 species found in the Afrotropical, Neotropical, Nearctic, and Palaearctic regions. In North America, approximately 30 species are known. Despite being such a large genus, relatively few larvae have been described, and very few have been studied. Larvae cannot be identified at this time. North Carolina (Biological Assessment Unit, 2006) and Tennessee (Arnwine, 2006) assign *Polycentropus* larvae a genus-level tolerance value of 3.5.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Polycentropus carlsoni</i> JC Morse, 1971	BLRI, CARL , GRSM ^(L)	AL, NC, SC, VA	730-1265 m	G2, ALS1, SCS2	3.5	9 -27 Jun (Apr - Oct)
Comments — <i>Polycentropus carlsoni</i> is ranked critically imperiled in Alabama and imperiled in South Carolina. Morse and others (1997) treated this species as rare and vulnerable, being known from just AL and SC. Recent study has found populations in two additional states. Larvae in SC are found in first order, clear, cold streams (Floyd and Morse, 1993). Adult up to 9 mm in length. We have 3 collections and 15 specimens of this species, including 3 males from Mountain Reservoir in CARL.						
<i>Polycentropus colei</i> HH Ross, 1941	BLRI, CARL , GRSM	KY, NC, PA, QC, TN, WV	374-1786 m	G3	3.5	19 Jun - 12 Jul (Jul)

Comments — Very little is known of the biology of this species. It is considered vulnerable globally. We know of 35 specimens of this species, including 2 adults from Mountain Reservoir in CARL.

Family Philopotamidae Stephens fingernet-making caddisflies

Another large cosmopolitan family, Philopotamidae has about 800 described species and 20 genera. In North America five genera are recognized, two of those only recently erected. Philopotamid larvae are characterized by the unique membranous, T-shaped labrum, or “upper lip.” Larvae construct a fine-meshed tube attached to rocks or other solid substrates in flowing water. The nets are kept expanded by the flow of water through them, and collapse into an amorphous mass when removed from the water. The labrum is specially modified to aid with the construction of these nets, being able to lay down about 70 fine strands of silk simultaneously. Wallace and Malas (1976) calculated that a single net of a mature *Dolophilodes distincta* larva could contain up to 100 million tiny mesh openings and more than a kilometer of silk. Philopotamid nets have the finest mesh found among filter-feeding caddisflies. Because of this, philopotamid larvae primarily consume fine detritus (>85% of their diet).

Genus *Chimarra* Stevens - [Habitat - Lotic erosional (warmer rivers): Habit - Clingers (saclike silk nets): Trophic - Collectors filterers] This is a very large genus having nearly 600 described species in all biogeographic regions of the world. In North America, about 20 species are known, with 10 known from the Southeast. We encountered five species in the parks. Most species in this genus are sensitive to pollution and disturbance.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Chimarra aterrima</i> HA Hagen, 1861	ABLI, BISO ^(L) , BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM ^(L) , KIMO, LIRI, MACA, NISI, OBRI, RUCA, SHIL ^(L)	AL, AR, CT, DC, DE, FL, GA, IL, IN, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NF, NH, NJ, NS, NY, OH, OK, ON, PA, QC, SC, TN, TX, VA, VT, WI, WV	114-739 m	G5	2.7	21 Mar - 16 Oct (Apr - Sep)

Comments — Widespread and common in North America, and throughout the study area. Bowles and Allen (1992) found that *C. aterrima* populations were bivoltine with overlapping generations in the Mulberry River in Arkansas. We have 103 collections and 734 specimens of this species. This includes 151 specimens from 11 locations from CARL.

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Chimarra obscura</i> F Walker, 1852	ABLI, BISO ^(L) , BLRI, CARL , CHCH, COWP, GRSM ^(L) , KIMO, LIRI, MACA, NISI, OBRI, SHIL ^(L) , STRI	AL, AR, CT, DE, FL, GA, IL, IN, KS, KY, LB, MA, MB, MD, ME, MI, MN, MO, MS, NE, NF, NH, NJ, NS, NY, OH, OK, ON, PA, QC, SC, TN, TX, VA, VT, WI, WV	109-668 m	G5	2.7	8 May - 14 Oct (May - Sep)
Comments — Parker and Voshell (1982) studied the life history of this species in Virginia. The populations were bivoltine at three study localities (indeterminate at the fourth). Larvae were primarily detritivores, with more than 85% of their gut contents composed of detritus. We have 96 collections and 4,796 specimens of this species. In CARL, we collected 9 adults at 3 locations.						
<i>Chimarra socia</i> HA Hagen, 1861	BISO ^(L) , BLRI, CARL , GRSM ^(L) , OBRI, STRI	AL, AR, CT, DC, FL, GA, IN, KY, LA, LB, MA, MB, MD, ME, MI, MN, MO, MS, NB, NC, NF, NH, NJ, NS, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	166–1146 m	G5, ALS1	2.7	17 May - 16 Sep (Jun - Sep)
Comments — Widespread throughout North America and common in the study area. It is considered critically imperiled in Alabama. We have 43 collections and 810 specimens of this species, including 3 adults from 2 locations in CARL.						
Genus <i>Dolophilodes</i> — [Habitat — Lotic erosional (warmer rivers): Habit — Clingers (saclike silk nets): Trophic — Collectors filterers] This genus consists of fewer than 60 species distributed in the Palaearctic (14 species), Oriental (34 species), and Nearctic (7 species) realms. Larvae make fine-mesh tube or finger nets that collapse into amorphous blobs when removed from the water. They are found in fast flowing streams and rivers, but the delicate nets avoid strong currents because of their location under rocks or other stable substrates.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Dolophilodes distincta</i> (F Walker, 1852)	BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM, KIMO, LIRI, MACA, NISI, OBRI	AL, CT, DC, DE, GA, IN, KY, LB, MA, MD, ME, MI, MN, MS, NB, NC, NF, NH, NJ, NS, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV, Korea	114-1660 m	G5	0.8	1 Feb - 29 Oct
Comments — This species is one of the very few caddisflies that has a common name. It is known as the Winter Caddisfly. The adults of this species can be found in most months of the year in the study area, but more intriguing is the fact that the adult females are wingless in winter months and fully winged in other months. This unusual condition is unknown among other <i>Dolophilodes</i> species. We collected 3,895 specimens of this species from 13 parks. We found 47 specimens from 8 locations in CARL.						
Genus <i>Wormaldia</i> McLachlan - [Habitat - Lotic erosional: Habit - Clingers (sac like silk nets): Trophic - Collectors filterers] This genus is cosmopolitan, with nearly 150 species. Most species are Oriental or Western Palearctic, but approximately 20 species are found in North America. Muñoz-Quesada and Holzenthal (2008) revised the North American species and provide keys for adult males. We found four species in the parks. We also found specimens that we are hesitant to put a name on, as they have characters that do not fit exactly with any known species.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Wormaldia moesta</i> N Banks, 1914	ABLI, BISO, BLRI, CARL , COWP, CUGA, GRSM ^(L) , KIMO, LIRI, MACA, OBRI, RUCA, SHIL ^(L)	AL, AR, CT, DE, FL, GA, IL, IN, KY, MA, MB, ME, MN, MO, MS, NB, NC, NF, NH, NJ, NS, NT, NY, OH, OK, ON, PA, QC, SC, TN, VA, VT, WI, WV	51-1786 m	G5	2.0	21 -16 Dec (Apr – Jun)
Comments — A common and widespread species. Bowles and Allen (1992) studied the life history of this species in the Mulberry River in Arkansas. Larvae have univoltine life histories, and adults from nearby streams emerged from April through June. First instar larvae were present throughout much of the year, suggesting an extended egg hatch period. We have 248 collections and 788 specimens of this species, including 14 adults from 6 locations in CARL.						

Suborder Integripalpia Martynov

This is the suborder of the case-building caddisflies, which represents just over one third of all Trichoptera. The development of cases was a major milestone in the evolution of caddisflies (Mackay and Wiggins, 1979), and, of course, cases have attracted a great deal of attention from scientists, and people in general. The roles of cases continue to be debated, with many ideas being propounded about their function in caddisfly biology. An obvious idea is that cases provide protection for the larvae, either directly by providing a shelter when a larva encounters a predator, or indirectly by serving as camouflage or by protecting the larva from environmental hazards. Some workers suggest that cases are essential in respiration, enhancing the flow of fresh water over the gills of the larva as its abdomen undulates within the case. This has allowed many species to colonize and inhabit warmer, lower oxygen habitats than might otherwise have been possible. In addition, it is possible that cases serve as a means of reducing cannibalism among larvae under certain conditions (Wissinger and others, 1996). Good expositions of many of these ideas are found in Wiggins (1996, 2004). Most of these ideas have supporters and critics, and no doubt many new ideas remain to be postulated. Under any circumstances, cases are a key element in the lives of the Integripalpia.

Family Beraeidae Wallengren beraeids

This is a small family consisting of 7 genera and 50 species (Holzenthal et al., 2007). Representatives are known from eastern North America, western Palearctic, Africa, and Japan. Larvae build curved cases of sand grains, and live in seeps, springs, and small streams.

Genus *Beraea* Stephens - [Habitat - Lotic—depositional (detritus, springs): Habit - Sprawlers (curved case, smooth, fine mineral): Trophic - Probably collectors—gatherers] In North America the genus *Beraea* has three described species. Little is known of any of these species with the exception of *Beraea gortebe* Ross that was studied by Hamilton (1985). The information presented below is from that study.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Beraea gortebe</i> HH Ross, 1944	CARL	GA, NC	656 m	G1	n/a	24 May

Comments — These caddisflies are extremely rare, and this represents the first record of this family from NC. Our single specimen was collected in the Malaise trap at Duck Pond, and was operated 16-24 May 2012. Hamilton (1985) collected specimens in a second order, blackwater stream in GA. He found adults from 7 May-11 June, and pupae April. Larvae occur in sand and organic debris at or near the shoreline. Larvae appear to be burrowing detritivores that feed on small bits of vascular plants, fungus, and unrecognizable organic matter. Larvae overwinter as fifth instars, pupate in April, and emerge from May to early June.

Family Leptoceridae Leach long-horned caddisflies

The Leptoceridae is the second largest family of Trichoptera, with approximately 1,800 described species and 47 described genera (Holzenthal and Andersen, 2007). The common name derives from the very long antennae of the adults, which are much longer than the front wings. Adults typically have narrow front wings, which are often strikingly marked and colorful, unlike in so many other caddisfly adults. The wing patterns are important in identification, and some adults are more easily identified from dry pinned material than from alcohol material. Larvae make a wide variety of cases and live in many different habitats. Fittingly, the larvae also tend to have unusually long antennae for caddisfly larvae.

Genus *Ceraclea* Stephens - [Habitat - Lotic and lentic (some in sponges): Habit - Sprawlers, climbers (case a fine mineral or silk tube): Trophic - Collectors gatherers, shredders herbivores (chewers), predators (engulfers of sponge)] The genus *Ceraclea* is composed of approximately 160 species from every biotic region except the Neotropics. Approximately 40 species are found in North America, and 16 were found in this study. *Ceraclea* larvae engage in a variety of behaviors and have diverse feeding habits. Some species are detritus feeders and some are herbivores. Some species are predators of freshwater sponges. Morse (1975) revised *Ceraclea* adults and Resh (1976a, b) reviewed the biology, described the larvae, and presented a key to 22 species. Much of the information below is taken from these works. The biology of *Ceraclea* species that feed on sponges has received a great deal of study (Corallini and Gaino, 2003; Resh, 1976a, b; Resh and others, 1976). Larvae that live in and feed on sponges differ from other larvae morphologically, as well as in habits. The antennae of most leptocerid larvae are quite long relative to other caddisflies, being up to eight times the length versus the diameter of the antenna. Sponge feeding larvae of *Ceraclea* have much shorter antennae that are only twice as long as wide. In addition, larvae of sponge feeders lack the parafrontal areas characteristic of larvae that do not feed on sponges. In addition, the cases of sponge-feeding larvae are cylindrical and are made entirely of silk or of silk with bits of sponge. The cases of non-sponge-feeding larvae typically incorporate sand grains, pieces of detritus, or other materials, and may be cylindrical, tapered, or flattened and hooded with lateral expansions. Many species of *Ceraclea* are highly intolerant of disturbance. Because of this, we have chosen to include all species of *Ceraclea*, even those that do not have established tolerance values and would be excluded from the table on other grounds.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Ceraclea enodis</i> Whitlock & JC Morse, 1994	BISO, CARL , CHCH, MACA, NISI, OBRI, SHIL	CT, GA, IL, MI, NC, ON, SC, TN, VA	157-266 m	G4	2.2	9 May - 7 August (May - August)

Comments — This species feeds on the sponge *Anheteromeyenia ryderi* Potts in North Carolina (Whitlock and Morse 1994). Flint et al. (2008) suggest that this may be a facultative rather than an obligatory condition, based on the wide range of streams from which it has been collected in Virginia. We have 9 collections and 24 specimens of this species, including 1 male from Trout Pond in CARL.

<i>Ceraclea neffi</i> (VH Resh, 1974)	BISO ⁽¹⁾ , BLRI, CARL , OBRI	AL, KS, KY, MI, MN, OH, TN, VA, WV	218-668 m	G5, ALS1	2.6	14 Jun - 18 Jul (May - Jun)
---------------------------------------	--	------------------------------------	-----------	----------	-----	-----------------------------

Comments — This species makes the flattened cases with the wide dorsolateral projections, similar to those of *C. ancylus* and *C. flava*. Populations studied by Resh (1976) appeared to have two cohorts each year. Alabama ranks *C. neffi* critically imperiled. Larva up to 5 mm in length, case up to 5 mm. We have 7 collections and 2,125 specimens of this species, with 1 specimen from Memminger Creek in CARL.

Genus *Mystacides* Berthold - [Habitat - Lotic—depositional; lentic—vascular hydrophytes: Habit - Climbers—sprawlers (case a rough tube of mineral and vegetation pieces may balance sticks): Trophic - Collectors—gatherers; facultative shredders—herbivores (chewers)]

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Mystacides sepulchralis</i> (F Walker, 1852)	BISO, BLRI, CARL , CHCH, CUGA, GRSM, KIMO, LIRI, NISI, OBRI, SHIL, STRI	AB, AL, AK, AR, BC, CA, CT, DE, GA, IL, IN, KY, MA, MB, ME, MI, MN, MO, MT, NB, NC, ND, NF, NH, NJ, NS, NT, NY, OH, OK, ON, PA, QC, SC, SD, SK, TN, VA, VT, WI, WV, WY, YT	125-1451 m	G5	2.6	9 May – 7 Nov (Apr - Oct)

Comments — We found 317 specimens *M. sepulchralis* in 12 parks, including 2 specimens from Front Lake in CARL.

Genus *Oecetis* McLachlan - [Habitat - Lotic erosional and depositional, lentic littoral: Habit - Clingers sprawlers, climbers (case a curved tube, often tapered, of coarse mineral or plant material): Trophic - Predators (engulfers), shredders herbivores (chewers)?] *Oecetis* consists of nearly 500 described species in all biotic regions. Approximately 25 species are known from North America, but see the discussion below under *O. inconspicua*. *Oecetis* larvae are considered carnivorous, feeding exclusively on small aquatic invertebrates, although some species, particularly the early instars, may feed on plant matter. Floyd (1995) described, illustrated, and keyed the larvae of 22 species, and is the source for much of the biology information in the Comments below. We found 11 species in the parks. *Oecetis* larvae have a genus-level tolerance value of 5.7.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Oecetis inconspicua</i> F Walker, 1852	ABLI, BISO, BLRI, CARL , CHCH, COWP, CUGA, FODO, GRSM ^(L) , GUCO, KIMO, LIRI, MACA, NISI, OBRI, SHIL, STRI	AB, AK, AL, AR, AZ, BC, CA, CO, CT, DC, DE, FL, GA, IA, IL, IN, KS, KY, LA, MA, MB, MD, ME, MI, MN, MO, MS, MT, NB, NC, ND, NE, NF, NH, NJ, NS, NT, NY, OH, OK, ON, OR, PA, QC, SC, SD, SK, TN, TX, UT, VA, VT, WA, WI, WV, WY, YT	105-1146 m	G5	5.1	12 Jan - 21 Sep (Apr - Oct)

Comments — Floyd (1995) associated seven larval types that belong to the *O. inconspicua* complex, but did not distinguish any particular form as this species. Current rankings treat each of the separate types of Floyd, referred to as sp. A through sp. G, as globally critically imperiled, imperiled, or vulnerable. Much work remains to be done before this widespread complex of species is resolved. Because of the taxonomic uncertainty in this taxon it is included in this table. We have 250 collections and 5,827 specimens of this “species,” of which 214 specimens from 12 locations in CARL.

Genus *Triaenodes* McLachlan - [Habitat - Lentic littoral, lotic depositional (vascular hydrophytes): Habit - Swimmers, climbers (case long, tapered of spirally arranged leaf and stem fragments): Trophic - Shredders herbivores (chewers)] Another large genus with more than 200 species rather evenly distributed throughout the biotic regions, including about 25 species in North America. All species make similar cases from plant material arranged in a long, tapered spiral. Glover (1996) described, illustrated, and keyed the larvae of 16 species, and is the source of much of the information in the Comments below. Manuel (2010) revised the North American species, and is the best source for information on adults and distributions.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Triaenodes flavescens</i> N Banks, 1900	BLRI, CARL , NISI, SHIL	AL, BC, CT, FL, GA, IL, IN, KY, ME, MI, MN, MO, MS, NC, NJ, NY, OH, OK, ON, PA, QC, TX, VA, WI, WV	115-987 m	G5, ALS1	6.0	20 Jun - 19 Jul (May - Oct)

Comments — An eastern species also known from British Columbia. Larvae are found with aquatic macrophytes in lakes and streams. It seems to be less abundant in the Southeast compared with the Northeast. It is considered critically imperiled in AL. Case made of spirally arranged plant pieces. Larvae 10-12 mm in length, case up to 23 mm, adult up to 12 mm. We have 4 collections and 6 specimens of this species, including 4 adults from CARL.

<i>Triaenodes ignitus</i> F Walker, 1852	ABLI, BISO, BLRI, CARL , CHCH, COWP, CUGA, GUCO, GRSM, KIMO, LIRI, NISI , OBRI, SHIL, STRI	AL, AR, CT, DE, FL, GA, IL, IN, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NS, NY, OH, OK, PA, QC, SC, TN, TX, VA, WI, WV	112-995 m	G5	4.6	9 May - 16 Sep (Apr - Oct)
--	--	--	-----------	----	-----	-------------------------------

Comments — Larva 10 mm in length, case up to 23 mm, adult 11-12 mm. We collected 15 specimens from 5 locations in CARL.

<i>Triaenodes marginatus</i> CK Sibley, 1926	BISO, BLRI, CARL , CHCH, CUGA, GRSM ^(L) , KIMO, LIRI, SHIL, STRI	AB, AL, AR, CT, DC, DE, GA, IL, IN, KS, MA, MB, MD, ME, MI, MN, MO, MS, NC, ND, NF, NH, NJ, NS, NY, OH, OK, ON, PA, QC, SC, SD, SK, TN, TX, VA, WI, WV	154-1078 m	G5, NCS3	0.0	1 May - 28 Sep (Apr - Nov)
--	--	--	------------	----------	-----	-------------------------------

Comments — Larvae are often found in association with aquatic macrophytes in lakes, ponds, and in root mats in streams. Larva up to 10 mm in length, case up to 23 mm, adult 12-13 mm. We have 33 collections and 172 specimens of this species, including 59 specimens from 6 locations in CARL.

<i>Trienodes perna</i> HH Ross, 1938	BISO ^(L) , BLRI, CARL , CHCH, GRSM ^(L) , LIRI, OBRI, SHIL, STRI	AL, AR, DE, FL, GA, IL, KY, KS, LA, MA, MD, MO, MS, NC, NH, NJ, OH, OK, ON, PA, QC, SC, TN, TX, VA, WV	115-668 m	G5	0.4	9 May - 15 Sep (May - Sep)
--------------------------------------	--	--	-----------	----	-----	-------------------------------

Comments — Larvae usually found in root mats in slow flowing areas of streams and rivers, and in swamps. Cases are made of a spiral of rootlets. Larvae up to 8 mm long, cases up to 12 mm. We have 25 collections and 55 specimens of this species. In CARL we collected 12 specimens from 6 locations.

<i>Trienodes tardus</i> LJ Milne, 1934	BISO, BLRI, CARL , GRSM ^(L) , LIRI	AB, AK, AL, AR, AZ, BC, CO, CT, DC, DE, FL, GA, IA, ID, IL, IN, IO, KS, KY, MA, MB, MD, ME, MI, MN, MO, MS, MT, NB, NC, ND, NE, NH, NJ, NS, NY, OH, OK, ON, OR, PA, QC, SC, SD, SK, TN, TX, UT, VA, VT, WA, WI, WV, WY, YT	218-793 m	G5	0.4	11 May - 14 Oct (May - Oct)
--	--	--	-----------	----	-----	--------------------------------

Comments — Larvae may be restricted to lentic habitats, although adults may be collected near streams. Larvae in lakes are associated with aquatic plants. Cases are made of plant pieces spirally arranged. Larvae up to 10 mm long, cases up to 27 mm, adult 10-12 mm. We have 25 collections and 252 specimens of this species, including 5 specimens from 4 locations in CARL.

Family Molannidae Curtis molannid or hooded caddisflies

The Molannidae is a small family of the Oriental and Holarctic faunas, having only two genera and about three dozen species. Both genera occur in North America, but only one of those occurs in the study area. Larvae are instantly recognized by their distinctive shield-shaped tube cases, made of a central tube of fine sand grains with lateral flanges and a prolonged hood or cowl anteriorly made of larger sand grains or gravel. Larvae are completely hidden by the flanges and hood when moving and feeding. In this sense they resemble certain larvae of *Ceraclea* (Leptoceridae), but differ in details of the case construction and in their habitats.

Genus *Molanna* Curtis - [Habitat - Lentic erosional, lotic depositional (headwater streams and springs): Habit - Sprawlers clingers (case flat with dorsal projection and flanges): Trophic - Scrapers, collectors gatherers, predators (engulfers)] This is a mostly Holarctic genus with approximately two dozen known species. Six species are known from North America, and four are recorded from the parks. Larvae are believed to be omnivorous, feeding on diatoms, algae, plant material, and small invertebrates. Larvae of three species were described, illustrated, and keyed by Sherberger and Wallace (1971) (see also (Unzicker and others, 1982). These papers and Roy and Harper (1980) are the sources for much of the information cited in the Comments below.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Molanna blenda</i> CK Sibley, 1926	BISO, BLRI, CARL , CHCH, COWP, CUGA, GRSM ^(L) , KIMO, LIRI, MACA, OBRI, SHIL ^(L)	AL, AR, CT, DE, GA, IL, IN, KY, LA, MA, MI, MN, MO, MS, NC, NF, NH, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	124-1757 m	G5, ALS2	2.0	10 May - 5 Oct (Mar - Oct)

Comments — *Molanna blenda* occurs in cold springs and seeps, and in similar areas with accumulations of debris, sand, and silt along the edges of small streams. It is common and widespread in the mountainous areas of the study zone, but also occurs in the coastal zone of at least some of the target states. *Molanna blenda* cases tend to have numerous mica flakes incorporated in them, along with a fair amount of vegetable debris. Alabama has rated this species as imperiled. Larva up to 12 mm in length, adult up to 11 mm. We have 190 collections and 627 specimens of *M. blenda*, including 48 specimens from 7 locations in CARL.

Family Odontoceridae Wallengren

large sturdy-case maker caddisflies

Odontoceridae is a small family of just over 100 species and 14 genera with a worldwide distribution. In North America, thirteen species are known representing six genera. Two genera and six species are found in the study area. Larvae make very sturdy stone cases, reinforced with extra silk, particularly in the genus *Psilotreta* (Wiggins, 1996). They are burrowers in sand and gravel, emerging at night to feed on detritus. See the discussion below under *Psilotreta*.

Subfamily Odontocerinae Wallengren

Genus *Psilotreta* Banks - [Habitat - Lotic erosional (gravel, detritus) and depositional (detritus), (lentic erosional): Habit - Burrowers (case curved, smooth, coarse mineral): Trophic - Scrapers, collectors gatherers] The approximately 50 species of *Psilotreta* are predominately Oriental and eastern Palearctic. Six species are found in eastern North America. Larvae are burrowers in coarse sand. Different species are found in springs, seeps, streams, or rivers. The cases are unusually strong and resistant to crushing (Wiggins, 1996). The coarser sand grains that make the bulk of the case are supplemented with smaller grains internally to fill the gaps, and are held securely in place by thick silk. In general outline, the cases are slightly curved and tapered, very much like the cases of *Agarodes* and *Fattigia* (family Sericostomatidae, below). However, sericostomatid cases are made of smaller and more uniform sand grains, appear to have a very smooth outline, and are not unusually resistant to crushing. The differences between the cases are intriguing, since *Psilotreta*, *Agarodes*, and *Fattigia* have very similar habitats and behaviors, being burrowers in sandy substrates (not sprawlers as given by (Merritt and others, 2008). By comparison with *Psilotreta*, the cases of *Agarodes* and *Fattigia* seem to be very delicate. Parker and Wiggins (1987) revised *Psilotreta* and provided keys to the Nearctic larvae and adults. *Psilotreta* has a genus level tolerance value of 0.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Psilotreta amera</i> HH Ross, 1939	BLRI, CARL , GRSM ^(L)	GA, NC, SC, TN	408-1575 m	G3, NCS2	0.0	18 May - 15 Jun (Apr - Jun)
Comments — Endemic to the southern Appalachian Mountains. This is the least common <i>Psilotreta</i> species, possibly due to its predilection for cold, very small, high elevation spring seeps. It is ranked vulnerable globally, and imperiled in North Carolina. Larva up to 9 mm in length, case up to 10 mm, adult up to 13 mm. We have 19 collections and 34 specimens of this species, including 1 male from the Trout Pond spring at CARL.						
<i>Psilotreta frontalis</i> N Banks, 1899	BISO, BLRI, CARL , COWP, GRSM ^(L) , KIMO	AL, CT, DE, FL, GA, MA, ME, NB, NC, NF, NH, NJ, NS, NY, PA, QC, SC, TN, VA, VT	214-1539 m	G5, ALS2	0.0	17 May - 9 Jun (Apr - Jun)
Comments — A widespread and common species in the study area. Larvae are found in small, clean sandy streams. This species was designated as threatened by the Invertebrate Taxa Review Committee of the South Carolina Heritage Trust Program (Floyd and Morse, 1993), and is ranked imperiled in South Carolina. Larva up to 14 mm in length, case up to 16 mm, adult up to 16 mm. We have 276 collections and 2,074 specimens of this species, and from CARL we collected 3 females from 2 locations.						

Family Brachycentridae Ulmer

short-horned caddisflies

This Holarctic and Oriental family contains six genera and about 100 species. Five of the genera are found in North America, and three have been found in the parks. Larvae are characterized by their short antennae, which provide the family with its common name. Cases are made of plant materials with a square cross section, or are made of silk spun as tubes that may or may not have sand or plant material incorporated.

Genus *Micrasema* McLachlan - [Habitat - Lotic erosional (on logs, branches, or vascular hydrophytes): Habit - Clingers sprawlers (case tapered, sometimes curved, of silk and strands of vegetation): Trophic - Shredders herbivores (chewers), collectors gatherers] More than 60 species are known from the northern Palearctic and Oriental regions, and about 17 species are known from North America. Seven species have been found in the parks. Larvae of *Micrasema* make cylindrical cases of sand grains, plant pieces, or almost entirely of silk. Early instars of some species make cases entirely of sand, and later instars switch to cases mostly of silk. Larvae are inevitably associated with vascular plants, typically mosses, liverworts, or *Podostemum* (Chapin, 1978). Most of the species in the study area are univoltine, although *M. burksi* apparently takes two years to develop in GRSM. The adults emerge primarily in early spring, with only a few species having a more extended emergence period. As with most Brachycentridae, *Micrasema* are day-active. Chapin (1978) reviewed the genus, and provided descriptions and keys to the males and larvae. We collected two species in BLRI. Most *Micrasema* species have tolerance values less than 3.0, but *M. wataga*, one of the two species collected along the BLRI has tolerance value of 3.2 and is not included below.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
Comments — This taxon is included here because it is the only representative of the genus known to occur in CARL. We collected 26 females from 4 sites in CARL.						

Family Goeridae Ulmer armored caddisflies

This family often has been treated as a subfamily within the Limnephilidae. The general consensus now is to treat it as a separate family. It consists of approximately 180 species and 11 or 12 genera found in most regions of the world, although they are absent from the Neotropical region and Australia (de Moor and Ivanov, 2008, Holzenthal and others, 2011). There are 30 species in 5 genera in North America, of which 6 species in 2 genera were found in the parks. Among these species larvae are characterized by having, among other features, the anterolateral corners of the pronotum and the mesepisternum sharply produced forward. In addition, the cases are strongly made sand particles with larger “ballast” stones attached along the sides. When a larva is tightly tucked in its stone case with its legs withdrawn and these stout projections at the entrance, the larva seems well protected from intrusion by potential predators. For these reasons, we refer to goerids as armored caddisflies. Larvae feed on periphyton and fine detritus.

Genus *Goera* Stevens - [Habitat - Lotic erosional: Habit - Clingers (case mineral, with two lateral ballast stones on each side): Trophic - Scrapers] This genus is represented in Asia, Europe, and North America by about 130 species. Six species are found in the Southeast, and three have been found in the parks. Flint (1960) described and keyed the larvae of three species. All species have very similar cases consisting of a central cylinder of rock pieces, with larger “ballast” stones attached in a series along each side. The number of ballast stones on each side of a case is typically 2-4, but in some populations there is a single, very large stone on each side. A rather common and well-known undescribed species occurs throughout GRSM.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Goera calcarata</i> N Banks, 1895	BISO ^(L) , BLRI, CARL , CHCH, COWP, CUGA ^(L) , GRSM ^(L)	AL, CT, DE, GA, KY, MA, ME, MN, NB, NC, NH, NJ, NS, NY, OH, PA, PQ, SC, TN, VA, VT, WV	206 - 1575 m	G5	1.0	5 May - 21 Oct

Comments — We have 122 collections and 707 specimens of this species. Including a single female from CARL.

Family Lepidostomatidae Ulmer

scale-mouthed caddisflies

This worldwide family of more than 400 species contains only two genera, *Lepidostoma* Rambur and *Theliopsyche* Banks, each in its own subfamily. Both genera are represented in the study region. Males of *Lepidostoma* often have bizarre secondary sexual characteristics, such as highly modified palps, antennae, and wings. This led one of the pioneers of Trichoptera studies to call *Lepidostoma* the “curiosity shop” of the Trichoptera (McLachlan, 1874-1880). Many early Trichoptera workers erected genera for oddly modified species, such that about 20 different genera were at one time recognized within the family. Comprehensive work by Weaver (1988, 2002) led to most of those genera being synonymized with *Lepidostoma*, resulting in the classification used here.

Subfamily Lepidostomatinae Ulmer

Genus *Lepidostoma* Rambur - [Habitat - Lotic erosional and depositional (detritus) (headwater streams and springs): Habit - Climbers sprawlers clingers (case square or “rough log cabin” type of leaf and bark fragments, or cylindrical, of sand or silk): Trophic - Shredders detritivores (chewers) (also scavengers)] This large genus contains nearly 400 species distributed around the world. Approximately 80 species are known from North America, and 23 were collected in the parks. Eggs are carried by the females in green masses at the end of the abdomen, and are deposited directly into or nearby water. Larval cases are varied, although the cases of species within certain groups are characteristic of those groups. Cases of early instars of many species may be entirely of sand grains. Some species retain the sand grain construction throughout development, while others transition to cases of stems, leaves, and other detrital material. These cases are then either a panel case or a turret case. In the panel-type case, larvae cut leaves or other appropriate detrital material into quadrate pieces and attach the pieces together in a 4-sided arrangement, linking several such units together. Depending on the softness of the material used, the resulting cases are somewhat rounded to almost perfectly square in cross-section. Turret cases are formed of small stems or other slender plant fragments arranged transversely in a whorl. The larvae are not generally identifiable. *Lepidostoma* larvae a tolerance value of 1.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Lepidostoma carrolli</i> OS Flint, 1958	CARL, GRSM ^(L)	AR, CT, KY, MAD, ME, NC, NJ, OH, PA, SC, TN, VA	754 m	G5	0.0	9-13 Sep (Jul - Oct)
Comments — We collected a single male of this species from CARL.						
<i>Lepidostoma griseum</i> N Banks, 1911	BLRI ^(L) , CARL, CUGA ^(L) , GRSM ^(L) , SHIL	AL, CO, CT, DE, GA, KY, MA, ME, MI, NC, NH, NJ, NS, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	139-1575 m	G5, ALS1	0.0	18 Aug - 13 Oct (Aug - Oct)
Comments — This species is critically imperiled in Alabama. Larvae generally found in second order streams. Cases square in cross-section, made of pieces of bark. Adult up to 10 mm in length. We have 8 collections and 25 specimens of this species, including 2 males from Mountain Reservoir in CARL.						
<i>Lepidostoma latipenne</i> N Banks, 1905	BLRI ^(L) , CARL, COWP, GRSM ^(L) , GUCO, KIMO, SHIL ^(L)	AL, DE, GA, MA, NC, NH, NS, PA, QC, SC, TN, VA, VT	124-859 m	G5	1.0	24 May - 22 Sep (Apr - Nov)
Comments — Case is a panel-type and is square in cross-section. Larvae prefer second and third order streams. We have 24 collections and 92 specimens of this species, including 14 specimens from 4 locations in CARL.						

Carl Sandburg Home National Historic Site

Survey of Aquatic Insects of the Cumberland Piedmont and Appalachian Highlands Monitoring Networks

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Lepidostoma ontario</i> HH Ross, 1941	BLRI, CARL , GRSM	AL, CT, MA, ME, NC, NE, NH, NS, ON, PA, QC, SC, TN, VA, VT	705-1169 m	G5	1.0	7 May – 9 Jul (Apr - Jul)
Comments — Cases are cigar-shaped panel-type. We have 22 females and 6 males from one location in CARL.						
<i>Lepidostoma tibiale</i> (FM Carpenter, 1933)	CARL , OBRI	AL, GA, NC, SC, TN, VA	318 m	G4	0.9	4 Jun - 6 Oct (May - October)
Comments — Larva not described. Adult up to 6.5 mm in length. We collected 3 specimens from OBRI, and 1 specimen from Front Lake in CARL.						
<i>Lepidostoma wigginsi</i> Weaver, 2002	CARL	CT, FL, LA, NC, PA, SC, TN, VA	691 m	G4	0.9	20 Sep (Mar - Sep)
Comments — This is an eastern US species that is uncommonly encountered. Larvae are found in springs where they make somewhat cigar-shaped cases of bark pieces. We collected one male and three females from the spring at Trout Pond in CARL.						

Family Limnephilidae Kolenati

northern caddisflies

This family has nearly 900 described species in about 100 genera. As the common name implies, these caddisflies are dominant in the Holarctic region, with many species found in both the Nearctic and the Palaearctic. More than 200 species in 39 genera occur in the Nearctic, while 45 species in 10 genera occur in the Neotropical region. This group has attracted the attention of scientists for many years (for example, Schmid, 1955), yet much uncertainty remains about what the family limits and internal organization should be. Most recently, Vshivkova and others (2007) have suggested a number of changes to the classification of the family. The arrangement used below likely will change again in the near future. Wiggins (1996) and Morse and Holzenthal (2008) provide keys to genera of larvae. For adults, Ruiter (1995) published a key to the genera of the Western Hemisphere.

Subfamily Dicosmoecinae Schmid

Genus *Ironoquia* Banks - [Habitat - Lotic depositional, lentic littoral (temporary streams and ponds): Habit - Sprawlers (case a curved tube of leaf or bark pieces, or mineral): Trophic - Shredders] [Habitat - Lotic depositional, lentic littoral (temporary streams and ponds): Habit - Sprawlers (case a curved tube of leaf or bark pieces, or mineral): Trophic - Shredders] This is a genus of six species, five from North America and one from Europe. Four have been found in the study area, and three in the parks. Larvae of *Ironoquia* are unusual among North American Dicosmoecinae in that they live in temporary pools and streams, that often have extremes of temperature and extended dry periods (Wiggins, 1996). The larvae of one species, *I. plattensis* Alexander & Whiles, are known to burrow and aestivate underground for up to four months (Geluso and others, 2011; Whiles and others, 1999). The larvae of *I. punctatissima* and *I. parvula* have been described by Flint (1960), and the larvae of *I. lyrata* are known (Wiggins, 1996). Kentucky Division of Water (2009) assigns *Ironoquia* larvae a tolerance value of 7.7.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Ironoquia punctatissima</i> (F Walker, 1852)	BLRI, CARL , CHCH, CUGA, GRSM ^(L) , LIRI, MACA, NISI, SHIL	AK, AL, AR, CT, DE, FL, IL, IN, KS, KY, LA, MA, MD, ME, MI, MN, MO, MS, NC, NH, NJ, NS, NY, OH, OK, ON, PA, QC, SC, TN, TX, VA, VT, WI, WV	124-960 m	G5, ALS2	7.8	30 Aug - 26 Oct (Aug - Nov)

Comments — This species is included here because Alabama has ranked this species imperiled. Larvae prefer marshes and slow moving streams with an abundance of plants and organic matter (Flint, 1960). Williams and Williams (1975) reported that larvae of *I. punctatissima* first appeared in October in the temporary stream in Ontario that they studied, just as pools began forming following a five-month summer dry spell. Extremely rapid growth occurred with the larvae reaching the 4th instar by early Nov, and 5th instars appearing by the end of December. Following ice melt in early April, larvae migrated from the water to the stream banks, where they remained mostly without moving and without feeding until July. Then they sealed their cases and pupated. Adults first appeared at the end of July, and continued to emerge into August. Case made of pieces of bark and leaves, slightly tapered and curved. Larva up to 20 mm in length, adult up to 18 mm. We have 29 collections and 113 specimens of this species, including 7 specimens from the Duck Pond in CARL.

Subfamily Limnephilinae Kolenati

Genus *Pycnopsyche* Banks - [Habitat - Lotic erosional and depositional, lentic littoral (detritus): Habit - Sprawlers climbers or clingers (case smooth mineral, or like *Hydatophylax*): Trophic - Shredders detritivores (chewers), scrapers (last instar in some species)] This is a North American genus of approximately 17 species, mostly distributed east of the Rocky Mountains. Fourteen species were collected during this survey. Betten (1950) and Wojtowicz (1982b) reviewed the genus most recently. Flint (1960) described the larvae of six species and one species group, and presented a key. (Wojtowicz, 1982a) described the larva of *P. flavata*. Wojtowicz and Flint (2007) described *P. pani* and reported that the larvae were indistinguishable from *P. luculenta* and *P. sonso*. Certain species are identifiable as larvae (for example, *P. gentilis* and *P. flavata*), but many specimens can only be assigned to a group, and the larvae of some species remain undescribed. The genus has a tolerance value of 2.3. *Pycnopsyche* are shredders, feeding on leaves and other organic detritus.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Pycnopsyche antica</i> (F Walker, 1852)	BISO ^(L) , BLRI, CARL , CUGA ^(L) , GRSM ^(L) , KIMO, MACA, OBRI ^(L) , SHIL ^(L)	AL, FL, GA, IN, LA, MA, MI, MS, NC, NH, NJ, NY, ON, PA, SC, TN, TX, VA, WI, WV	124-1694 m	G5	2.3	14 Jun- 27 Oct (Jun – Nov)
Comments — This species is often synonymized with <i>P. scabripennis</i> (i.e., Flint and others, 2008). We have chosen to accept Wojtowicz's interpretation (Wojtowicz 1982b) and treat <i>P. antica</i> as a valid species. All specimens we collected were identified as <i>P. antica</i> ; none matched the description of <i>P. scabripennis</i> . Larva up to 25 mm, adult up to mm. We have 86 collections and 403 specimens of this species, and one male from Side Lake in CARL.						
<i>Pycnopsyche gentilis</i> (R McLachlan, 1871)	BISO ^(L) , BLRI, CARL , CUGA ^(L) , GRSM ^(L) , MACA, OBRI	AL, CT, DE, GA, KY, MA, MD, ME, NC, NF, NH, NJ, NS, NY, OH, PA, QC, SC, TN, VA, VT, WV	173-1694 m	G5, ALS1	2.3	25 -27 Nov (Jul - Oct)
Comments — Alabama ranks <i>P. gentilis</i> as critically imperiled. This species lives in tiny spring seeps only a few centimeters wide up to about 1 meter wide. They can also be found in larger streams with strong currents. Many early instar larvae make cases of circular leaf pieces attached to a silk cylinder in a triangular arrangement. Wojtowicz (1982a) reported that some early instar individuals make sand cases throughout their development. Later instars convert leaf cases to sand and gravel cases, and it is not uncommon to find cases in the intermediate state that are partly sand and partly leaf. Mature larvae are always in cylindrical sand cases. Larva up to 25 mm in length, adult up to 19 mm. We have 165 collections and 826 specimens of this species, including 4 specimens from Trout Pond and its spring at CARL.						

Genus *Platycentropus* Ulmer - [Habitat - Lentic littoral, lotic depositional (vascular hydrophytes, detritus): Habit - Climbers (case a rough log cabin type of plant stems and other fine pieces): Trophic - Shredders detritivores (and herbivores) (chewers)] This is a Nearctic genus with three species. Only one species is found in the study area. In the field, larvae are readily recognized by their cases, which are of the turret type consisting of cut plant stems arranged transversely to make a coarse, straight cylinder. Larva up to 22 mm in length, case up to 25 mm.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Platycentropus radiatus</i> (T Say, 1824)	BLRI, CARL , GRSM ^(L)	AL, CT, DE, GA, IA, IL, IN, KY, MA, MB, MD, ME, MI, MN, MS, NC, ND, NF, NH, NJ, NS, NT, NY, OH, ON, PA, QC, SC, TN, VA, WA, WI, WV	303-1475 m	G5, ALS1	6.2	3 Jun - 22 Jul (May - Sep)
Comments — In Alabama this species is considered critically imperiled. Larvae live in a variety of water types, from cool streams to warm ponds, such as beaver ponds. They are usually found in thick growths of aquatic vegetation. We have 32 collections and 64 specimens of this species, including 12 specimens from 7 locations in CARL.						

Subfamily Pseudostenophylacinae Schmid

Genus *Pseudostenophylax* Martynov - [Habitat - Lotic erosional (detritus) and depositional (including seeps and temporary streams): Habit - Sprawlers (case tapered, curved, smooth, mineral): Trophic - Shredders detritivores (chewers), collectors gatherers] This is the only genus of the subfamily Pseudostenophylacinae found in North America. The genus is primarily Oriental, with a few Asian Palearctic species, and three species in North America. One species is found in the West, and either one or two species are found in the East. We treat the eastern forms as separate species—some prefer to treat them as variants of a single species. Larvae are found in cold headwater streams, and in intermittent streams. Cases are made of small rock pieces, and are tapered and slightly curved. Larva up to 16 mm in length, case up to 19 mm. Kentucky Division of Water (2009) assigns larvae of *Pseudostenophylax* a tolerance value of 2.0.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Pseudostenophylax sparsus</i> N Banks, 1908	BLRI, CARL , GRSM ⁽¹⁾	CT, MA, ME, MI, NF, NH, NY, OH, ON, PA, QC, TN, VA, VT, WI, WV	594-1575 m	G5	2.0	17 May - 28 Sep (May - Aug)
Comments — We have 8 collections and 10 specimens of this species. We found a female from Front Lake in CARL.						
<i>Pseudostenophylax uniformis</i> C Betten, 1934	BLRI, CARL , CUGA, GRSM ⁽¹⁾ , MACA, RUCA	CT, IL, IN, KY, MA, ME, MN, MO, NC, NH, NY, OH, ON, PA, QC, SC, TN, VA, VT, WI, WV	149-1944 m	G5, NCS3	2.0	10 May - 12 Sep (May - Jul)
Comments — Larvae are restricted to small spring fed streams and pools (Flint, 1957). Larva up to 15 mm in length, pupa up to 17 mm, case up to 17 mm. We collected 249 specimens from 59 locations in the 5 parks listed. This includes 1 male from Trout Pond in CARL.						

Family Phryganeidae Burmeister

phryganeid caddisflies

The Phryganeidae is a small family of less than 75 species in 15 genera. The family generally is Holarctic in distribution. Ten genera have representatives in North America and species of five of those genera occur in the study area. The largest known caddisflies are phryganeids, having a forewing length of up to 43 mm. Most larvae make cylindrical cases from plant pieces cut into rectangles and arranged either as stacked rings (*Oligostomis*, *Ptilostomis*) or as a spiral (*Agrypnia*, *Banksiola*, *Phryganea*). Phryganeid larvae occur in a wide range of habitats, from cool streams to lakes and ponds, and temporary pools, and even acidic bogs and brackish coastal waters. Selgeby (1974) reported larvae of three genera from depths as much as 100 m in Lake Superior. Larvae are primarily predaceous as final instars, but early instars of some species feed on filamentous algae and detritus. The principal source for information about Phryganeidae is the book by Wiggins (1998). Phryganeid larvae are easily separated to genus using Wiggins (1996, 1998), but cannot be identified to species at this time. Phryganeids have high assigned tolerance values.

Genus *Phryganea* Linnaeus - [Habitat - Lotic depositional and lentic (detritus and vascular hydrophytes): Habit - Climbers (case a spirally arranged, tapered cylinder constructed of leaf pieces): Trophic - Shredders herbivores and detritivores (chewers), predators (engulfers)] A Holarctic genus of eight species. Two species are found in North America and both were collected in this survey. Larvae prefer lakes and marshes, and have been taken from 100 m depth in Lake Superior (Selgeby, 1974). Larvae tend to be omnivorous.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Phryganea sayi</i> LJ Milne, 1931	ABLI, BISO, BLRI, CARL , COWP, KIMO, LIRI, MACA, OBRI, SHIL ⁽¹⁾	AL, AR, CT, DC, DE, IL, IN, KS, KY, MA, MD, ME, MI, MO, NC, ND, NJ, NY, OH, ON, PA, QC, SC, SK, TN, VA, WI, WV	124-1080 m	G5, ALS1	6.0	25 May - 13 Oct (May - Sep)
Comments — This is one of the largest caddisflies in the Southeast. It is considered critically imperiled in Alabama. Adult forewing length 18-22 mm; mature larvae up to 43 mm; case up to 56 mm. We have 39 collections and 107 specimens of this species. We found 33 specimens from 6 locations in CARL.						

Family Sericostomatidae Stephens

delicate-case maker caddisflies

This family is distributed throughout the world, except for the region about Australia and New Zealand. About 100 species are recognized among 19 genera (Holzenthal and others, 2007). In North America 15 species are placed in two (Schmid, 1998) or three (Wiggins, 1996) genera. We follow Wiggins' treatment because of the clear distinctions in larval characters, which Schmid discounted. Studies of several species from Europe and western North America have demonstrated that sericostomatids have more than the typical (for Trichoptera) five larval instars, ranging from six to 10 in *Sericostoma* in Europe, to 14 in *Gumaga* in western North America. Larvae of both genera found in the study area make curved and tapered cases of fine sand grains. Larvae burrow in sandy areas of mountain streams during the day, emerging at night to feed on detritus, and then burrowing again with the daylight. Sericostomatidae are shredders.

Genus *Agarodes* Banks - [Habitat - Lotic erosional (detritus) and depositional (detritus): Habit - Sprawlers (case tapered, curved, short, smooth, coarse mineral and wood fragments): Trophic - Shredders detritivores (chewers), collectors gatherers] *Agarodes* is endemic to eastern North America and contains 12 species that range from southern Canada to the southern United States (Keth and Harris, 2008). McEwan (1980) studied the biology of five species in South Carolina, including two of the three we encountered in the parks. The species are univoltine. McEwan believed the species she studied have more than five instars, but could not determine a set number. Larvae were found in the upper five centimeters of sandy sediments in depositional areas of higher elevation streams. In lower elevation streams and spring runs, larvae are found in depositional areas having intermixed, partially decomposed leaves and other plant material. Larvae at pupation either added a cluster of sand and gravel pieces to the posterior end of the case and oriented the case vertically in the substrate with the anterior end upward; or larvae attached both ends of the case to roots, logs, stems, or leaf stalks of aquatic macrophytes. Pupae often were found in aggregations of several to many cases. Larval gut contents were predominately decomposing leaves, amorphous detritus, and other plant tissue, with a small proportion of diatoms and algae. Mature larvae were shown to preferentially select mineral particles in the size range of 0.5 - 1.0 mm for case building and this type of preference may contribute to limiting the distribution of *Agarodes* species in streams.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Agarodes griseus</i> N Banks, 1899	BLRI, CARL	AL, CT, DC, DE, FL, GA, MA, MS, NH, NS, NY, PA, QC, SC, VA	829-867 m	G5	3.0	8 Jun (May - Jun)
Comments — This species was designated as threatened by the Invertebrate Taxa Review Committee of the South Carolina Heritage Trust Program (Floyd and Morse, 1993). Larvae are found in depositional areas of small spring seepages and spring streams. Adult up to 21 mm in length. This species is included here because it is known from just three parks. We have 5 collections and 63 specimens of this species, including 16 specimens from the Trout Pond in CARL.						
<i>Agarodes tetron</i> HH Ross, 1948	BLRI, CARL , COWP, GRSM ^(L)	GA, NC, SC, TN	274-866 m	G3	3.0	21 May - 27 Jun (May - Jun)
Comments — “A montane species, occurring in deep ravines of the Smoky Mountain ridges” (Keth and Harris, 2008). It is considered vulnerable globally. Adult up to 12 mm in length. We collected 86 specimens from 4 parks, including 10 specimens from Duck Pond in CARL.						

Genus <i>Fattigia</i> Ross & Wallace – [Habitat – Lotic: Habit – Sprawlers? (case curved, short smooth coarse mineral): Trophic – Shredders] This monotypic genus is restricted to the southern Appalachians. It is most commonly encountered in the mountainous regions of the study area.						
Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Fattigia pele</i> HH Ross, 1938	BLRI, CARL , GRSM	GA, NC, SC, TN, VA	518-1694 m	G4	1.1	26 May – 22 Jul (May - Jul)
Comments — Stocks (2000) studied the distribution and life history of <i>F. pele</i> in GRSM and the surrounding regions. <i>Fattigia</i> larvae are shredders that feed on decaying leaves. The species appears to have a two- or three-year life cycle, with some members of a cohort taking two years and others taking three years to develop. Pupation takes place in the late spring and lasts for six to eight weeks. <i>Fattigia</i> larvae were found in streams ranging from 452 to 1400 m elevation, very similar to the results of this survey. Although Stocks did not find any <i>Agarodes</i> species during her study, she noted considerable overlap in reported elevation ranges between <i>Agarodes</i> and <i>Fattigia</i>, and found no statistically significant differences between the two species. Our finding reported here seem to suggest that this result needs to be examined with fresh data. <i>Fattigia</i> larvae preferred substrates having mostly fine sands <0.5 mm diameter, where the <i>Agarodes</i> larvae studied by McEwan (1980) preferred substrates having larger particle sizes. Larvae up to 15 mm in length, case up to 18 mm in length. We found 2 females in CARL.						

Family Thremmatidae Martynov

horsehead caddisflies

This family has a disjunct North America - eastern Asia distribution. Some subfamilies and genera have closest relatives in the two regions to the exclusion of other regions. Worldwide there are fewer than 90 species in seven genera. Only one genus occurs in the study area, *Neophylax*, which has about 40 species worldwide. There are 21 species in North America, with 17 in the East.

Genus *Neophylax* McLachlan - [Habitat - Lotic erosional: Habit - Clingers (case tapered, slightly curved, mineral with ballast stones one each side): Trophic - Scrapers] Currently about 32 species of *Neophylax* are known from North America, Western Palearctic, and Oriental regions. In the seven states of the study area 16 species are known, along with at least two undescribed species. Eleven species were found during this inventory, although only larvae were found for *N. fuscus*. Larvae make a very distinctive case that is instantly recognizable in the field. Cases are robust and tubular, slightly curved and tapered, made of rock pieces, and often have larger “ballast” stones laterally. Pupal cases are firmly attached to the underside of stable rocks. Larvae are found in springs, creeks, and large rivers. Within a stream species tend to be longitudinally distributed, with overlapping populations resulting in more than one species being found at a single site. Larvae are scrapers, feeding on diatoms, periphyton, and organic debris from the surfaces of rocks. *Neophylax* are univoltine, the adults normally emerging in the fall following a summer diapause of two to six months in the prepupal stage. Eggs are laid under rocks or overhanging banks above the water surface (Beam and Wiggins, 1987), although at least one western Nearctic species lays eggs in water. Larval growth rates vary considerably. In North Carolina, Georgian and Wallace (1983) demonstrated that *N. consimilis* larvae take 135 days or fewer to progress from 1st instar to prepupa, while in Ontario, Beam and Wiggins (1987) demonstrated that *N. aniqua* larvae take up to 240 days. When larvae prepare for diapause they tend to aggregate and often are found in clumps of 5 to 20 cases on the same rock. Often the current generation of larvae uses the same locations for aestivation as previous generations, as empty pupal cases of the prior generation persist and can be found together with the current cohort. This has been demonstrated to lead to enhanced aquatic invertebrate diversity compared with rocks that do not have aggregations of *Neophylax* larvae (McCabe and Gotelli, 2003). *Neophylax* was revised recently by Vineyard and others (2005), which is the best source for information and keys to the species. Although *Neophylax* larvae are usually easily identifiable, in biomonitoring programs they are given a genus level tolerance value of 1.6.

Species	Parks	States	Elevation Range	Rankings	Tolerance Value	Flight Dates
<i>Neophylax mitchelli</i> FM Carpenter, 1933	BLRI, CARL , CUGA, GRSM ⁽¹⁾	NC, PA, SC, TN, VA	351-1818 m	G3	1.6	15 May, Sep - 5 Dec (Sep - Nov)
Comments — Morse and others (1997) considered <i>N. mitchelli</i> to be rare and at risk. It has a global rank of vulnerable. Numerous collections from widespread locations suggest this ranking is unwarranted. The 15 May record, which is early in the year for most species in this genus, is an adult male from a Malaise trap operated continuously for several years near LeConte Creek in GRSM. Adult up to 12 mm in length. We have 350 collections and 1,630 specimens of this species. In CARL we found a single female from Duck Pond.						

References Cited

- Abbott, J. C., 2005, Dragonflies and damselflies of Texas and the south-central United States: Texas, Louisiana, Arkansas, Oklahoma, and New Mexico, Princeton, New Jersey, Princeton University Press, viii + 344 p.
- Alstad, D. N., 1982, Current speed and filtration rate link caddisfly phylogeny and distributional patterns on a stream gradient: Science, v. 216, p. 533-554.
- Anonymous, 2003, Return of the mayfly: an indicator of an improving habitat: Pennsylvania State University, 4 p.
- Arnwine, D., 2006, Quality system standard operating procedure for macroinvertebrate stream surveys: Tennessee Department of Environment and Conservation, Division of Water Pollution Control, xiv + 135 p.
- Balian, E. V., Segers, H., Lévêque, C., and Martens, K., 2008, The Freshwater Animal Diversity Assessment: an overview of the results: Hydrobiologia, v. 595, p. 627-637.
- Barber-James, H. M., Gattolliat, J.-L., Sartori, M., and Hubbard, M. D., 2008, Global diversity of mayflies (Ephemeroptera, Insecta) in freshwater: Hydrobiologia, v. 595, p. 339-350.
- Barbour, M. T., Gerritsen, J., Snyder, B. D., and Stribling, J. B., 1999, Rapid bioassessment protocols for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates, and fish, second edition, US EPA, Office of Water: Washington, D. C., p. B1-B50.
- Baumann, R. W., 1975, Revision of the stonefly family Nemouridae: A study of the world fauna at the generic level: Smithsonian Contributions to Zoology, v. 211, p. 74 p.
- Baumann, R. W., Gaufin, A. R., and Surdick, R. F., 1977, The stoneflies (Plecoptera) of the Rocky Mountains: Memoirs of the American Entomological Society, v. 31, p. 1-208.
- Baumann, R. W., and Grubbs, S. A., 1996, Two new species of *Soyedina* (Plecoptera: Nemouridae) from the Appalachian Mountains: Entomological News, v. 107, p. 220-224.
- Beam, B. D., and Wiggins, G. B., 1987, A comparative study of the biology of five species of *Neophylax* (Trichoptera: Limnephilidae) in southern Ontario: Canadian Journal of Zoology, v. 65, p. 1741-1754.
- Beaton, G., 2007, Dragonflies and Damselflies of Georgia and the Southeast, Athens, Georgia, University of Georgia Press, ix + 355 p.
- Beaty, S. R., 2011, The Ephemeroptera of North Carolina, a biologist's handbook with standard taxonomic effort levels, Biological Assessment Unit, Division of Water Quality, North Carolina Department of Environment and Natural Resources, p. 1-62.
- Benke, A. C., and Wallace, J. B., 1980, Trophic basis of production among net-spinning caddisflies in a southern Appalachian stream: Ecology, v. 61, p. 108-118.
- Berner, L., 1975, The mayfly family Leptophlebiidae in the southeastern United States: Florida Entomologist, v. 58, p. 137-156.

- Berner, L., and Pescador, M. L., 1998, The Mayflies of Florida, Gainesville, Florida, University Presses of Florida, xvi + 415 p.
- Betten, C., 1934, The caddis flies or Trichoptera of New York State: New York State Museum Bulletin, v. 292, p. 5-576.
- , 1950, The genus *Pycnopsyche* (Trichoptera): Annals of the Entomological Society of America, v. 43, p. 508-522.
- Biological Assessment Unit, 2006, Standard operating procedures for benthic macroinvertebrates: North Carolina Department of Environment and Natural Resources, ii + 42 p.
- Blahnik, R. J., 2005, *Alterosa*, a new caddisfly genus from Brazil (Trichoptera: Philopotamidae): Zootaxa, v. 991, p. 3-60.
- Blahnik, R. J., and Holzenthal, R. W., 2006, Revision of the genus *Culoptila* (Trichoptera: Glossosomatidae): Zootaxa, v. 1233, p. 1-52.
- Blocksom, K. A., and Winters, L., 2006, The evaluation of methods for creating defensible, repeatable, objective and accurate tolerance values for aquatic taxa: U.S. Environmental Protection Agency, 68 p.
- Bonada, N., Zamora-Muñoz, C., Rieradevall, M., and Prat, N., 2004, Ecological profiles of caddisfly larvae in Mediterranean streams: implications for bioassessment methods: Environmental Pollution, v. 132, p. 509-521.
- Bowles, D. E., and Allen, R. T., 1992, Life histories of six species of caddisflies (Trichoptera) in an Ozark Stream, U.S.A.: Journal of the Kansas Entomological Society, v. 65, p. 174-184.
- Bouchard, R. W., Jr., Schuetz, B. E., Ferrington, L. C., Jr., and Kells, S. A., 2009, Cold hardiness in the adults of two winter stonefly species: *Allocapnia granulata* (Claassen, 1924) and *A. pygmaea* (Burmeister, 1839) (Plecoptera: Capniidae): Aquatic Insects, v. 31, p. 145-155.
- Brittain, J. E., 1982, Biology of mayflies: Annual Review of Entomology, v. 27, p. 119-147.
- Burks, B. D., 1953, The mayflies, or Ephemeroptera, of Illinois: Bulletin of the Illinois Natural History Survey, v. 26, p. 1-216.
- Cardinale, B. J., Hillebrand, H., and Charles, D. F., 2006, Geographic patterns of diversity in streams are predicted by a multivariate model of disturbance and productivity: Journal of Ecology, v. 94, p. 609-618.
- Carle, F. L., 1978, A new species of *Ameletus* (Ephemeroptera: Siphonuridae) from western Virginia: Annals of the Entomological Society of America, v. 71, p. 581-584.
- , 1980, A new *Lanthus* from eastern North America with adult and nymphal keys to American ocotgomphines: Annals of the Entomological Society of America, v. 73, p. 172-179.
- Carle, F. L., and Lewis, P. A., 1978, A new species of *Stenonema* (Ephemeroptera: Heptageniidae) from eastern North America: Annals of the Entomological Society of America, v. 71, p. 285-288.
- Chamorro, M. L., and Holzenthal, R. W., 2011, Phylogeny of Polycentropodidae Ulmer, 1903 (Trichoptera : Annulipalpia : Psychomyioidea) inferred from larval, pupal and adult characters: Invertebrate Systematics, v. 25, p. 219-253.
- Chapin, J. W., 1978, Systematics of Nearctic *Micrasema* (Trichoptera: Brachycentridae) [Master's thesis]: Clemson University, 136 p.
- Chuluunbat, S., Morse, J. C., Lessard, J. L., Benbow, M. E., Wesener, M. D., and Hudson, J., 2010, Evolution of terrestrial habitat in *Manophylax* species (Trichoptera: Apataniidae), with a new species from Alaska: Journal of the North American Benthological Society, v. 29, p. 413-430.

- Claire, E. W., and Phillips, R. W., 1968, The stonefly *Acroneuria pacifica* as a potential predator on salmonid embryos: Transactions of the American Fisheries Society, v. 97, p. 50-52.
- Corallini, C., and Gaino, E., 2003, The caddisfly *Ceraclea fulva* and the freshwater sponge *Ephydatia fluviatilis*: a successful relationship: Tissue and Cell, v. 35, p. 1-7.
- Crichton, M. I., and Fisher, D., 1978, Life histories and distribution of British Trichoptera, excluding Limnephilidae and Hydroptilidae, based on the Rothamsted Insect Survey: Holarctic Ecology, v. 1, p. 31-45.
- Cummins, K. W., 1964, Factors limiting the microdistribution of larvae of the caddisflies *Pycnopsyche lepida* (Hagen) and *Pycnopsyche guttifer* (Walker) in a Michigan stream (Trichoptera: Limnephilidae): Ecological Monographs, v. 34, p. 271-295.
- Cummins, K. W., Merritt, R. W., and Berg, M. B., 2008, Ecology and distribution of aquatic insects, in Merritt, R. W., Cummins, K. W., and Berg, M. B., eds., An Introduction to the Aquatic Insects of North America: Dubuque, Iowa, Kendall/Hunt Publishing Company, p. 105-122.
- de Moor, F. C., and Ivanov, V., D., 2008, Global diversity of caddisflies (Trichoptera: Insecta) in freshwater: Hydrobiologia, v. 595, p. 393-407.
- Department of Environmental Protection, 2007, Appendix B: Taxa tolerance and trophic classification table: Pennsylvania Department of Environmental Protection, 36 p.
- DeWalt, R. E., 2004, Summer Ephemeroptera, Plecoptera and Trichoptera of southwestern of 15 drainages in Great Smoky Mountains National Park: Champaign, Illinois, Illinois Natural History Survey, p. 27 p.
- DeWalt, R. E., Favret, C., and Webb, D. W., 2005, Just how imperiled are aquatic insects? A case study of stoneflies (Plecoptera) in Illinois: Annals of the Entomological Society of America, v. 98, p. 941-950.
- DeWalt, R. E., and Heinhold, B. D., 2005, Summer emerging Ephemeroptera, Plecoptera, and Trichoptera of Abrams Creek, Great Smoky Mountains National Park: Proceedings of the Entomological Society of Washington, v. 107, p. 34-48.
- DeWalt, R. E., and Olive, J. H., 1988, Effects of eroding glacial silt on the benthic insects of Silver Creek, Portage County, Ohio: Ohio Journal of Science, v. 88, p. 154-159.
- DeWalt, R. E., Webb, D. W., and Kompare, T. N., 2001, The *Perlesta placida* (Hagen) complex (Plecoptera: Perlidae) in Illinois, new state records, distributions, and an identification key: Proceedings of the Entomological Society of Washington, v. 103, p. 207-216.
- DeWalt, R. E., Webb, D. W., and Soli, A. M., 2002, The *Neoperla clymene* (Newman) complex (Plecoptera: Perlidae) in Illinois, new state records, distributions, and an identification key: Proceedings of the Entomological Society of Washington, v. 104, p. 126-137.
- Dobrin, M., and Giberson, D. J., 2003, Life history and production of mayflies, stoneflies, and caddisflies (Ephemeroptera, Plecoptera, and Trichoptera) in a spring-fed stream in Prince Edward Island, Canada: evidence for population asynchrony in spring habitats?: Canadian Journal of Zoology, v. 81, p. 1083-1095.
- Dosdall, L. M., and Lehmkuhl, D. M., 1979, Stoneflies (Plecoptera) of Saskatchewan: Quaestiones Entomologicae, v. 15, p. 3-116.

- Edler, C., and Georgian, T., 2004, Field measurements of particle-capture efficiency and size selection by caddisfly nets and larvae: *Journal of the North American Benthological Society*, v. 23, p. 756-770.
- Edmunds, G. F., Jr., Jensen, S. L., and Berner, L., 1976, *The Mayflies of North and Central America*, Minneapolis, Minnesota, University of Minnesota Press, x + 330 p.
- Ellis, R. J., 1962, Adult caddisflies (Trichoptera) from Houghton Creek, Ogemaw County, Michigan: *Occasional Papers of the Museum of Zoology University of Michigan*, v. 624, p. 1-16.
- Etnier, D. A., Parker, C. R., Baxter, J. T., Jr., and Long, T. M., 2010, A review of the genus *Agapetus* Curtis (Trichoptera: Glossosomatidae) in eastern and central North America, with description of 12 new species: *Insecta Mundi*, v. 149, p. 1-77.
- Etnier, D. A., Parker, C. R., and Stocks, I. C., 2004, A new species of *Rhyacophila* Pictet (Trichoptera: Rhyacophilidae) from Great Smoky Mountains National Park, with illustrations of females of *R. appalachia* Morse and Ross and *R. mycta* Ross: *Proceedings of the Entomological Society of Washington*, v. 106, p. 396-406.
- FADA, 2010, Insecta-Ephemeroptera checklist; Freshwater Animal Diversity Assessment, 66 p. (generated Wed Oct 20 12:11:33 +0200 2010 from FADA website)
- Flint, O. S., Jr., 1956, The life history and biology of the genus *Frenesia* (Trichoptera: Limnephilidae): *Bulletin of the Brooklyn Entomological Society*, v. 51, p. 93-108.
- , 1960, Taxonomy and biology of Nearctic limnephilid larvae (Trichoptera), with special reference to species in eastern United States: *Entomologica Americana*, v. 60, p. 1-117.
- , 1961, The immature stages of the Arctopsychninae occurring in eastern North America (Trichoptera: Hydropsychidae): *Annals of the Entomological Society of America*, v. 54, p. 5-11.
- , 1962a, Larvae of the caddis fly genus *Rhyacophila* in eastern North America (Trichoptera: Rhyacophilidae): *Proceedings of the United States National Museum*, v. 113, p. 465-493.
- , 1962b, The immature stages of *Palaeagapetus celsus* Ross (Trichoptera: Hydroptilidae): *Bulletin of the Brooklyn Entomological Society*, v. 57, p. 40-44.
- , 1964, Notes on some Nearctic Psychomyiidae with special reference to their larvae (Trichoptera): *Proceedings of the United States National Museum*, v. 115, p. 467-481.
- , 1984, The genus *Brachycentrus* in North America, with a proposed phylogeny of the genera of Brachycentridae (Trichoptera): *Smithsonian Contributions to Zoology*, v. 398, p. iv + 58 pp.
- , 2007, Synonymy of some eastern North American species of *Apatania* (Trichoptera: Apataniidae): *Proceedings of the Entomological Society of Washington*, v. 109, p. 739-740.
- , Hoffman, R. L., and Parker, C. R., 2004, An annotated list of the caddisflies (Trichoptera) of Virginia: Part I. Introduction and families of Annulipalpia and Spicipalpia: *Banisteria*, v. 24, p. 23-46.
- Flowers, R. W., and Hilsenhoff, W. L., 1975, Heptageniidae (Ephemeroptera) of Wisconsin: *Great Lakes Entomologist*, v. 8, p. 201-218.

- Floyd, M. A., 1995, Larvae of the caddisfly genus *Oecetis* (Trichoptera: Leptoceridae) in North America: Bulletin of the Ohio Biological Survey New Series, v. 10, p. viii + 85.
- Floyd, M. A., and Morse, J. C., 1993, Caddisflies (Trichoptera) of Wildcat Creek, Pickens County, South Carolina: Entomological News, v. 104, p. 171-179.
- Floyd, M. A., Moulton, J. K., Schuster, G. A., Parker, C. R., and Robinson, J., 2012, An annotated checklist of the caddisflies (Insecta: Trichoptera) of Kentucky: Journal of the Kentucky Academy of Science, v. 73, p. 4-40.
- Frana, H. E., and Wiggins, G. B., 1997, Analysis of morphological and behavioural evidence for the phylogeny and higher classification of Trichoptera (Insecta): Royal Ontario Museum Life Sciences Contributions, v. 160, p. 1-67.
- Funk, D. H., Sweeney, B. W., and Jackson, J. K., 2008, A taxonomic reassessment of the *Drunella lata* (Morgan) species complex (Ephemeroptera: Ephemerellidae) in northeastern North America: Journal of the North American Benthological Society, v. 27, p. 647-663.
- Garrison, R. W., 1990, A synopsis of the genus *Hetaerina* with descriptions of four new species (Odonata: Calopterygidae): Transactions of the American Entomological Society, v. 116, p. 175-259.
- , 2010, A synonymic list of the New World Odonata: Sacramento, California, California Department of Food & Agriculture, p. 38.
- Garrison, R. W., von Ellenrieder, N., and Louton, J. A., 2006, Dragonfly genera of the New World, Baltimore, Maryland, John Hopkins University Press, 159 p
- Gattolliat, J.-L., and Nieto, C., 2009, The family Baetidae (Insecta: Ephemeroptera): synthesis and future challenges: Aquatic Insects, v. 31, p. 41-62.
- Geluso, K., Harner, M. J., and Vivian, L. A., 2011, Subterranean behavior and other notes for *Ironoquia plattensis* (Trichoptera: Limnephilidae) in Nebraska: Annals of the Entomological Society of America, v. 104, p. 1021-1025.
- Genito, D., and Kerans, B. L., 1999, Effects of a diverse prey assemblage on stonefly feeding: Journal of Freshwater Ecology, v. 14, p. 219-231.
- Georgian, T. J., and Wallace, J. B., 1981, A model of seston capture by net-spinning caddisflies: Oikos, v. 36, p. 147-157.
- , 1983, Seasonal production dynamics in a guild of periphyton-grazing insects in a southern Appalachian stream: Ecology, v. 64, p. 1236-1248.
- Glover, J. B., 1996, Larvae of the caddisfly genera *Triaenodes* and *Ylodes* (Trichoptera: Leptoceridae) in North America: Bulletin of the Ohio Biological Survey New Series, v. 11, p. vii + 89 p.
- Glover, J. B., and Floyd, M. A., 2004, Larvae of the genus *Nectopsyche* (Trichoptera: Leptoceridae) in eastern North America, including a new species from North Carolina: Journal of the North American Benthological Society, v. 23, p. 526-541.
- Gordon, A. E., 1974, A synopsis and phylogenetic outline of the Nearctic members of *Cheumatopsyche*: Proceedings of the Academy of Natural Sciences of Philadelphia, v. 126, p. 117-160.
- Gordon, A. E., and Wallace, J. B., 1975, Distribution of the family Hydropsychidae (Trichoptera) in the Savannah River basin of North Carolina, South Carolina and Georgia: Hydrobiologia, v. 46, p. 405-423.

- Grubbs, S. A., 2008, *Allocapnia tsalagi*, sp. n. and notes on *A. recta* (Claassen) from the Cumberland Plateau region of northeastern Alabama, U.S.A.: *Zootaxa*, v. 1754, p. 63-68.
- Grubbs, S. A., Pessimo, M., and DeWalt, R. E., 2013, Distribution patterns of Ohio stoneflies, with an emphasis on rare and uncommon species: *Journal of Insect Science*, v. 13, p. 1-18.
- Gurtz, M. E., and Wallace, J. B., 1986, Substratum-production relationships in net-spinning caddisflies (Trichoptera) in disturbed and undisturbed hardwood catchments: *Journal of the North American Benthological Society*, v. 5, p. 230-236.
- Haddock, J. D., 1977, The biosystematics of the caddis fly genus *Nectopsyche* in North America with emphasis on the aquatic stages: *American Midland Naturalist*, v. 98, p. 382-421.
- Haidekker, A., and Hering, D., 2007, Relationship between benthic insects (Ephemeroptera, Plecoptera, Coleoptera, Trichoptera) and temperature in small and medium-sized streams in Germany: A multivariate study: *Aquatic Ecology*, v. 42, p. 463-481.
- Halverson, T. G., 1984, Autecology of two *Aeshna* species (Odonata) in western Virginia: *Canadian Entomologist*, v. 116, p. 567-578.
- Harris, S. C., and Rasmussen, A. K., 2010, The *Neotrichia caxima* Group (Trichoptera: Hydroptilidae) in the southeastern United States: *Zootaxa*, v. 2608, p. 25-44.
- Harvey, L. E., Geraci, C. J., Robinson, J. L., Morse, J. C., Kjer, K. M., and Zhou, X., 2012, Diversity of mitochondrial and larval morphology characters in the genus *Diplectrona* (Trichoptera: Hydropsychidae) in the eastern United States: *Terrestrial Arthropod Reviews*, v. 5, p. 191-211.
- Holzenthal, R. W., 1982, The caddisfly genus *Setodes* in North America (Trichoptera: Leptoceridae): *Journal of the Kansas Entomological Society*, v. 55, p. 253-271.
- Holzenthal, R. W., and Andersen, T., 2007, Review of the caddisfly genus *Tagalopsyche* with the description of new species and a related new genus (Trichoptera: Leptoceridae: Mystacidini): *Zootaxa*, p. 1-32.
- Holzenthal, R. W., Blahnik, R. J., Prather, A. L., and Kjer, K. M., 2007, Order Trichoptera Kirby, 1813 (Insecta), caddisflies: *Zootaxa*, v. 1668, p. 639-698.
- Holzenthal, R. W., Morse, J. C., and Kjer, K. M., 2011, Order Trichoptera Kirby, 1813, in Zhang, Z.-Q., ed., *Animal biodiversity: An outline of higher-level classification and survey of taxonomic richness*, Volume 3148: Auckland, New Zealand, Magnolia Press, p. 209-211.
- Hudson, P. L., Morse, J. C., and Voshell, J. R., Jr., 1981, Larva and pupa of *Cernotina spicata*: *Annals of the Entomological Society of America*, v. 74, p. 516-519.
- Huggins, D. G., and Brigham, W. U., 1982, Odonata, in Brigham, A. R., Brigham, W. U., and Gnillka, A., eds., *Aquatic Insects and Oligochaetes of North and South Carolina*: Mahomet, Illinois, Midwest Aquatic Enterprises, p. 4.1-4.100.
- Huryn, A. D., and Wallace, J. B., 1985, Life history and production of *Goerita semata* Ross (Trichoptera: Limnephilidae) in the southern Appalachian Mountains: *Canadian Journal of Zoology*, v. 63, p. 2604-2611.
- , 1987, The exopterygote insect community of a mountain stream in North Carolina, USA: life histories, production, and functional structure: *Aquatic Insects*, v. 9, p. 229-251.

- Ito, T., 1997, Oviposition preference and behavior of hatched larvae of an oligophagous caddisfly, *Palaeagapetus ovatus* (Hydroptilidae: Ptilocolepinae), in Holzenthal, R. W., and Flint, O. S., Jr., eds., Proceedings of the 8th International Symposium on Trichoptera, 1997, Volume 8, Ohio Biological Survey, Columbus, Ohio, p. 177-181.
- Ito, T., Wisseman, R. W., Morse, J. C., Colbo, M. H., and Weaver, J. S. I., 2014, The genus *Palaeagapetus* Ulmer (Trichoptera, Hydroptilidae, Ptilocolepinae) in North America: Zootaxa, v. 3794, p. 201-221.
- Jackson, J. K., and Resh, V. H., 1992, Variation in genetic structure among populations of the caddisfly *Helicopsyche horealis* from three streams in northern California, U.S.A.: Freshwater Biology, v. 27, p. 29-42.
- Jacobi, D. I., and Benke, A. C., 1991, Life histories and abundance patterns of snag-dwelling mayflies in a blackwater Coastal Plain river: Journal of the North American Benthological Society, v. 10, p. 372-387.
- Jacobus, L. M., 2009, Insecta, Ephemeroptera, Ephemerellidae, *Teloganopsis subsolana*: distribution extension and first report since its original description: Check List, v. 5, p. 537-538.
- , 2010, Taxonomic review of the *Caudatella heterocaudata* (McDunnough) and *C. hystrix* (Traver) complexes (Insecta: Ephemeroptera: Ephemerellidae): Psyche, v. 2010, p. 1-5.
- Jacobus, L. M., and Fleek, E. D., 2010, Insecta, Ephemeroptera, Ephemerellidae, *Attenella margarita* (Needham, 1927): Southeastern range extension to North Carolina, USA: Check List, v. 6, p. 311-313.
- Jacobus, L. M., and McCafferty, W. P., 2000, Variability in the larvae of *Serratella serrata* (Ephemeroptera: Ephemerellidae): Entomological News, v. 111, p. 39-44.
- , 2001, Adult descriptions and commentary for two species of southeastern Nearctic *Ephemerella* (Ephemeroptera: Ephemerellidae): Entomological News, v. 112, p. 294-298.
- , 2003a, A new synonym of *Caudatella hystrix* (Traver) - (Ephemeroptera: Ephemerellidae): Proceedings of the Entomological Society of Washington, v. 105, p. 776-777.
- , 2003b, Revisionary contributions to North American *Ephemerella* and *Serratella* (Ephemeroptera: Ephemerellidae): Journal of the New York Entomological Society, v. 111, p. 174-193.
- , 2004, Revisionary contributions to the genus *Drunella* (Ephemeroptera: Ephemerellidae): Journal of the New York Entomological Society, v. 112, p. 127-147.
- , 2007, Reinstatement of *Serratella serratoides* (McDunnough) and status of *Ephemerella molita* (McDunnough) (Ephemeroptera: Ephemerellidae): Proceedings of the Entomological Society of Washington, v. 109, p. 730-732.
- , 2008, Revision of Ephemerellidae genera (Ephemeroptera): Transactions of the American Entomological Society, v. 134, p. 185-274.
- Jacobus, L. M., McCafferty, W. P., and Spichiger, S., 2002, First adult description for *Ephemerella hispida* (Ephemeroptera: Ephemerellidae): Entomological News, v. 113, p. 342-343.
- Jansson, A., and Vuoristo, T., 1979, Significance of stridulation in larval Hydropsychidae (Trichoptera): Behaviour, v. 71, p. 167-186.
- Jin, H. S., and Ward, G. M., 2007, Life history and secondary production of *Glossosoma nigrior* Banks (Trichoptera :

- Glossosomatidae) in two Alabama streams with different geology: *Hydrobiologia*, v. 575, p. 245-258.
- Kalkman, V. J., Clausnitzer, V., Dijkstra, K.-D. B., Orr, A. G., Paulson, D. R., and van Tol, J., 2008, Global diversity of dragonflies (Odonata) in freshwater: *Hydrobiologia*, v. 595, p. 351-363.
- Keiper, J. B., 1999, Morphology of final instar *Ochrotrichia xena* (Trichoptera: Hydroptilidae): *Entomological News*, v. 110, p. 231-235.
- , 2002, Biology and immature stages of coexisting Hydroptilidae (Trichoptera) from northeastern Ohio lakes: *Annals of the Entomological Society of America*, v. 95, p. 608-616.
- Keiper, J. B., and Bartolotta, R. J., 2003, Taxonomic and ecological notes on *Leucotrichia pictipes* (Trichoptera: Hydroptilidae), a microcaddisfly newly recorded from Ohio, USA: *Entomological News*, v. 114, p. 255-259.
- Keiper, J. B., and Foote, B. A., 2000, Biology and larval feeding habits of coexisting Hydroptilidae (Trichoptera) from a small woodland stream in northeastern Ohio: *Annals of the Entomological Society of America*, v. 93, p. 225-234.
- Keiper, J. B., and Harris, S. C., 2002, Biology and immature stages of *Ochrotrichia footei* (Trichoptera: Hydroptilidae), a new microcaddisfly from a torrential mountain stream: *Proceedings of the Entomological Society of Washington*, v. 104, p. 291-299.
- Keiper, J. B., and Walton, W. E., 1999, Biology and morphology of the mature larva of *Oxyethira arizona* Ross (Trichoptera: Hydroptilidae): *Pan-Pacific Entomologist*, v. 75, p. 212-220.
- , 2000, Biology and immature stages of *Ochrotrichia quadrispina* Denning and Blickle (Trichoptera: Hydroptilidae), a spring-inhabiting scraper: *Proceedings of the Entomological Society of Washington*, v. 102, p. 183-187.
- Kentucky Division of Water, 2009, Laboratory procedures for macroinvertebrate processing, taxonomic identification and reporting: Kentucky Department for Environmental Protection, Division of Water, 21 p. + appendices.
- Keth, A. C., and Harris, S. C., 2008, The North American genus *Agarodes* Banks (Trichoptera: Sericostomatidae), Columbus, Ohio, The Caddis Press, vi + 33 p.
- Kjer, K. M., Blahnik, R. J., and Holzenthal, R. W., 2001, Phylogeny of Trichoptera (caddisflies): Characterization of signal and noise within multiple datasets: *Systematic Biology*, v. 50, p. 781-816.
- , 2002, Phylogeny of caddisflies (Insecta, Trichoptera): *Zoologica Scripta*, v. 31, p. 83-91.
- Klemm, D. J., Blocksom, K. A., Fulk, F. A., Herlihy, A. T., Hughes, R. M., Kaufmann, P. R., Peck, D. V., Stoddard, J. L., Thoeny, W. T., Griffith, M. B., and Davis, W. S., 2003, Development and evaluation of a macroinvertebrate biotic integrity index (MBII) for regionally assessing mid-Atlantic highlands streams: *Environmental Management*, v. 31, p. 656-669.
- Kondratieff, B. C., and Voshell, J. R., Jr., 1984, The North and Central American species of *Isonychia* (Ephemeroptera: Oligoneuriidae): *Transactions of the American Entomological Society*, v. 110, p. 129-244.
- Landwer, B. H. P., and Sites, R. W., 2010, The larval Odonata of ponds in the Prairie Region of Missouri: *Transactions of the American Entomological Society*, v. 136, p. 1-105.
- Lenat, D. R., 1988, Water quality assessment of streams using qualitative collection methods for benthic macroinvertebrates: *Journal*

- of the North American Benthological Society, v. 7, p. 222-233.
- Lenat, D. R., Ruiters, D. E., Parker, C. R., Robinson, J. L., Beaty, S. R., and Flint, O. S., Jr., 2010, Caddisfly (Trichoptera) records for North Carolina: Southeastern Naturalist, v. 9, p. 201-236.
- Lepneva, S. G., 1964, Larvae and pupae of the Annulipalpia, Moscow, Zoological Institute of the Academy of Sciences of the USSR, Fauna of the U.S.S.R.: Trichoptera, New Series, No. 88, iv + 638 p.
- Lewis, P. A., 1974, Taxonomy and ecology of *Stenonema* mayflies (Heptageniidae: Ephemeroptera): Environmental Protection Agency, EPA-670/4-74-006, vii + 80 p.
- Loudon, C., and Alstad, D. N., 1990, Theoretical mechanics of particle capture: predictions for hydropsychid caddisfly distributional ecology: American Naturalist, v. 135, p. 360-381.
- Louton, J. A., 1982, Lotic dragonfly (Anisoptera: Odonata) nymphs of the southeastern United States: identification, distribution and historical biogeography [PhD Dissertation]: University of Tennessee, xvii + 357 p.
- Lugo-Ortiz, C. R., and McCafferty, W. P., 1998, A new North American genus of Baetidae (Ephemeroptera) and key to *Baetis* complex genera: Entomological News, v. 109, p. 345-353.
- Lugo-Ortiz, C. R., McCafferty, W. P., and Waltz, R. D., 1999, Definition and reorganization of the genus *Pseudocloeon* (Ephemeroptera: Baetidae) with new species descriptions and combinations: Transactions of the American Entomological Society, v. 125, p. 1-37.
- Lutz, P. E., 1974, Environmental factors controlling duration of larval instars in *Tetragoneuria cynosura* (Odonata): Ecology, v. 55, p. 630-637.
- Mackay, R. J., 1979, Life history patterns of some species of *Hydropsyche* (Trichoptera: Hydropsychidae) in southern Ontario: Canadian Journal of Zoology, v. 57, p. 963-975.
- , 1984, Life history patterns of *Hydropsyche bronta* and *H. morosa* (Trichoptera: Hydropsychidae) in summer-warm rivers of southern Ontario: Canadian Journal of Zoology, v. 62, p. 271-275.
- Malicky, H., 2001, Notes on the taxonomy of *Rhadicoleptus*, *Ptilocolepus* and *Pseudoneureclipsis*: Braueria, v. 28, p. 19-20.
- Malm, T., Johanson, K. A., and Wahlberg, N., 2013, The evolutionary history of Trichoptera (Insecta): A case of successful adaptation to life in freshwater: Systematic Entomology, v. 38, p. 459-473.
- Manuel, K. L., 2010, The longhorn caddisfly genus *Triaenodes* (Trichoptera: Leptoceridae) in North America, Columbus, Ohio, The Caddis Press, v + 109 p.
- Manuel, K. L., and Braatz, D. A., 1984, The life cycle and fifth instar larval description of *Triaenodes taenia* (Leptoceridae), in Morse, J. C., ed., Proceedings of the Fourth International Symposium on Trichoptera: Clemson, South Carolina, Dr. W. Junk, p. 213-217.
- Manuel, K. L., and Folsom, T. C., 1982, Instar sizes, life cycles, and food habits of five *Rhyacophila* (Trichoptera: Rhyacophilidae) species from the Appalachian Mountains of South Carolina, U.S.A.: Hydrobiologia, v. 97, p. 281-285.
- Marshall, J. E., 1979, A review of the genera of the Hydroptilidae (Trichoptera): Bulletin of the British Museum of Natural History

- (Entomology), v. 39, p. 135-239.
- Martin, I. D., 1985, Microhabitat selection and life cycle patterns of two *Rhyacophila* species (Trichoptera: Rhyacophilidae) in southern Ontario streams: Freshwater Biology, v. 15, p. 1-14.
- Martin, T. H., Johnson, D. M., and Moore, R. D., 1991, Fish-mediated alternative life-history strategies in the dragonfly *Epitheca cynosura*: Journal of the North American Benthological Society, v. 10, p. 271-279.
- Masteller, E. C., 1983, Emergence phenology of Plecoptera from Sixmile Creek, Erie County, Pennsylvania, USA: Aquatic Insects, v. 5, p. 1-8.
- Matczak, T., and Mackay, R. J., 1990, Territoriality in filter-feeding caddisfly larvae: laboratory experiments: Journal of the North American Benthological Society, v. 9, p. 26-34.
- Mathews, R. C., Jr., 1982, Predator stoneflies: role in freshwater stream communities: Journal of the Tennessee Academy of Science, v. 57, p. 12-13.
- Matthews, K. A., and Tarter, D. C., 1989, Ecological life history, including laboratory investigation, of the mayfly, *Ameletus tarteri* (Ephemeroptera: Siphonuridae): Psyche, v. 96, p. 21-37.
- McAuliffe, J. R., 1982, Behavior and life history of *Leucotrichia pictipes* (Banks) (Trichoptera: Hydroptilidae) with special emphasis on case reoccupancy: Canadian Journal of Zoology, v. 60, p. 1557-1561.
- McCabe, D. J., and Gotelli, N. J., 2003, Caddisfly diapause aggregations facilitate benthic invertebrate colonization: Journal of Animal Ecology, v. 72, p. 1015-1026.
- McCafferty, W. P., Lenat, D. R., Jacobus, L. M., and Meyer, M. D., 2010, The mayflies (Ephemeroptera) of the southeastern United States: Transactions of the American Entomological Society, v. 136, p. 221-233.
- McCafferty, W. P., Waltz, R. D., Webb, J. M., and Jacobus, L. M., 2005, Revision of Heterocloeon McDunnough (Ephemeroptera: Baetidae): Journal of Insect Science, v. 5:35, p. 1-11.
- McCafferty, W. P., and Wang, T. Q., 2000, Phylogenetic systematics of the major lineages of pannote mayflies (Ephemeroptera: Pannota): Transactions of the American Entomological Society, v. 126, p. 9-101.
- McEwan, E., 1980, Biology and life history of the genus *Agarodes* (Trichoptera: Sericostomatidae) in the southeastern U.S. [Master's thesis]: Clemson University, vi + 67 p.
- McLachlan, R., 1874-1880, A monographic revision and synopsis of the Trichoptera of the European fauna, London, England.
- Merrill, D., and Wiggins, G. B., 1971, The larva and pupa of the caddisfly genus *Setodes* in North America (Trichoptera: Leptoceridae): Occasional Papers of the Royal Ontario Museum, v. 19, p. 1-12.
- Merritt, R. W., Cummins, K. W., and Berg, M. B., 2008, An Introduction to the Aquatic Insects of North America: Dubuque, Iowa, Kendall/Hunt Publishing Company, xvi + 1158 p.
- Michael, D. I., and Culver, D. A., 1987, Influence of plecopteran and megalopteran predators on *Hydropsyche* (Trichoptera: Hydropsychidae) microdistribution and behavior: Journal of the North American Benthological Society, v. 6, p. 46-55.
- Miller, J. C., 1984, Competition, predation, and catchnet differentiation among net-spinning caddisflies (Trichoptera): Oikos, v. 43, p.

117-121.

- Minshall, G. W., 1967, Role of allochthonous detritus in the trophic structure of a woodland springbrook: *Ecology*, v. 48, p. 139-149.
- Moriwaka, D. K., and McCafferty, W. P., 1979, The *Baetis* larvae of North America: *Transactions of the American Entomological Society*, v. 105, p. 139-221.
- Morse, J. C., 1975, A phylogeny and revision of the caddisfly genus *Ceraclea* (Trichoptera, Leptoceridae): *Contributions of the American Entomological Society*, v. 11, p. 1-97.
- , 1997, Phylogeny of Trichoptera: *Annual Review of Entomology*, v. 42, p. 427-450.
- Morse, J. C., Stark, B. P., McCafferty, W. P., and Tennessen, K. J., 1997, Southern Appalachian and other southeastern streams at risk: implications for mayflies, dragonflies and damselflies, stoneflies, and caddisflies, in Benz, G. W., and Collins, D. E., eds., *Aquatic Fauna in Peril: the Southeastern Perspective*, Volume Special Publication 1: Decatur, GA, Southeast Aquatic Research Institute, Lenz Design and Communications, p. 17-42.
- Muñoz-Quesada, F. J., and Holzenthal, R. W., 2008, Revision of the Nearctic species of the caddisfly genus *Wormaldia* McLachlan (Trichoptera: Philopotamidae): *Zootaxa*, v. 1838, p. 1-75.
- Myers, L. W., Kondratieff, B. C., Mihuc, T. B., and Ruiter, D. E., 2011, The mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) of the Adirondack Park (New York State): *Transactions of the American Entomological Society*, v. 137, p. 63-140.
- Needham, J. G., Westfall, M. J., Jr., and May, M. L., 2000, *Dragonflies of North America*, Gainesville, Florida, Scientific Publishers, Inc., xv + 939 p.
- Nelson, C. H., 1982, Notes on the life histories of *Strophopteryx limata* (Frison) and *Oemopteryx contorta* (Needham and Claassen) (Plecoptera: Taeniopterygidae) in Tennessee: *Journal of the Tennessee Academy of Science*, v. 57, p. 9-15.
- , 2000, Pteronarcyidae (the Salmonflies), in Stark, B. P., and Armitage, B. J., eds., *Stoneflies (Plecoptera) of Eastern North America*, Volume I: Columbus, OH, Ohio Biological Survey Bulletin New Series Volume 14 Number 1, p. 29-39.
- , 2001, The *Yugus bulbosus* complex, with a comment on the phylogenetic position of *Yugus* within the eastern Perlodini (Plecoptera: Perlodidae: Perlodinae): *Proceedings of the Entomological Society of Washington*, v. 103, p. 601-619.
- Nielsen, A., 1948, Postembryonic development and biology of the Hydroptilidae: *Kongelige Danske Videnskabskabernes Selskab Biologiske Skrifter*, v. 5, p. 1-200.
- Nimmo, A. P., 1987, The adult Arctopsychidae and Hydropsychidae (Trichoptera) of Canada and adjacent United States: *Quaestiones Entomologicae*, v. 23, p. 1-189.
- Parker, C. R., 1998, A review of *Goerita* (Trichoptera: Goeridae), with description of a new species: *Insecta Mundi*, v. 12, p. 227-238.
- Parker, C. R., and Voshell, J. R., Jr., 1982, Life histories of some filter-feeding Trichoptera in Virginia: *Canadian Journal of Zoology*, v. 60, p. 1732-1742.
- Parker, C. R., and Wiggins, G. B., 1987, Revision of the caddisfly genus *Psilotreta* (Trichoptera: Odontoceridae): *Royal Ontario Museum Life Sciences Contributions*, v. 144, iv + 55 p.

- Patterson, J. W., and Vannote, R. L., 1979, Life history and population dynamics of *Heteroplectron americanum*: Annals of the Entomological Society of America, v. 8, p. 665-669.
- Paulson, D. R., and Dunkle, S. W., 2012, A checklist of North American Odonata, including English name, etymology, type locality, and distribution, Volume 2012 Edition: Privately Published, Jim Johnson, Publisher, 92 p.
- Paulson, D. R., and Jenner, C. E., 1971, Population structure in overwintering larval Odonata in North Carolina in relation to adult flight season: Ecology, v. 52, p. 96-107.
- Peckarsky, B. L., 1979, A review of the distribution, ecology, and evolution of the North American species of *Acroneuria* and six related genera (Plecoptera: Perlidae): Journal of the Kansas Entomological Society, v. 52, p. 787-809.
- , 1980, Predator-prey interactions between stoneflies and mayflies: behavioral observations: Ecology, v. 61, p. 932-943.
- Pescador, M. L., and Berner, L., 1981, The mayfly family Baetiscidae (Ephemeroptera). Part II Biosystematics of the genus *Baetisca*: Transactions of the American Entomological Society, v. 1017, p. 163-228.
- Pond, G. J., Passmore, M. E., Borsuk, F. A., Reynolds, L., and Rose, C. J., 2008, Downstream effects of mountaintop coal mining: comparing biological conditions using family- and genus-level macroinvertebrate bioassessment tools: Journal of the North American Benthological Society, v. 27, p. 717-737.
- Prather, A. L., and Morse, J. C., 2001, Eastern Nearctic *Rhyacophila* species, with revision of the *Rhyacophila invaria* Group (Trichoptera: Rhyacophilidae): Transactions of the American Entomological Society, v. 127, p. 85-166.
- Provonsha, A. V., 1990, A revision of the genus *Caenis* in North America (Ephemeroptera: Caenidae): Transactions of the American Entomological Society, v. 116, p. 801-884.
- Resh, V. H., 1976a, The biology and immature stages of the caddisfly genus *Ceraclea* in eastern North America (Trichoptera: Leptoceridae): Annals of the Entomological Society of America, v. 69, p. 1039-1061.
- , 1976b, Life histories of coexisting species of *Ceraclea* caddisflies (Trichoptera: Leptoceridae): the operation of independent functional units in a stream ecosystem: Canadian Entomologist, v. 108, p. 1303-1318.
- Resh, V. H., and Houp, R. E., 1986, Life history of the caddisfly *Dibusa angata* and its association with the red alga *Lemanea australis*: Journal of the North American Benthological Society, v. 5, p. 28-40.
- Resh, V. H., Lamberti, G. A., and Wood, J. R., 1984, Biology of the caddisfly *Helicopsyche borealis* (Hagen): a comparison of North American populations: Freshwater Biology, v. 3, p. 172-180.
- Resh, V. H., Morse, J. C., and Wallace, I. D., 1976, The evolution of the sponge feeding habit in the caddisfly genus *Ceraclea* (Trichoptera: Leptoceridae): Annals of the Entomological Society of America, v. 69, p. 937-941.
- Robertson, D. R., and Holzenthal, R. W., 2013, Revision and phylogeny of the caddisfly subfamily Protoptilinae (Trichoptera: Glossosomatidae) inferred from adult morphology and mitochondrial DNA: Zootaxa, v. 3723, p. 1-99.
- Roble, S. M., Carle, F. L., and Flint, O. S., Jr., Dragonflies and damselflies (Odonata) of the Laurel Fork Recreation Area, George Washington National Forest, Highland County, Virginia: possible evidence for climate change, in Proceedings, A Lifetime of Contribution to Myriapodology and the Natural History of Virginia: A Festschrift in Honor of Richard L. Hoffman's 80th

- Birthday, Martinsville, VA, 2009, Volume Special Publication No. 16, Virginia Museum of Natural History, p. 365-399.
- Ross, H. H., 1944, The caddisflies, or Trichoptera, of Illinois: Bulletin of the Illinois Natural History Survey, v. 23, p. 1-326.
- , 1948, New Nearctic Rhyacophilidae and Philopotamidae: Annals of the Entomological Society of America, v. 41, p. 17-26.
- , 1970, Hydropsychid Genus A, *Diplectrona* (Trichoptera: Hydropsychidae): Journal of the Georgia Entomological Society, v. 5, p. 229-231.
- Ross, H. H., and Ricker, W. E., 1971, The classification, evolution, and dispersal of the winter stonefly genus *Allocapnia*: Illinois Biological Monographs, v. 45, p. 1-166.
- Roy, D., and Harper, P., 1980, Females of the Nearctic *Molanna* (Trichoptera: Molannidae): Proceedings of the Entomological Society of Washington, v. 82, p. 229-236.
- Ruiter, D. E., 1995, The adult *Limnephilus* Leach (Trichoptera: Limnephilidae) of the New World: Ohio Biological Survey Bulletin New Series, v. 11, p. iv + 200 p.
- Scheffer, P. W., and Wiggins, G. B., 1986, A systematic study of the Nearctic larvae of the *Hydropsyche morosa* group (Trichoptera: Hydropsychidae), Toronto, Ontario, Royal Ontario Museum, Life Sciences Miscellaneous Publications, 94 p.
- Schmid, F., 1955, Contribution à l'étude des Limnophilidae (Trichoptera): Mitteilungen der Schweizerischen Entomologischen Gesellschaft, v. 28, p. 1-245.
- , 1970, Le genre *Rhyacophila* et la famille des Rhyacophilidae (Trichoptera): Mém. Soc. ent. Can., v. 66, p. 230 p., 252 pis.
- , 1998, Genera of the Trichoptera of Canada and adjoining or adjacent United States: The Insects and Arachnids of Canada, Part 7, NRC Research Press, 319 p.
- Schmidt, D. A., and Tarter, D. C., 1985, Life history and ecology of *Acroneuria carolinensis* (Banks) in Panther Creek, Nicholas County, West Virginia (Plecoptera: Perlidae): Psyche, v. 92, p. 393-406.
- Schmude, K. L., and Hilsenhoff, W. L., 1986, Biology, ecology, larval taxonomy, and distribution of Hydropsychidae (Trichoptera) in Wisconsin: Great Lakes Entomologist, v. 19, p. 123-145.
- Schuster, G. A., 1993, A status survey report on the terrestrial caddisflies (Trichoptera) *Madeophylax altus* and *Madeophylax* sp.: Department of Biological Sciences, Eastern Kentucky University, 58 p.
- Schuster, G. A., and Etnier, D. A., 1978, A manual for the identification of the larvae of the caddisfly genera *Hydropsyche* Pictet and *Symphitopsyche* Ulmer in Eastern and Central North America (Trichoptera: Hydropsychidae): U. S. Environmental Protection Agency, xii + 129 p.
- Selgeby, J. H., 1974, Immature insects (Plecoptera, Trichoptera, and Ephemeroptera) collected from deep water in western Lake Superior: Journal of the Fisheries Research Board of Canada, v. 31, p. 109-111.
- Sherberger, F. F., and Wallace, J. B., 1971, Larvae of the southeastern species of *Molanna*: Journal of the Kansas Entomological Society, v. 44, p. 217-224.
- Stark, B. P., 1986, The Nearctic species of *Agnatina* (Plecoptera: Perlidae): Journal of the Kansas Entomological Society, v. 59, p. 437-445.

- Stark, B. P., Stewart, K. W., Szczytko, S. W., and Baumann, R. W., 1998, Common names of stoneflies (Plecoptera) from the United States and Canada: Ohio Biological Survey Notes, v. 1, p. 1-18.
- Stark, B. P., Stewart, K. W., Szczytko, S. W., Baumann, R. W., and Kondratieff, B. C., 2012, Scientific and common names of Nearctic stoneflies (Plecoptera), with corrections and additions to the list, The Caddis Press, Miscellaneous Contribution No. 1, 20 p.
- Statzner, B., Arens, M. F., Champagne, J. Y., Morel, R., and Herouin, E., 1999, Silk-producing stream insects and gravel erosion: significant biological effects on critical shear stress: Water Resources Research, v. 35, p. 3495-3506.
- Steffan, A., 1965, *Plecopteracoluthus downesi* gen. et sp. nov., a species whose larvae live phoretically on larvae of Plecoptera: Canadian Entomologist, v. 97, p. 1323-1344.
- Stewart, K. W., and Sandberg, J. B., 2006, Vibrational communication and mate searching behavior in stoneflies, in Drosopolos, S., and Claridge, M., eds., Insect sounds and communication: Physiology, behavior and evolution, CRC Press, Taylor & Francis Group, p. 179-186.
- Stewart, K. W., and Stark, B. P., 1984, Nymphs of North American Perlodinae genera: Great Basin Naturalist, v. 44, p. 373-415.
- , 1988, Nymphs of North American Stonefly Genera (Plecoptera), Thomas Say Foundation, 460 p.
- , 1993, Nymphs of North American stonefly genera (Plecoptera), Thomas Say Foundation, 2nd edition, xiii + 460 p.
- , 2008, Plecoptera, in Merritt, R. W., Cummins, K. W., and Berg, M. B., eds., An Introduction to the Aquatic Insects of North America: Dubuque, Iowa, Kendall/Hunt Publishing Company, p. 311-384.
- Stocks, I. C., and Morse, J. C., 2005, Erratum. Prather, A. L. and J. C. Morse. 2001. Eastern Nearctic *Rhyacophila* species, with revision of the *Rhyacophila invaria* Group (Trichoptera: Rhyacophilidae). Transactions of the American Entomological Society 127:85-166.
- Stocks, S. D., 2000, Distribution and life history analysis of *Fattigia pele* (Ross) (Trichoptera: Sericostomatidae), with natural history observations [Master's Thesis]: Western Carolina University, ix + 49 p.
- Stout, B. M. I., Stout, K. K., and Stihler, C. W., 1992, Predation by the caddisfly *Banksiola dossuaria* on egg masses of the Spotted Salamander *Ambystoma maculatum*: American Midland Naturalist, v. 127, p. 368-372.
- Sturkie, S. K., and Morse, J. C., 1998, Larvae of the three common North American species of *Phyloctropus* (Trichoptera: Dipseudopsidae): Insecta Mundi, v. 12, p. 175-179.
- Tennessen, K. J., 2008, Odonata, in Merritt, R. W., Cummins, K. W., and Berg, M. B., eds., An Introduction to the Aquatic Insects of North America: Dubuque, Iowa, Kendall/Hunt Publishing Company, p. 237-294.
- Thorp, J. H., 1983, An evaluation of hypotheses on the evolutionary differentiation of catchnets in net-spinning caddisflies (Hydropsychidae): Oikos, v. 40, p. 308-312.
- , 1984, Evolutionary differentiation of caddisfly catchnets: perspectives on the roles of competition and predation: Oikos, v. 43, p. 121-124.
- Thorp, J. H., Wallace, J. B., and Georgian, T. J., 1986, Untangling the web of caddisfly evolution and distribution: Oikos, v. 47, p.

253-256.

- Trapp, K. E., and Hendricks, A. C., 1984, Modifications in the life history of *Glossosoma nigrior* exposed to three different thermal regimes, in Morse, J. C., ed., Proceedings of the 3rd International Symposium on Trichoptera: Clemson, SC, Dr. W. Junk Publishers, p. 397-406.
- Unzicker, J. D., and Carlson, P. H., 1982, Ephemeroptera, in Brigham, A. R., Brigham, W. U., and Gnilka, A., eds., The Aquatic Insects and Oligochaetes of North and South Carolina: Mahomet, Illinois, Midwest Aquatic Enterprises, p. Pages 3.1-3.97.
- Unzicker, J. D., Resh, V. H., and Morse, J. C., 1982, Trichoptera, in Brigham, A. R., Brigham, W. U., and Gnilka, A., eds., The Aquatic Insects and Oligochaetes of North and South Carolina: Mahomet, Illinois, Midwest Aquatic Enterprises, p. Pages 9.1-9.138.
- Vineyard, R. N., Wiggins, G. B., Frania, H. E., and Schefter, P. W., 2005, The caddisfly genus *Neophylax* (Trichoptera: Uenoidae): ROM Contributions in Science, v. 2, vi + 141 p.
- Vshivkova, T. S., Morse, J. C., and Ruitter, D., 2007, Phylogeny of Limnephilidae and composition of the genus *Limnephilus* (Limnephilidae: Limnephilinae, Limnephilini), in Bueno-Soria, J., Barba-Álvarez, R., and Armitage, B. J., eds., Proceedings of the XIIth International Symposium on Trichoptera: México City, Mexico, The Caddis Press, p. 309-319.
- Walker, E. M., 1958, The Odonata of Canada and Alaska: The Anisoptera, Toronto, University of Toronto Press, 318 p.
- Wallace, J. B., 1975, The larval retreat and food of *Arctopsyche*; with phylogenetic notes on feeding adaptations in Hydropsychidae larvae (Trichoptera): Annals of the Entomological Society of America, v. 68, p. 167-173.
- Wallace, J. B., and Malas, D., 1976, The significance of the elongate, rectangular mesh found in capture nets of fine particle filter feeding Trichoptera larvae: Archiv für Hydrobiologie, v. 77, p. 205-212.
- Wallace, J. B., and Merritt, R. W., 1980, Filter-feeding ecology of aquatic insects: Annual Review of Entomology, v. 25, p. 103-132.
- Wallace, J. B., and Sherberger, F. F., 1975, The larval dwelling and feeding structure of *Macronema transversum* (Walker) (Trichoptera: Hydropsychidae): Animal Behaviour, v. 23, p. 592-596.
- Waltz, R. D., and Burian, S. K., 2008, Ephemeroptera, in Merritt, R. W., Cummins, K. W., and Berg, M. B., eds., An Introduction to the Aquatic Insects of North America: Dubuque, Iowa, Kendall/Hunt Publishing Company, p. 181-236.
- Weaver, J. S., III, 1988, A synopsis of the North American Lepidostomatidae (Trichoptera): Contributions of the American Entomological Society, v. 24, p. iv + 141.
- , 2002, A synonymy of the caddisfly genus *Lepidostoma* Rambur (Trichoptera: Lepidostomatidae), including a species checklist: Tijdschrift voor Entomologie, v. 145, p. 173-192.
- Weaver, J. S., III, Swegman, B. G., and Sykora, J. L., 1979, The description of immature forms of *Aphropsyche monticola* Flint (Trichoptera: Hydropsychidae): Aquatic Insects, v. 1, p. 143-148.
- Weaver, J. S., III, and Sykora, J. L., 1979, The *Rhyacophila* of Pennsylvania, with larval descriptions of *R. banksi* and *R. carpenteri* (Trichoptera: Rhyacophilidae): Annals of Carnegie Museum, v. 48, p. 403-423.
- Weaver, J. S., III, Wojtowicz, J. A., and Etnier, D. A., 1981, Larval and pupal descriptions of *Dolophilodes (Fumonta) major* (Banks)

- (Trichoptera: Philopotamidae): Entomological News, v. 92, p. 85-90.
- Westfall, M. J., Jr., and May, M. L., 1996, Damselflies of North America, Gainesville, Florida, Scientific Publishers, Inc., x + 649 p.
- Whiles, M. R., Goldowitz, B. S., and Charlton, R. E., 1999, Life history and production of a semi-terrestrial limnephilid caddisfly in an intermittent Platte River wetland: Journal of the North American Benthological Society, v. 18, p. 533-544.
- Wiggins, G. B., 1996, Larvae of the North American caddisfly genera (Trichoptera), Toronto, Ontario, University of Toronto Press, xiii + 457 p.
- , 1998, The caddisfly family Phryganeidae (Trichoptera), Toronto, ON, University of Toronto Press, ix + 306 p.
- , 2004, Caddisflies: the underwater architects, Totonto, Ontario, University of Toronto Press, xi + 292 p.
- Wiggins, G. B., and Mackay, R. J., 1978, Some relationships between systematics and trophic ecology in Nearctic aquatic insects, with special reference to Trichoptera: Ecology, v. 59, p. 1211-1220.
- Wiggins, G. B., and Wichard, W., 1989, Phylogeny of pupation in Trichoptera, with proposals on the origin and higher classification of the order: Journal of the North American Benthological Society, v. 8, p. 260-276.
- Williams, D. D., and Williams, N. E., 1975, A contribution to the biology of *Isonychia punctatissima* (Trichoptera: Limnephilidae): Canadian Entomologist, v. 107, p. 829-832.
- , 1982, Morphological and dietary variations in a riverine population of *Pycnopsyche guttifer* (Trichoptera: Limnephilidae): Aquatic Insects, v. 4, p. 21-27.
- Wissinger, S. A., 1988, Spatial distribution, life history and estimates of survivorship in a fourteen-species assemblage of larval dragonflies (Odonata: Anisoptera): Freshwater Biology, v. 20, p. 329-340.
- Wissinger, S. A., Sparks, G. B., Rouse, G. L., and Brown, W. S., 1996, Intraguild predation and cannibalism among larvae of detritivorous caddisflies in subalpine wetlands: Ecology, v. 77, p. 2421-2430.
- Wojtowicz, J. A., 1982a, Description of the larva and female of *Pycnopsyche flavata* (Banks) with comparative notes on the ecology of *P. flavata* and *P. gentilis* (McLachlan) (Trichoptera: Limnephilidae): Proceedings of the Entomological Society of Washington, v. 84, p. 304-314.
- , 1982b, A review of the adults and larvae of the genus *Pycnopsyche* (Trichoptera: Limnephilidae) with revision of the *Pycnopsyche scabripennis* (Rambur) and *Pycnopsyche lepida* (Hagen) complexes [PhD Dissertation]: University of Tennessee, 304 p.
- Wojtowicz, J. A., and Flint, O. S., Jr., 2007, A new species of *Pycnopsyche*, *P. pani* (Trichoptera: Limnephilidae), from the mountains of northern North Carolina and Virginia, in Bueno-Soria, J., Barba-Álvarez, R., and Armitage, B. J., eds., Proceedings of the XIIth International Symposium on Trichoptera: México City, The Caddis Press, p. 349-354.
- Wymer, D. A., and Morse, J. C., 2000, Larva, pupa, and adults of *Glossosoma nigrior* (Trichoptera: Glossosomatidae) with a review of the eastern North American species of *Glossosoma*: Entomological News, v. 111, p. 149-158.
- Yokum, K. A., Angradi, T. R., and Tarter, D. C., 1995, Ecology of *Peltoperla arcuata* and *Tallaperla maria* (Plecoptera: Peltoperlidae) at the Fernow Experimental Forest, Tucker County, West Virginia: Psyche, v. 102, p. 151-168.
- Zloty, J., 1996, A revision of the Nearctic *Ameletus* mayflies based on adult males, with descriptions of seven new species

(Ephemeroptera: Ameletidae): Canadian Entomologist, v. 128, p. 293-346.