1993

# Aquatic Insects of Upper Three Runs Creek, Savannah River Plant, South Carolina. Part IV: Caddisflies (Trichoptera) of the Lower Reaches

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# Aquatic Insects of Upper Three Runs Creek, Savannah River Site, South Carolina. Part IV: Caddisflies (Trichoptera) of the Lower Reaches[1,2]

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J. Entomol. Sci. 28(1):85-95 (January 1993)

**ABSTRACT** Ninety-three species of caddisflies, representing 14 families, were identified from collections obtained from two localities on Upper Three Runs Creek, Savannah River Site, Aiken County, South Carolina. Collections of adult caddisflies were made biweekly over a 1-yr period with ultraviolet light traps. The similarity index, Jaccard's Coefficient of Communities, showed that the two sites were over 78% similar with 73 species in common. Three species, *Oxyethira setosa* Denning, *Triaenodes smithi* Ross, and *Nyctiophylax serratus* Lago & Harris, are new distributional records for South Carolina. Two species of *Triaenodes* are new to science. Other species, which were considered to be endemic to the Upper Three Runs Creek drainage, rare outside of the drainage, or of limited distribution, included *Cheumatopsyche richardsoni* Gordon, *Oxyethira dunbartonensis* Kelley, *Protoptila morettii* Morse, *Hydrophysche elissoma* Ross, *Triaenodes ochraceus* (Betten and Mosely), *Neotrichia falca* Ross, *Oecetis morsei* Bueno-Soria, and *Pycnopsyche virginica* (Banks).

**KEY WORDS** Trichoptera, caddisfly, ultraviolet light trap, Savannah River Site, South Carolina, *Triaenodes*, new distribution records.

The Diverse Aquatic insect fauna of Upper Three Runs Creek, a swift, blackwater stream located partly on the Savannah River Site in Aiken County, SC, has been well documented with numerous surveys by the Academy of Natural Sciences of Philadelphia, by Morse *et al.* (1980, 1983), and by Morse (1988 [1990]), the latter three publications representing parts I-III of this series, respectively. Based on these studies and additional identifications resulting in over 650 species of aquatic insects, including 104 species of Trichoptera, it has been shown that Upper Three Runs Creek supports one of the richest known aquatic insect, and especially caddisfly, faunas of any stream in North America.

This study was undertaken because (1) the lower approximate one third of Upper Three Runs Creek has not been extensively sampled and, unlike the upstream portions, does receive some Savannah River Site effluent; (2) Upper Three Runs Creek is a United States Geologic Survey National Hydrologic Benchmark Stream in a National Environmental Research Park and can serve as a standard of reference for other streams in the region; (3) there are several

[1] Accepted for publication 15 October, 1992.
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rare and possibly endangered species which inhabit the stream; and (4) it is important to monitor periodically for any possible effects which anthropogenic discharges might have on the faunistic composition of Trichoptera or other aquatic insects.

## Materials and Methods

Collections of adult caddisflies were made from two stations on Upper Three Runs Creek (Fig. 1). Station one was located just downstream of the Road C bridge and the Savannah River Ecology Laboratory's Flowing Streams Laboratory. Station two was located approximately 2 km downstream of the SC 125 bridge and approximately 11 km downstream of station one. Collections of adult caddisflies were made biweekly with ultraviolet light traps (15 watt, GE®F15T8/BL) beginning in September 1989 and continuing through November 1989 and beginning again in February 1990 and continuing through October 1990. One ultraviolet light trap was used at each station. Collections were begun approximately 30 min before sunset and continued for 3 hr.

Caddisflies were later separated into distinct groups based on sight identifications. Many samples contained far too many individuals for complete separation, so these samples were searched exhaustively until all distinguishable groups had been collected. Adult males (and females when possible) were then identified to species. A total of 9315 adults were examined. To make positive identifications, many specimens had to be cleared in a 10% solution of potassium hydroxide (KOH).

Comparisons of the species composition of stations one and two were made using the community similarity index, Jaccard Coefficient of Communities ($CC_j$) (Plafkin et al. 1989). The species composition between stations can range from total dissimilarity ($CC_j = 0$) to complete similarity ($CC_j = 1$). All specimens collected in this study are housed in the Clemson University Arthropod Collection.

Upper Three Runs Creek is a fourth order tributary of the Savannah River which lies partly within the Savannah River National Environmental Research Park, Savannah River Site, Aiken County, SC. The stream drains approximately 490 $km^2$ and has a length of 39 km before emptying into the Savannah River. Upper Three Runs Creek originates outside the Savannah River Site in the Sandhills physiographic region of South Carolina, and the lower stretches near the Savannah River lie within the Upper Coastal Plain physiographic region (Bennet and McFarlane 1983). The stream substrate consists of shifting sand with fallen limbs and logs, but almost no rocks. The aquatic macrophyte, *Micranthemum umbrosum* (J. F. Gmelin) Blake, is abundant at station two, and riparian vegetation at both stations includes tulip poplar (*Liriodendron tulipifera* L.), sweet gum (*Liquidambar styraciflua* L.), willow oak (*Quercus phellos* L.), swamp chestnut oak (*Q. michauxii* Nuttall), water oak (*Q. nigra* L.), loblolly pine (*Pinus taeda* L.), dogwood (*Cornus* spp.), beech (*Fagus grandifolia* Ehrhart), holly (*Ilex* spp.), ash (*Fraxinus* spp.), red maple (*Acer rubrum* L.), gum (*Nyssa* spp.), bald cypress (*Taxodium distichum* (L.) Richard), hickory (*Carya* spp.), river birch (*Betula nigra* L.), and *Vibernum* spp. (Morse et al. 1980, Whipple et al. 1981).

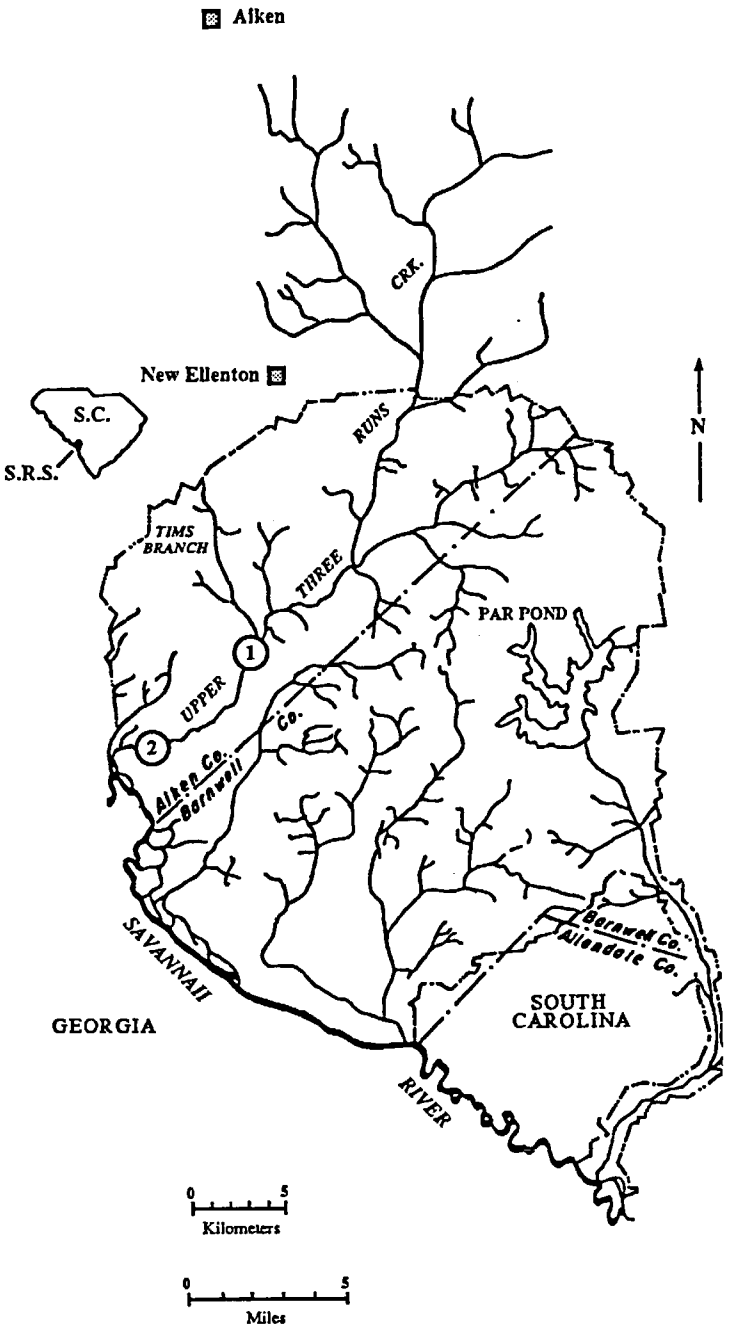



Fig. 1. Map of the Savannah River Site showing the two collection stations on Upper Three Runs Creek.

Upper Three Runs Creek is the least disturbed of all streams that occur on the Savannah River Site. It has never received any thermal effluent from the production reactors and receives only liquid discharges from the Effluent Treatment Facility (ETF) and Tims Branch. The ETF represents the largest contributor of radioactivity (e.g., tritium) to Upper Three Runs Creek, while some industrial pollutants are carried by Tims Branch, a small tributary which enters the stream above station one and just below the Savannah River Ecology Laboratory's Flowing Streams Lab (Bennet and McFarlane 1983; Cummins et al. 1990; Morse et al. 1989).

## Results and Discussion

A total of 93 species of Trichoptera, representing 14 families, were identified from collections obtained from the two stations on Upper Three Runs Creek (Table 1). The family Leptoceridae contained the most species (27) followed by the Hydroptilidae (19), Polycentropodidae (12), Hydropsychidae (11), and Limnephilidae (6). Based on results of the similarity index, Jaccard's Coefficient of Communities ($CC_j$ = 0.785), the two stations were over 78% similar with 73 species in common. The total number of species, 85, collected at station two was only slightly larger than the 80 species found at station one. Eight species were found only at station 1, while 12 species were collected only at station 2. Of the 9315 specimens examined, 4724 (50.7%) were from station 2 and 4591 (49.3%) were from station one. Females constituted 71% of all samples.

Although light trap species composition was very similar at the two stations, species abundances and community structure were quite different. At station one *Cheumatopsyche richardsoni* Gordon was clearly the most commonly collected species (694 specimens) followed by *Protoptila morettii* Morse (472), *Cheumatopsyche pettiti* (Banks) (338), *Ceraclea diluta* (Hagen) (337), *Triaenodes ignitus* (Walker) (279), and *Chimarra florida* Ross (226). Conversely, *Cheumatopsyche richardsoni, Ceraclea diluta,* and *Chimarra florida* were much less common downstream, as station two's most commonly collected species was *Cheumatopsyche pettiti* (393), followed by *Triaenodes ignitus* (324), *Oxyethira janella* Denning (269), *Cheumatopsyche pasella* Ross (248), *Oxyethira lumosa* Ross (241), and *Oecetis morsei* Bueno-Soria (214).

Seasonal occurrences (Table 1) indicated two separate periods of flight activity for at least 10 species. These included *Cheumatopsyche pettiti, Mayatrichia ayama* Mosely, *Oxyethira lumosa, Nectopsyche candida* (Hagen), *Nectopsyche pavida* (Hagen), *Oecetis georgia* Ross, *Oecetis morsei, Oecetis persimilis* (Banks), *Chimarra florida,* and *Phylocentropus placidus* (Banks). Other species displayed either short, synchronous periods of flight activity, continuous, asychronous flight activity, or no distinguishable pattern. Patterns of flight activity were recorded to indicate the presence or absence of each species. Because so many factors (i.e. weather, phototaxy, adult longevity, time of emergence, daily rhythms) can influence the attraction of a species to ultraviolet light, flight activity patterns are not meant to represent actual periods of emergence. Truncated flight periods of species occurring in early spring (February or March) or late fall (November) were due to low temperatures on trapping dates. It is very possible that these species were actively flying on warmer days during winter months.

New distributional records for South Carolina (as indicted by "*" in Table 1) were obtained for *Oxyethira setosa* Denning (previously known only from Alabama, Florida, and Georgia), *Triaenodes smithi* Ross (previously known from Alabama, Illinois, and Mississippi), and *Nyctiophylax serratus* Lago and Harris (Alabama and Mississippi). Two species of *Triaenodes* are new to science. A total of 17 species (as indicated by "+" in Table 1) represented new distributional records for Upper Three Runs Creek. Besides these new distributional records and species new to science, there were at least eight other species of special concern which are considered to be either endemic to the Upper Three Runs Creek drainage, rare outside of the drainage, or of limited distribution (as indicated by "#" in Table 1). *Cheumatopsyche richardsoni* and *Protoptila morettii* (both very common within Upper Three Runs Creek) have been reported from no other stream besides Upper Three Runs Creek. *Hydropsyche elissoma* Ross is endemic to the southeast and uncommon throughout its range. *Triaenodes ochraceus* (Betten and Mosely) has a local distribution and has been found in Alabama, Delaware, Georgia, Mississippi, South Carolina, and Tennessee. *Neotrichia falca* Ross has a scattered distribution, as it is known from Illinois, Kansas, Ohio, Wisconsin, and one stream, Upper Three Runs Creek, in South Carolina. *Oxyethira dunbartonensis* Kelley is known from only two streams in South Carolina and one stream in Georgia. *Oecetis morsei* is known only from three widely separated streams in Alabama, Florida, and South Carolina. *Pycnopsyche virginica* (Banks) is very rare, as it is represented by only 10 specimens, 1 female and 9 males, from Alabama, North Carolina, South Carolina, and Virginia. Of these eight species, *C. richardsoni, H. elissoma, T. ochraceus,* and *N. falca* are listed as "Species of Special Concern" by the South Carolina Department of Wildlife and Marine Resources.

Although not collected in this study, 30 other species of Trichoptera have been reported to inhabit Upper Three Runs Creek (Morse et al. 1980, Kelley and Morse 1982, Holzenthal 1982, Kelly and Harris 1983, Holzenthal and Kelley 1983). Included in this species total are eight additional species which are considered rare, endemic, or of limited distribution. These include *Agarodes wallacei* Ross and Scott (known from only Upper Three Runs Creek and Holly Creek, a stream just north of the Savannah River Site), *Cheumatopsyche edista* Gordon (a southeastern endemic known only from Alabama, Georgia, and South Carolina), *Hydroptila carolae* Holzenthal and Kelley (known only from Upper Three Runs Creek, the type locality), *Hydroptila disgalera* Holzenthal and Kelley (reported from Alabama and South Carolina), *Orthotrichia dentata* Kingsolver and Ross (reported from Florida, Mississippi, and South Carolina), *Setodes arenatus* Holzenthal (known only from two Sandhill streams in South Carolina), *Oxyethira elerobi* (Blickle) (found only in Alabama, Florida, Louisiana, and South Carolina), and *Oxyethira savanniensis* Kelley and Harris (reported only from Alabama, Florida, and South Carolina).

In summary, Upper Three Runs Creek is the only known locality for three species and contains 13 other species that are considered to be rare or of limited distribution. The combination of 17 new distributional records for Upper Three Runs Creek and the two species new to science provided by this study (Table 1), plus previous records provided by other authors (Morse et al. 1980, Kelley and Morse 1982, Holzenthal 1982, Kelley and Harris 1983, Holzenthal and Kelley

**Table 1. Seasonal Occurrence and Abundance for Adult Trichoptera of the Lower Reaches of Upper Three Runs Creek, 1989-1990, Savannah River Site, Aiken County, SC (+ = New distributional record for Upper Three Runs Creek; * = New distributional record for South Carolina, # = Rare, endemic, or of limited distribution; Number of Specimens: — = 1 -5, — = 6-10, — = 11-20, — = 21- 35, — = 36=50, — = > 50, NA = not available or unknown).**

| | Station | ♀, ♂ |
|---|---|---|
| **BRACHYCENTRIDAE** | | |
| Micrasema rusticum (Hagen) | 2 | 0, 2 |
| Micrasema wataga Ross | 1 | 3, 13 |
| | 2 | 1, 4 |
| **CALAMOCERATIDAE** | | |
| Anisocentropus pyraloides (Walker) | 1 | 11, 8 |
| | 2 | 12, 11 |
| Heteroplectron americanum (Walker) | 2 | 1, 0 |
| **GLOSSOSOMATIDAE** | | |
| Protoptila morettii Morse # | 1 | 374, 98 |
| | 2 | 112, 77 |
| **HYDROPSYCHIDAE** | | |
| Cheumatopsyche pasella Ross | 1 | 60, 35 |
| | 2 | 139, 109 |
| Cheumatopsyche pettiti (Banks) | 1 | 335, 3 |
| | 2 | 389, 4 |
| Cheumatopsyche pinaca Ross | 1 | 40, 5 |
| | 2 | 29, 5 |
| Cheumatopsyche richardsoni Gordon # | 1 | 558, 136 |
| | 2 | 55, 27 |
| Diplectrona modesta Banks | 1 | 0, 1 |
| Hydropsyche betteni Ross | 1 | 10, 9 |
| | 2 | 1, 5 |
| Hydropsyche elissoma Ross # | 1 | NA, 72 |
| | 2 | NA, 20 |
| Hydropsyche incommoda Hagen | 1 | NA, 54 |
| | 2 | NA, 178 |
| Hydropsyche rossi Flint, Voshell & Parker+ | 1 | NA, 25 |
| | 2 | NA, 126 |
| Hydropsyche venularis Banks + | 1 | NA, 3 |
| Macrostemum carolina (Banks) | 1 | 40, 37 |
| | 2 | 0, 55 |
| **HYDROPTILIDAE** | | |
| Hydroptila armata Ross + | 1 | NA, 2 |
| Hydroptila delineata Morton | 2 | NA, 2 |
| Hydroptila quinola Ross | 1 | NA, 9 |
| | 2 | NA, 5 |

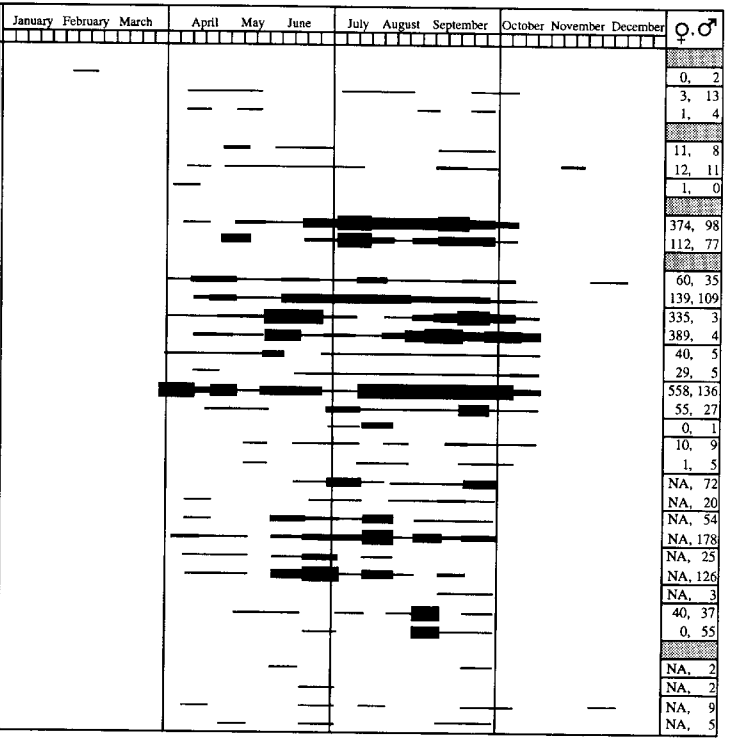


**Table 1. Continued.**

| | Station | ♀, ♂ |
|---|---|---|
| **HYDROPTILIDAE** | | |
| Hydroptila remita Blickle & Morse | 1 | NA, 3 |
| | 2 | NA, 9 |
| Hydroptila waubesiana Betten | 2 | NA, 3 |
| Mayatrichia ayama Mosely | 1 | 35, 6 |
| | 2 | 67, 19 |
| Neotrichia falca Ross # | 1 | 9, 13 |
| | 2 | 15, 10 |
| Neotrichia minutisimella (Chambers) | 1 | 35, 22 |
| | 2 | 47, 14 |
| Orthotrichia aegerfasciella (Chambers | 1 | 25, 6 |
| | 2 | 30, 7 |
| Oxyethira abacatia Denning | 2 | 2, 0 |
| Oxyethira dunbartonensis Kelley # | 1 | 2, 0 |
| | 2 | 2, 0 |
| Oxyethira glasa (Ross) | 1 | 2 2 |
| | 2 | 3, 2 |
| Oxyethira grisea Betten | 1 | 0, 3 |
| | 2 | 0, 2 |
| Oxyethira janella Denning | 1 | 129, 22 |
| | 2 | 235, 34 |
| Oxyethira lumosa Ross | 1 | 188, 12 |
| | 2 | 235, 6 |
| Oxyethira novasota Ross | 1 | 1, 2 |
| | 2 | 1, 2 |
| Oxyethira pallida (Banks) | 2 | 3, 0 |
| Oxyethira setosa Denning *+ | 1 | 0, 1 |
| Oxyethira zeronia Ross | 1 | 1, 1 |
| | 2 | 2, 0 |
| **LEPIDOSTOMATIDAE** | | |
| Lepidostoma carolina (Banks) | 1 | 0, 1 |
| | 2 | 0, 1 |
| Lepidostoma latipenne (Banks) | 1 | 4, 4 |
| | 2 | 16, 4 |
| **LEPTOCERIDAE** | | |
| Ceraclea cancellata Betten | 1 | 5, 2 |
| | 2 | 17, 2 |
| Ceraclea diluta (Hagen) | 1 | 330, 7 |
| | 2 | 87, 15 |
| Ceraclea maculata (Banks) | 1 | 50, 32 |
| | 2 | 111, 24 |

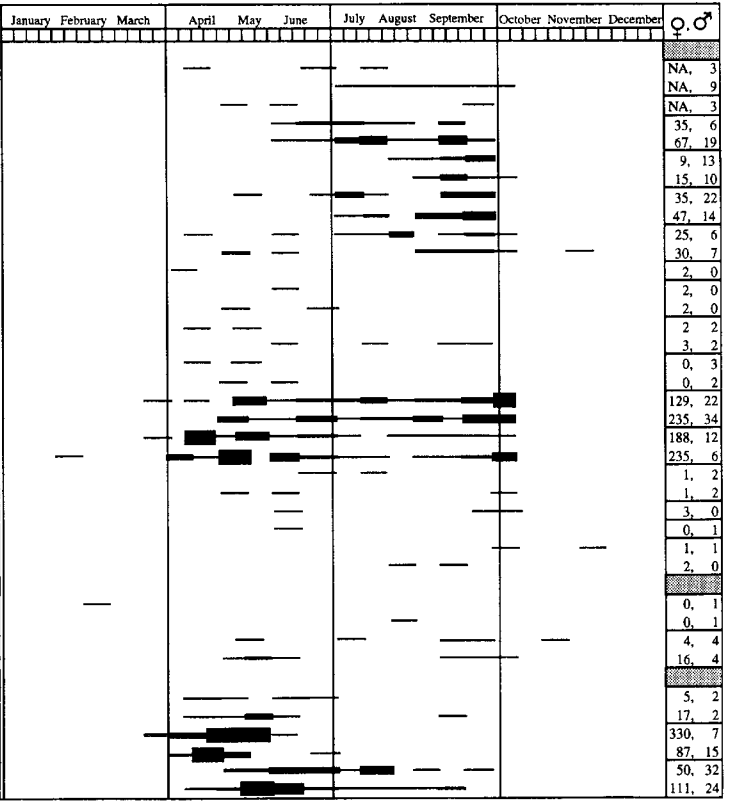


**Table 1. Continued.**

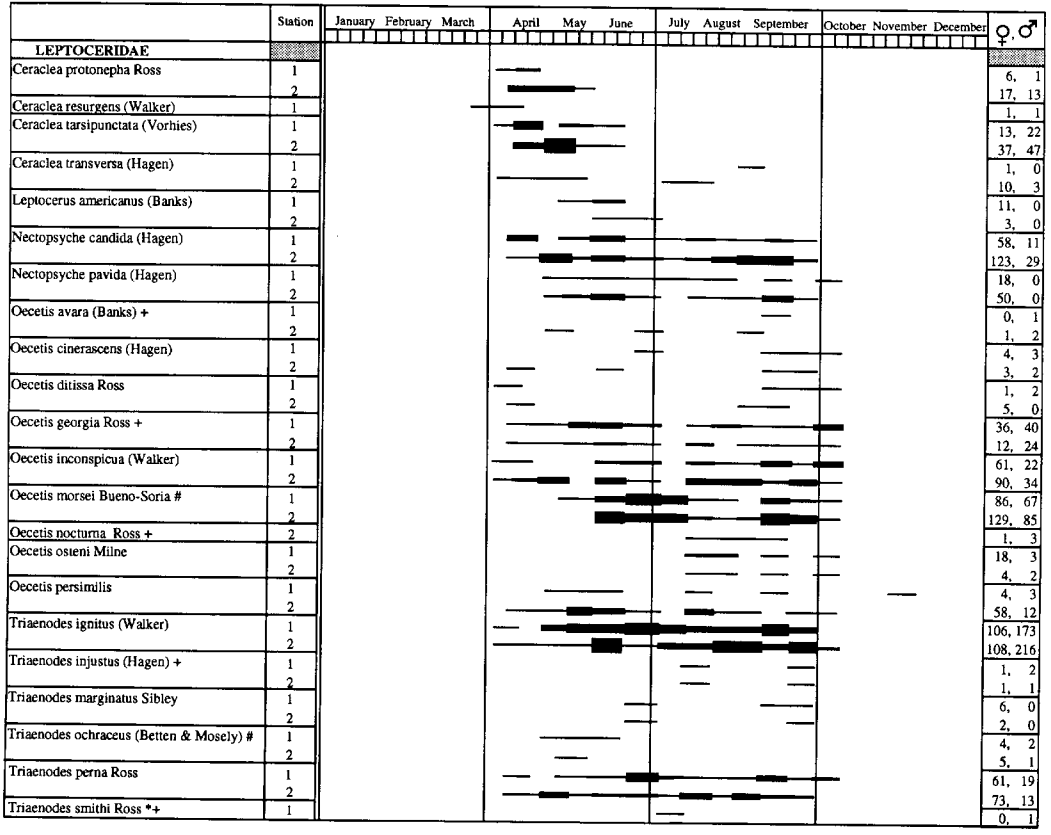
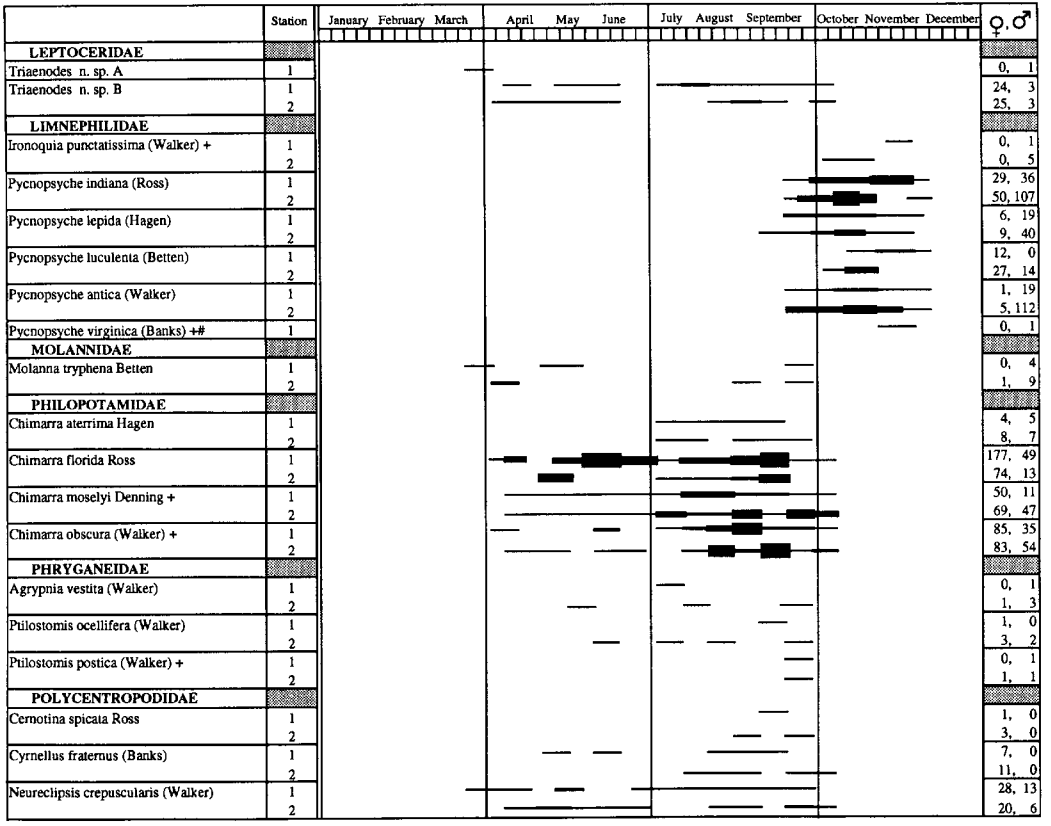


**Table 1. Continued.**



| | Station | ♀, ♂ |
|---|---|---|
| **LEPTOCERIDAE** | | |
| Triaenodes n. sp. A | 1 | 0, 1 |
| Triaenodes n. sp. B | 1 | 24, 3 |
| | 2 | 25, 3 |
| **LIMNEPHILIDAE** | | |
| Ironoquia punctatissima (Walker) + | 1 | 0, 1 |
| | 2 | 0, 5 |
| Pycnopsyche indiana (Ross) | 1 | 29, 36 |
| | 2 | 50, 107 |
| Pycnopsyche lepida (Hagen) | 1 | 6, 19 |
| | 2 | 9, 40 |
| Pycnopsyche luculenta (Betten) | 1 | 12, 0 |
| | 2 | 27, 14 |
| Pycnopsyche antica (Walker) | 1 | 1, 19 |
| | 2 | 5, 112 |
| Pycnopsyche virginica (Banks) +# | 1 | 0, 1 |
| **MOLANNIDAE** | | |
| Molanna tryphena Betten | 1 | 0, 4 |
| | 2 | 1, 9 |
| **PHILOPOTAMIDAE** | | |
| Chimarra aterrima Hagen | 1 | 4, 5 |
| | 2 | 8, 7 |
| Chimarra florida Ross | 1 | 177, 49 |
| | 2 | 74, 13 |
| Chimarra moselyi Denning + | 1 | 50, 11 |
| | 2 | 69, 47 |
| Chimarra obscura (Walker) + | 1 | 85, 35 |
| | 2 | 83, 54 |
| **PHRYGANEIDAE** | | |
| Agrypnia vestita (Walker) | 1 | 0, 1 |
| | 2 | 1, 3 |
| Ptilostomis ocellifera (Walker) | 1 | 1, 0 |
| | 2 | 3, 2 |
| Ptilostomis postica (Walker) + | 1 | 0, 1 |
| | 2 | 1, 1 |
| **POLYCENTROPODIDAE** | | |
| Cernotina spicata Ross | 1 | 1, 0 |
| | 2 | 3, 0 |
| Cyrnellus fraternus (Banks) | 1 | 7, 0 |
| | 2 | 11, 0 |
| Neureclipsis crepuscularis (Walker) | 1 | 28, 13 |
| | 2 | 20, 6 |

**Table 1. Continued.**

| | Station | January February March | April May June | July August September | October November December | ♀, ♂ |
|---|---|---|---|---|---|---|
| **POLYCENTROPODIDAE** | | | | | | |
| Nyctiophylax affinis (Banks) | 1 | | | | | NA, 2 |
| | 2 | | | | | NA, 7 |
| Nyctiophylax celta Denning + | 1 | | | | | NA, 1 |
| | 2 | | | | | NA, 1 |
| Nyctiophylax serratus Lago & Harris *+ | 2 | | | | | NA, 1 |
| Phylocentropus carolinus Carpenter | 1 | | | | | 6, 4 |
| | 2 | | | | | 6, 1 |
| Phylocentropus lucidus (Hagen) | 1 | | | | | 0, 1 |
| | 2 | | | | | 0, 1 |
| Phylocentropus placidus (Banks) | 1 | | | | | 35, 8 |
| | 2 | | | | | 67, 12 |
| Polycentropus blicklei Ross & Yammamoto | 2 | | | | | 0, 1 |
| Polycentropus cinereus Hagen | 1 | | | | | 6, 1 |
| | 2 | | | | | 4, 5 |
| Polycentropus crassicornis Walker + | 2 | | | | | 1, 0 |
| **PSYCHOMYIIDAE** | | | | | | |
| Lype diversa (Banks) | 2 | | | | | 1, 1 |
| **SERICOSTOMATIDAE** | | | | | | |
| Agarodes crassicornis (Walker) | 2 | | | | | 2, 0 |
| Agarodes libalis Ross & Scott | 1 | | | | | 107, 30 |
| | 2 | | | | | 117, 76 |

1983, Morse 1988 [1990]), brings the Trichoptera fauna of Upper Three Runs Creek to 123 species. Based on this number, Upper Three Runs Creek can be said to have the largest reported Trichoptera fauna of any stream its size in North America.

## Acknowledgments

We wish to thank Bob Kelley of ETT Environmental, Inc., Ken Manuel of Duke Power Company, and Guenter Schuster of Eastern Kentucky University, for the identification and verification of numerous specimens. We are also grateful to Doug Bidlack, Thomas Floyd, Morgan McClure, and Kevin Moulton for providing field assistance. Mr. David Scarborough, Clemson University, gave invaluable advice and assistance concerning the construction of the figures and tables. Research and manuscript preparation were supported by Contract DE-AC09-76SR00-819 between the U. S. Department of Energy and the University of Georgia's Savannah River Ecology Laboratory (SREL). Under this contract, the work of Michael A. Floyd was supported by the SREL Educational Program and the manuscript was approved by the Director, SREL, for publication. This is Contribution No. 3272 of the South Carolina Agricultural Experiment Station, Clemson University.

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