FINAL PERFORMANCE REPORT



Federal Aid Grant No. F16AF01215 OK-T-93-R-1

A Survey for Rare Mayfly and Caddisfly Species of Greatest Conservation Need

Oklahoma Department of Wildlife Conservation

Grant Period: January 1, 2017 through December 31, 2018

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State: Oklahoma

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Project Leader: Rickey D. Cothran

Executive Summary

Several species of aquatic insects (mayflies and caddisflies) have been recently added to the list of Species of Greatest Conservation Need. Many of the species have overlapping distributions making a comprehensive survey and effective way to determine their distribution in suitable habitat in Oklahoma. Our study objectives were to (1) attempt to recollect the three-toothed triaenodes caddisfly (*Triaenodes tridontus*) in Pushmataha County, OK. (2) Update the distribution of several caddisfly species (*Metrichia nigritta, Hydroptila protera, Mayatrichia ponta, Ochrontrichia robisoni, Ochrontrichia weddleae*, and *Triaenodes tridontus*) and mayfly species (*Apobaetis futilis, Nixe flowersi*, and *Tricorythodes curvatus*) by collecting within and beyond their poorly known ranges in Oklahoma. (3) Describe habitat characteristics and other species associated with the rare species we find.

We focused on SE Oklahoma for our *Triaenodes tridontus* survey based on previous collections in Pushmataha County. In addition to sampling streams in Pushmataha County, we also surveyed the Kiamichi and Little River watersheds in adjacent counties, McCurtain and LeFlore. We currently only have *Triaenodes* species-level identifications for the summer 2017 field season. Although several individuals from the genus were collected no *Triaenodes tridontus* were discovered. We have material that is currently being processed from the 2018 field season that may include *Triaenodes tridontus*. We also have aquatic samples from both field seasons that are being processed.

Our Arbuckle Region microcaddisfly survey was a success. This group of caddisflies is diverse in the region. The survey extended known distributions for two of the three hydroptilid species targeted. We also discovered other rare species in this family that were not targets of the current grant. We have SE Oklahoma hyroptilid identifications from the 2017 but not the 2018 field season. We collected over 1500 hydroptilids (9 genera and 15 confirmed species) from 13 sites in SE Oklahoma. However, all individuals surveyed were from widespread species (all G4 or G5 level taxa [indicating secure conservation status--not imperiled] NatureServe Conservation Status) and all had previously been collected in Oklahoma. Our 2018 survey was more extensive and this material will soon be sent to our taxonomic expert for identification to species. Our mayfly survey did not collect *Tricorythodes curvatus* or *Apobaetis futilis*. We very likely collected the target *Nixe flowersi* in both the Spring Creek drainage and the Little River drainage. This species has been collected in Spring Creek but not the Little River. We also collected this species later in the season than it previously had been collected. The caveat to this discovery is that keys for this and many other mayfly species require male imago stages, which were extremely rare in our collections, making definitive identification impossible.

I. OBJECTIVES:

- 1. We will attempt to recollect the three-toothed triaenodes caddisfly (*Triaenodes tridontus*) in Pushmataha County, OK.
- 2. We will update the distribution of several caddisfly species (*Metrichia nigritta*, *Hydroptila protera*, *Mayatrichia ponta*, *Ochrontrichia robisoni*, *Ochrontrichia weddleae*, and *Triaenodes tridontus*) and mayfly species (*Apobaetis futilis*, *Nixe flowersi*, and *Tricorythodes curvatus*) by collecting within and beyond their (poorly) known ranges in Oklahoma.
- 3. We will describe habitat characteristics and other species associated with the rare species we find.

Performance reports will include survey locations, associated species and relevant habitat information.

II. SUMMARY OF PROGRESS A. APPROACH Arbuckle Region Survey

The survey consisted of 64 samples at 61 different sites (see map; Figure 1; sites are listed in Table 1). Three pairs of samples were collected at the same site or in close proximity (i.e., sites 3 & 4, sites 9 & 48, and sites 29 & 50). Five counties were included in the survey: Murray County (37 sites); Johnston County (12 sites); Carter County (7 sites); Garvin County (6 sites); and Pontotoc (3 sites). All field work (beyond the first two sites) was done solely by Kambridge (Brown) Stephens.

The sampling period spanned two months in 2017 (8 June to 13 July) and 2018 (2 June to 19 July), except for two sites that were sampled on 17 May 2017. During the May sampling, we trialed sampling techniques (sweeping vegetation, blacklighting with a sheet and hand picking insects, and using black light traps) and selected using traps only as the most efficient and effective survey method.

Black lights attract a wide variety of night-flying insects, including caddisflies. Traps consisted of small hand-held, battery operated blacklights (13.5 cm long, 4 W bulb with overall length of the unit of 16 cm) placed on top of plastic boxes (internal dimensions: $13 \times 13 \times 3$ cm), which collected the attracted insects in 70% ethanol. A mesh top (rectangular openings of 3×5 mm) was placed over the opening of the plastic container and beneath the light to prevent larger insects from entering the trap, as only small insects (microcaddisflies) were targeted in the Arbuckle-area portion of the overall study.

Sample sites were primarily at bridge locations or where roadways ran close to streams. Sites were only sampled one time, which allowed a greater number of sites to be inventoried and reduced the capture at any one site. GPS coordinates were recorded for each site and checked for accuracy using Google Maps (www.google.com). Locations were mapped using the on-line site BatchGeo (www.batchgeo.com) and topographic maps (Roads of Oklahoma; Mapsco; 2008).

Black light traps were placed in the evening. In 2017, traps were picked up in the morning (3-4 hours of strong light; Dave Ruiter, personal communication). Traps collected numerous microcaddisflies and in 2018, traps were collected at night after a sampling time of 0.5 to 1.5 hours to reduce 'take'.

Trap samples were sorted and microcaddisflies were sent to Dave Ruiter in Oregon for identification. A generous subsample was sent for very large samples. Taxonomy is largely based on features of adult male genitalia, which may require clearing of specimens or dissection. Females are associated with males and identification of females without males in the sample is tentative for some species. Because of the difficulty of identifying females, not all were identified and are listed as 'unidentified' for the genus (or even for the family). An additional challenge with identification is the occurrence of individuals that cannot be identified to species—especially when taxonomic features differ slightly from the standard description. Such individuals include variation within a species (including spatial variants), members of species complexes (where a 'species' includes several morphologically similar species), or potentially new species. These taxa are indicated by 'nr' (near) within the species designation or a species number for recognized variants and are considered 'morphospecies'.

Most identified caddisflies were donated to the C.P. Gillette Museum of Arthropod Diversity at Colorado State University in Ft. Collins, which has an extensive aquatic insect collection and is a designated repository for invertebrates collected on federal lands (in this case, sites in the Chickasaw National Recreation Area). Dave Ruiter retained a few specimens.

A permit (CHIC-2017-SCI-0003) was obtained for the sampling in the Chickasaw National Recreation Area and the final report associated with the permit was submitted in March 2018. Other sampling was on public right-of-ways or on private lands with landowner/manager permission.

Southeastern Oklahoma Survey

The survey included 51 samples that were distributed across two years (2017 and 2018), two seasons (Spring and Summer), and three drainages (Kiamichi River [7 sites], Little River [9 sites], and Spring Creek [4 sites]). The Kiamichi sites were located in Pushmataha and LeFlore counties. The Little River sites were located in Pushmataha, LeFlore, and McCurtain counties (see Appendix 1 for site details).

At each sampling event we collected both aquatic and terrestrial samples to target immatures and adults, respectively. Aquatic sampling consisted of a combination of timed dip nets samples, hand picking in habitats expected to hold target taxa, and surber samples. Aquatic samples were preserved in 70% ETOH and all macroinvertebrates are in the process of being sorted to Order or Family (for target taxa). A number of abiotic and biotic variables were collected at each site and will be used to determine predictors of species occurrences.

Terrestrial samples were collected at night using either manned or unmanned black light traps. We used similar unmanned light trapping methods explained in the Arbuckle Region Survey. Samples were sorted to Family and target caddisfly families were sent to Dave Ruiter for identification. Leptocerids in the genus *Triaenodes* from the 2017 sampling period have been identified to species. We are still currently working on other caddisfly identifications. Mayfly target families were examined by Peter Grant. Deposition of samples follow the methods described above for the Arbuckle Region survey.

B. RESULTS Arbuckle Survey Results

A total of 5298 individual hydroptilids were identified at some level (most to species). This number comprised 8 genera and 37 species, including 4 morphospecies (Table 2). Microcaddisflies were found at all but **five** sampling sites (**59** of 64 sites). Microcaddisfly diversity was high and averaged 5.8 species/morphospecies (excluding unidentified taxa) per site. Indeed, 11 sites had 10 or more species/morphospecies despite a single sampling event at each site. Data are in Appendix 2.

Three species were targeted in this survey: *Hydroptila protera*; *Hydroptila ponta*; and *Metrichia nigritta*. All three were found in the survey and results and discussion of each species follows:

(1) *Hydroptila protera* (Hydroptilidae): This species was originally described from the Turner Falls area (Murray County) from a 1937 collection; but was not re-collected in a collecting trip in the early 1990's (Moulton and Stewart 1996).

Our survey found 46 individual *H. protera* at a total of 10 sites (Figure 2a and Appendix 1). Three of these sites are in the Turner Falls area of Murray County (tributaries of Honey Creek at sites 25 and 28; Falls Creek at site 32), and two additional sites were fairly close but more northern tributaries of the Washita River: Lick Creek (site 31) and Colbert Creek (site 30).

The most interesting finding was a population of *H. procera* in tributaries of Wildhorse Creek (Fivemile, Eightmile, and Massey Creek; sites 59, 60, and 61; respectively); although only a single individual was collected at each of these three sites. This increases the known distribution from a single county (Murray County) to also include Carter County.

The 10^{th} site with *H. procera* was on Delaware Creek (Johnston County), where 3 individuals were identified. This site is disjunct from the rest of the distribution and warrants further investigation.

The largest numbers of *H. protera* (10 or more individuals) were collected in an unnamed springbrook tributary of Honey Creek near Turner Falls (site 25), Colbert Creek (site 30), and Falls Creek (site 32).

(2) *Mayatrichia ponta* (Hydroptilidae): This species is known from several small Arbuckle streams. It was described from Honey Creek in the Turner Falls area and is also known from Travertine Creek in the Chickasaw National Recreation Area (both sites are in Murray County). Larvae live in small, rapidly flowing waters with gravel, cobble or bedrock substrates. Adults have been collected in February, May, June and August.

Our survey found 144 individual *M. ponta* at a total of 11 sites (Figure 2b and Appendix 1). In comparison to previous records, this species was not collected in the Turner Falls area but *M. ponta* was collected at 3 sites in or near Travertine Creek (sites 5 and 6 in Travertine Creek and site 12 in Rock Creek – all three in the Chickasaw National Recreation Area). Numbers collected in the Chickasaw National Recreation area were low (1 to 3 individuals per site).

In addition to the two known areas in Murray County, we documented a new population of *M. ponta* in two close-by tributaries of the Washita River: Colbert Creek (site 30) and Chigley Sandy Creek (site 34). These records are also significant for the higher number of collected individuals – 96 and 23 at Colbert Creek and Chigley Sandy Creek, respectively.

M. ponta was also documented in 5 samples from 4 sites in Johnston County, an eastward expansion of the known range. Note: 2 samples were from near-by sites on Pennington Creek and are considered as a single site. These 4 sites are widely distributed within the county and represent 3 different drainages. Pennington Creek (nearby samples 23 and 24) enters the Washita River not far above its confluence with Lake Texoma. Peter Sandy Creek (site 22) flows into the Blue River, which joins the Red River well below Lake Texoma. The Delaware Creek (site 19) and Mill Creek (site 16) are tributaries of the Clear Boggy Creek, which feeds into Muddy Boggy Creek, which joins the Red River well downstream the confluence with the Blue River.

A second distribution extension occurred westward with 5 individuals collected in Eightmile Creek (site 60) in Carter County.

(3) *Metrichia nigritta* (Hydroptilidae): This is a species documented from several Arbuckle springs (Johnston County: unnamed spring near the town of Mill Creek and Cummins Spring; Murray County: Buffalo and Antelope Springs, Chickasaw National Recreation Area; Pontotoc County: Byrd's Mill Spring). Adults are easily distinguished by their black color and may be present in February through October. Adults can be observed moving on vegetation and stream bank rocks during the day.

This species was only collected at 4 sites and only 17 individuals were found (figure 2c and Appendix 1). Sites with *M. nigritta* were primarily springs and included known sites: Cummins Spring (site 4) in Johnston County and Canyon Spring (site 1) and Byrd's Mill

Spring (site 15) in Pontotoc County. Note: permission to sample site 1 was based on calling the spring Canyon Spring, as the owner objects to the site name on topographic maps, which is Deadman Spring). The fourth site with *M. nigritta* was Sheep Creek (site 17) in Johnston County.

The paucity of sites for this 'widespread' species may have resulted from survey timing, as adults for *M. nigritta* are reported as occurring over a 9-month period and perhaps this species more typically emerges at times other than the survey months of June and July. The larger size and black color are consistent with emergence during cooler periods, as these traits are shared with winter emerging stoneflies. Daytime activity is also consistent with 'winter' emergence and might decrease trap capture. We conclude that this species may have been inadequately sampled by our survey methods and the apparent reduction in range that was indicated by our survey should be investigated.

(4) Interesting occurrences of other, non-target microcaddisfly species.

Although most collected species are considered widespread and common, two categories of distributions merit mention—three rare species that were not survey targets and four species not listed as occurring in Oklahoma on the NatureServe web site.

(A) Rare species.

- *Cernotina oklahoma* has a G rank of G2G3 and occurs in OK, TX and OH. This species was found at one site (site 34, Chigley Sandy Creek in Murray County).

- *Hydroptila melia* has a G rank of G2G3. Ranked S2 in Texas, the species is unranked in Oklahoma, the only other state listed for this species by NatureServe. Our survey found the species at 10 sites.

- *Neotrichia edalis* has a G rank of G3G4 and is unranked in 4 states, including Oklahoma. We collected this species at 2 sites.

- *Ochrotrichia capitana* has a G rank of G1G3, is ranked as S2? in Texas, the only state listed in the distribution on the NatureServe web site. We collected the species from 3 sites.

(B) Species not listed as occurring in Oklahoma on the NatureServe web site. Species with distributions not listing Oklahoma are necessarily new state records. Unlisted species may have unpublished museum records or published records not yet reflected on the NatureServe web site.

- *Hydroptila arctia*. This G5 species is a western species, with its eastern limt in Texas (and evidently Oklahoma; with 2 sites).

- *Hydroptila argosa*. Oklahoma is similarly on the eastern edge of this species range (with 1 site). The closest occurrence according to NatureServe is indicated as Colorado. - *Hydroptila modica*. The distribution of this G3G5 species is spotty with records from Arizona, Washington and Oregon. Oklahoma would add to this disjunct distribution. The species was found at a single site.

- *Neotrichia osmena*. This G3G4 species is ranked as S1 in Arizona and is unranked in Colorado, Utah, and Wyoming. The species was found at a single site in this survey.

- *Ochrotrichia capitana*. With a G rank of G1G3, this species is also listed above as a rare species. NatureServe lists a distribution of only Texas (S2?), which would make a

new Oklahoma record a major increase in distribution. The species was collected at 3 sites.

Southeastern Oklahoma Survey Results

For the leptocerid caddisfly samples, only *Triaenodes* spp. collected from the 2017 field season have been processed and identified to species. *Triaenodes* were collected at three of seven sites in the Kiamichi drainage and one of nine sites in the Little River drainage. Spring Creek was not sampled in 2017. None of the *Triaenodes* collected in 2017 were *T. tridontus*.

For hydroptilid caddisflies we have species identifications for the summer 2017 field season. We collected 1525 individuals from 13 sites. Nine genera and 15 confirmed species were collected (Figure 3). However, all individuals surveyed were from widespread species (all G4 or G5 level taxa [indicating secure conservation status--not imperiled] for NatureServe Conservation Status) and all had previously been collected in Oklahoma. Our 2018 survey was more extensive and this material will soon be sent to our taxonomic expert, Dave Ruiter, for identification to species.

For the adult mayfly samples from manned and unmanned light traps, we found no specimens of *Tricorythodes*, including the target species *Tricorythodes curvatus*, in our samples. As stated in our proposal, this species has been found in Texas and Missouri but not yet in Oklahoma. Adults of this species were collected June through August in the other two states, so we collected during the appropriate months. If we collect again, we might light trap early in the morning, starting in the dark before sunrise, at sites where *Tricorythodes* nymphs were collected.

Apobaetis (target species was *Apobaetis futilis*) adults belong to a group of mayflies that have large eyes that diverge anteriorly in the males and they also lack hind wings. So, this group is pretty easy to identify. We identified a few specimens with these characteristics. Only one specimen was a male imago and it keyed to *Plauditus*. We also collected a few subimagos with these characteristics, but they do not appear to be *Apobaetis*. This genus has a large projection between the base of the forceps and the subimaginal specimens do not show that character. If we look for this species again, we will review the literature on the three species in this genus to see if others have developed a successful method for collecting adult males.

We <u>likely</u> collected specimens that may be *Nixe flowersi* at on site in the Little River drainage and three sites in the Spring Creek drainage. We are still working on mapping the species occurrences to these sites. The problem is these specimens are all male subimagos, so it is difficult to be confident of the species identification. *Nixe flowersi* is a very pale species and these subimagos are also pale. Adult specimens of this species have been collected in Spring Creek (Cherokee County) in June (McCafferty et al. 1997). Our light trapping took place in early August possibly extending the flying period of adults by two months.

Although species-level identifications are incomplete, we have begun to explore familylevel abundance patterns in the adult caddisfly data set. This work has been spear-headed by undergraduate students that were supported by the grant. They have presented this research at the Southwestern Oklahoma State University Scholarly Activity and Research Fair and the Oklahoma Academy of Sciences Technical Meeting, and plan to do so at Oklahoma Research Day in March 2019.

We have discovered that unmanned light traps are particularly successful at collecting microcaddisflies (Figure 4). We also found that leptocerid abundance was higher in the Little River drainage than the Kiamichi and Spring Creek drainages (Figure 5). We explored seasonal and stream order patterns in family-level abundances and found no significant trends in the data. As more samples are processed, we will continue to look for patterns in both the immature and adult data sets.

C. Conclusions

Overall conclusions from the Arbuckle Region microcaddisfly survey:

- 1. Hydroptilids are both abundant and speciose across the greater Arbuckle region.
- 2. Known distributions (based on published records) were expanded for 2 of the 3 targeted species (*Hydroptila protera* and *Mayatrichia ponta*). The design of the survey may have impacted the collection of the third targeted species (*Metrichia nigritta*); hence the distribution found in our survey may be incomplete.
- 3. For non-target microcaddisfly species, potential new distribution records (in comparison to NatureServe distributions) and the occurrence of rare species in the survey indicate the usefulness of surveys beyond targeted species and indicate additional species that may be of conservation interest (e.g., *Ochrotrichia capitana*).
- 4. The amount of new information gained in this survey highlights the need for additional surveys both within the Arbuckle area and more generally in Oklahoma.

Overall conclusions from the Southeast Oklahoma Region survey:

- 1. The 2017 field season did not produce any of the target caddisfly species. Several individuals in the genus *Triaenodes* were collected in 2017 although none were the target species *Tiaenodes tridontus*. We are in the process of processing our adult caddisfly samples from the 2018 field season and will send them to Dave Ruiter in the coming months.
- 2. The SE Oklahoma Region was not the primary target for the hydroptilids, but our 2017 survey found several species, although not as many as the Arbuckle Region. Our 2018 survey of the Kiamichi and Little River drainages was more expansive and so we might be able to extend the ranges of some of the targeted hydroptilids. These samples will be sent to Dave Ruiter in the coming months. It is unlikely that completing the identification of remaining samples will reveal the presence of target *Triaenodes* species as none have been found to date in completed samples.
- 3. Our mayfly survey very likely collected the target *Nixe flowersi*, however, definitive identification requires male imago stages, which were not available in our samples.
- 4. We very likely collected the target Nixe flowersi in the Spring Creek drainage.
- 5. We have a fair amount of sorting and identification ahead of us. The grant relied heavily on Dave Ruiter's expertise for caddisfly identifications. We collected a

tremendous amount of material and prioritized the Arbuckle Region identifications based on past information about species occurrences. Completion of sorting and identification of all remaining samples is not likely to expand or change current known ranges of targeted hydroptilids.

D. Acknowledgements

We are especially grateful to Dave Ruiter, who identified and counted the microcaddisflies without his expertise this project would not have been possible. We also thank all the landowners and managers who allowed site access. We would also like to thank David Castellanos, Amy Hofeld, Skyler Mills, Ruchina Shakya, Theresa Stein, and Gwen Ukeje for their work in the field and laboratory. The Oklahoma Biological Station served as a research base during the summer of 2017 and 2018. Housing was also provided the Nature Conservancy at the Pontotoc Ridge Preserve and the Oklahoma State University Kiamichi Research Station near Idabel, OK.

III. RECOMMENDATIONS

Light trapping methods that were used to collect the adult stages of mayflies were successful, both manned and unmanned light traps. The vast majority of specimens we collected, however, were female subimagos, which need to molt one more time to the imaginal stage. Most species descriptions are based on the male imago. Subimagos often do not quite have the exact color pattern of the imago and body parts often have different shapes.

While using the manned light traps, collectors used forceps to capture specimens and placed those specimens in alcohol. If we use the manned light trap technique again, specimens will be collected but placed in a large plastic container with moist paper towels. That environment allows most subimagos to molt to the imaginal stage during the following 24-hours and should provide more male imagos for identification.

IV. SIGNIFICANT DEVIATIONS

No significant deviations.

V. EQUIPMENT

No equipment was purchased on the grant.

VI. PREPARED BY: Rickey D. Cothran¹, Peter Grant¹ and Elizabeth Bergey²

 ¹ Southwestern Oklahoma State University, Department of Biological Sciences, Weatherford, OK
² University of Oklahoma, Oklahoma Biological Survey and Department of Biology, Norman, OK

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APPROVED BY:

Fisheries Division Administration Oklahoma Department of Wildlife Conservation

Andrea Crews, Federal Aid Coordinator Oklahoma Department of Wildlife Conservation

VII. REFERENCES

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VIII. TABLES AND FIGURES

Table 1. List of the 64 sampled sites. In addition to site information, the number of individuals collected for each of the three targeted species (*Hydroptila procera*, *Mayatrichia ponta*, and *Metrichia nigritta*) are given for the appropriate sites.

Site						Н.	M.	М.
#	County	Site name	Date	Latitude	Longitude	procera	ponta	nigritta
		Canyon/Deadman	17-May-					
1	Pontotoc	Spr	17	34.54504	-96.6008			1
		-	17-May-					
2	Pontotoc	Canyon Crk	17	34.54527	-96.6007			
3	Johnston	Cummins Spring	13-Jul-17	34.4525	-96.6281			
4	Johnston	Cummins Spring	13-Jul-17	34.45252	-96.6276			12
5	Murray	Travertine Crk	8-Jun-17	34.50448	-96.9695		1	
6	Murray	Travertine Crk	8-Jun-17	34.50424	-96.9699		1	
7	Murray	Pavilion Spring	8-Jun-17	34.50369	-96.9686			
8	Murray	Hillside Spring	8-Jun-17	34.50287	-96.9692			
9	Murray	Buckhorn Creek	8-Jun-17	34.42622	-96.9505			
10	Murray	Buckhorn Creek	8-Jun-17	34.41441	-96.9684			
11	Murray	Buckhorn Creek	8-Jun-17	34.40928	-96.9511			
12	Murray	Rock Creek	14-Jun-17	34.50381	-96.9717		3	
13	Murray	Antelope Spring	14-Jun-17	34.50481	-96.9414			
14	Murray	Buffalo Spring	14-Jun-17	34.50258	-96.9393			
15	Pontotoc	Byrd's Mill Spring	22-Jun-17	34.59446	-96.666			1
16	Johnston	Mill Creek	22-Jun-17	34.60669	-96.6435		5	
17	Johnston	Sheep Creek	22-Jun-17	34.60241	-96.5998			3
18	Johnston	Little Blue Creek	22-Jun-17	34.46297	-96.6213			
19	Johnston	Delaware Creek	22-Jun-17	34.44861	-96.5547	3	5	
20	Johnston	Diamond Spr Br.	22-Jun-17	34.42167	-96.6356			
21	Johnston	Pecan Creek	22-Jun-17	34.36111	-96.6225			
		Peter Sandy						
22	Johnston	Creek	22-Jun-17	34.36131	-96.5754		1	
23	Johnston	Pennington Creek	13-Jul-17	34.3535	-96.7105		3	
24	Johnston	Pennington Creek	13-Jul-17	34.35115	-96.7105		1	
		unnamed						
25	Murray	springbrook	13-Jul-17	34.43282	-97.1467	14		
26	Murray	unnamed	13-Jul-17	34.43333	-97.1472			
27	Murray	unnamed	13-Jul-17	34.42361	-97.1444			
28	Murray	unnamed	13-Jul-17	34.42341	-97.1464	3		
29	Murray	Red Branch Crk	2-Jun-18	34.49896	-97.1779			
30	Murray	Colbert Crk	2-Jun-18	34.49217	-97.1751	10	96	
31	Murray	Lick Crk	2-Jun-18	34.46404	-97.1473	1		

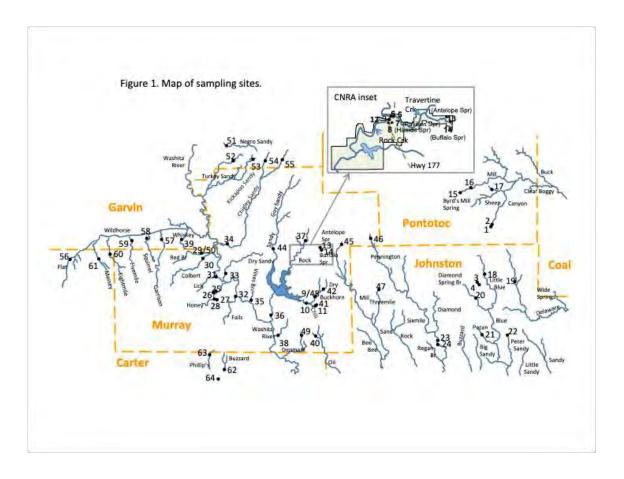
32	Murray	Falls Crk	2-Jun-18	34.42888	-97.1059	10		
33	Murray	Dry Sandy Crk	2-Jun-18	34.46281	-97.1282			
34	Murray	Chigley Sandy Crk	2-Jun-18	34.51364	-97.122		23	
35	Murray	Vines Branch	12-Jun-18	34.42045	-97.0757			
Site						Н.	M.	M.
#	County	Site name	Date	Latitude	Longitude	procera	ponta	nigritta
36	Murray	Rock Crk	12-Jun-18	34.39733	-97.03742			
37	Murray	Rock Crk	12-Jun-18	34.51584	-96.9685			
38	Murray	Board Hollow	12-Jun-18	34.36402	-97.0275			
39	Murray	Whiskey Crk	13-Jul-18	34.52135	-97.2182			
40	Murray	Oil Crk	12-Jun-18	34.3626	-96.9508			
41	Murray	Chili Crk	12-Jun-18	34.4093	-96.9508			
42	Murray	Dry Crk	12-Jun-18	34.43693	-96.9333			
43	Murray	Wilson Crk	12-Jun-18	34.48959	-96.9652			
44	Murray	Guy Sandy Crk	12-Jun-18	34.50675	-97.034			
45	Murray	Mill Crk	22-Jun-18	34.50967	-96.8983			
46	Murray	Pennington Crk	22-Jun-18	34.52058	-96.8525			
47	Johnston	Threemile Crk	22-Jun-18	34.4406	-96.8293			
48	Murray	Buckhorn Crk	22-Jun-18	34.42629	-96.9508			
49	Murray	Denmark Crk	22-Jun-18	34.36138	-96.9785			
50	Garvin	Red Branch Crk	29-Jun-18	34.49899	-97.1778			
51	Garvin	Negro Sandy Crk	29-Jun-18	34.67673	-97.1254			
52	Garvin	Turkey Sandy Crk	29-Jun-18	34.65153	-97.1185			
		Kickapoo Sandy						
53	Garvin	Crk	29-Jun-18	34.65147	-97.0821			
		W Branch Chigley			-			
54	Garvin	Crk	29-Jun-18	34.65145	97.050077			
		E Branch Chigley						
55	Garvin	Crk	29-Jun-18	34.65136	-97.0175			
56	Carter	Flat Crk	13-Jul-18	34.49246	-97.4396			
57	Murray	Garrison Crk	13-Jul-18	34.52139	-97.254			
					-			
58	Murray	Squirrel Crk	13-Jul-18	34.52141	97.287116			
59	Murray	Fivemile Crk	13-Jul-18	34.52127	-97.3149	1		
					-			
60	Carter	Eightmile Crk	13-Jul-18	34.49984	97.358308	1	5	
61	Carter	Massey Crk	13-Jul-18	34.49254	-97.3808	1		
62	Carter	Buzzard Crk	19-Jul-18	34.30356	-97.12			
63	Carter	Philips Crk	19-Jul-18	34.3327	-97.1634			
64	Carter	Caddo Cr	19-Jul-18	34.2458	-97.1434			

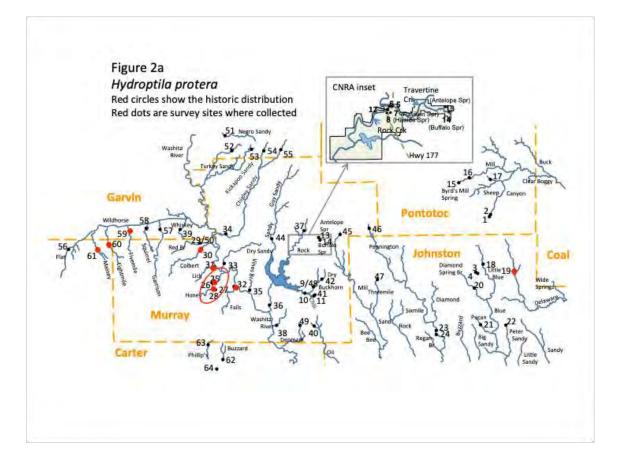
Table 2. Microcaddisfly taxa list for the Arbuckle-area sites, with the number of sites (of 64) in which each taxon was collected. Information on G ranks and State notes is from NatureServe (www.explorer.natureserve.org). Ranks range from 1 (very rare; at risk) to 5 (common and widespread); S (state) ranks are listed for species with small distributions (SNR = state not ranked). Species collected but not listed as occurring in Oklahoma on Natureserve are indicated and, for these species, notes indicate NatureServe-reported occurrences near Oklahoma.

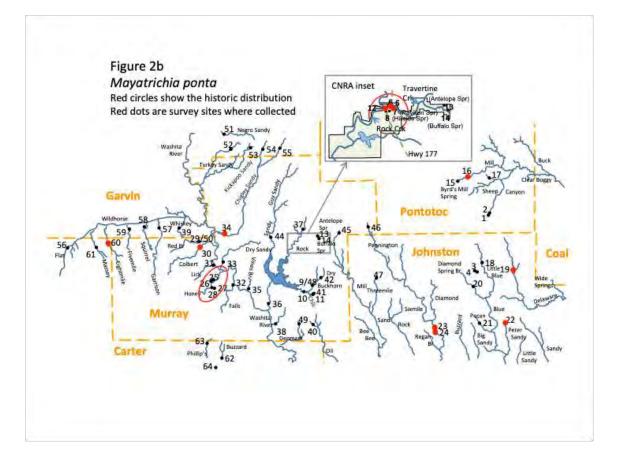
	# of		^
Taxon*	sites	G rank	State notes
Cernotina calcea	4	G5	widespread
Cernotina oklahoma	1	G2G3	SNR for OH, OK, TX
Cernotina spicata	6	G5	widespread
Cernotina unidentified	4		
Hydroptila ajax	24	G5	widespread
Hydroptila species nr			
ajax	6		
Hydroptila amoena	1	G5	widespread
Hydroptila angusta	22	G5	widespread
			widespread; not listed in OK (E edge of range is shared
Hydroptila arctia	2	G5	with TX)
			widespread; not listed in OK (E edge of range; closest is
Hydroptila argosa	1	G5	CO)
Hydroptila armata	18	G5	widespread
Hydroptila consimilis	17	G5	widespread
Hydroptila grandiosa	1	G5	widespread
Hydroptila hamata	17	G5	widespread
Hydroptila melia	10	G2G3	OK: SNR; TX: S2
<i>Hydroptila</i> sp 08 (nr			
melia)	8		
Hydroptila modica	1	G3G5	not listed in OK; disjunct distribution: AZ; OR; WA
Hydroptila protera	10	G1G2	OK: SNR; TX: SNR
Hydroptila tarsalis	1	NGR	possibly Ochrotrichia tarsalis?
Hydroptila waubesiana	38	G5	widespread
Hydroptila sp 09	1		
Hydroptila unidentified	9		
Mayatrichia ayama	9	G5	widespread
Mayatrichia ponta	11	G2G4	OK: SNR; WY: SNR
Mayatrichia species	1		
Metrichia nigritta	4	G5	OK: SNR; TX: SNR; AZ: S1
Neotrichia edalis	2	G3G4	IL, MO, OK, TX (all SNR)
Neotrichia			
minutisimella	2	G5	widespread
Neotrichia okopa	3	G5	widespread
Neotrichia osmena	1	G3G4	not listed for OK; AZ: S1; CO,UT, WY (all 3 SNR)

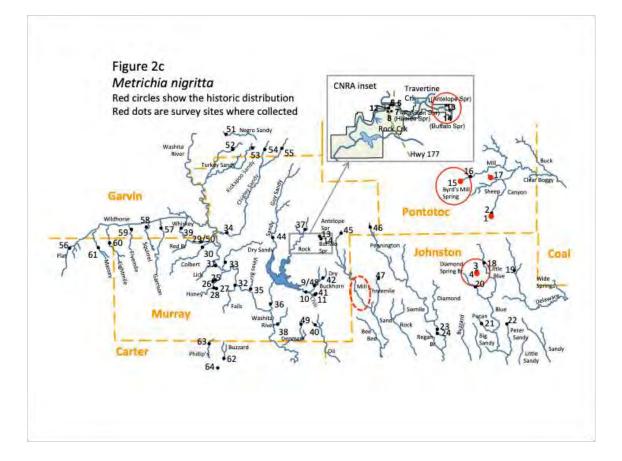
Neotrichia vibrans	2	G5	widespread
Neotrichia unidentified	3		
Ochrotrichia capitana	3	G1G3	not listed for OK; TX: S2?
	# of		
Taxon	sites	G rank	State notes
Ochrotrichia spinosa	2	G5	widespread
Ochrotrichia stylata	8	G5	widespread
Ochrotrichia nr stylata	6		
Ochrotrichia tarsalis	20	G5	widespread
Ochrotrichia			
unidentified	4		
Orthotrichia			
aegerfasciella	34	G5	widespread
Orthotrichia cristata	25	G5	widespread
Orthotrichia			
unidentified	10		
Oxyethira aculea	2	G5	widespread
Oxyethira pallida	42	G5	widespread
Oxyethira unidentified	1		
Hydroptilidae			
unidentified	7		

*Unidentified taxa are generally females. G ranks and State notes are not applicable to genus or family –level taxa; nor to morphospecies .









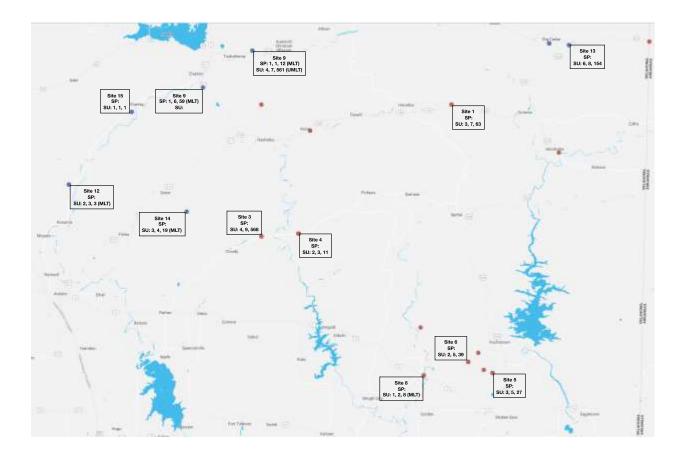
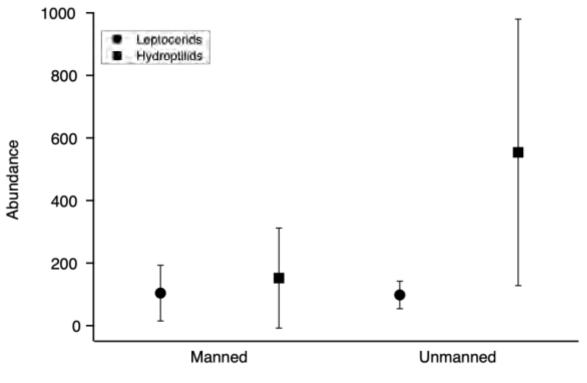


Figure 3. Hydroptilid results from the SE Oklahoma Region 2017 survey. Red and blue markers indicate Little River and Kiamichi River drainage sites, respectively. SP is a spring sample and SU is a summer sample. First number in series is the number of genera collected followed by species and individuals. Sites without data were sampled in 2018. All sites were resampled in 2018 both spring and summer for each site, so the 2018 data represent a more complete survey. These samples are currently being identified to species. Raw data used to produce this map are provided in Appendix 3. The map was produced using BatchGeo.



Type of Light Trap

Figure 4. Family-level abundance collected in manned and unmanned light traps during the summer of 2018. Markers are means and error bars are 88% confidence intervals. Non-overlapping error bars signify statistical significance at alpha = 0.05.

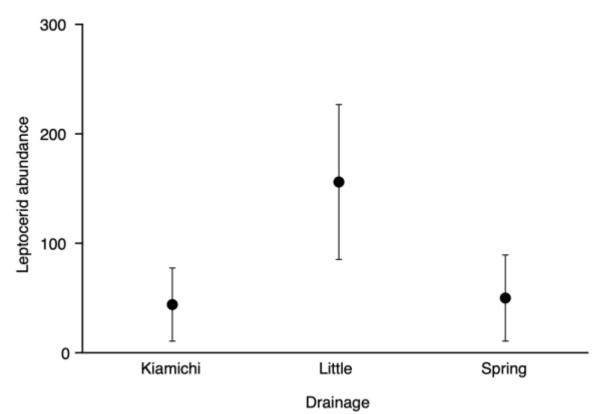


Figure 5. Numbers of individuals in the caddisfly family Leptoceridae in manned and unmanned light trap samples collected from three drainages sampled in the southeast Oklahoma survey. Markers are means and error bars are 88% confidence intervals. Non-overlapping error bars signify statistical significance at alpha = 0.05.

IX. APPENDIX

Appendix 1. Site information for the SE Oklahoma survey.

Appendix 2. Trap counts for microcaddisflies collected from 64 sites in the greater Arbuckle region of Oklahoma. Counts among sites are not directly comparable because of differences in trapping time and occasional subsampling. Sites are listed in Table 1.

Appendix 3. Raw data for the SE Oklahoma 2017 hydroptilid survey effort.

		Site and Collecti	County Ecoretion Rat. Long. Drainage Date Start Time End Time Weather Local				General Habitat Vegetation				Aquatic Sampling Adult Sampling			ng Habitat med LT Air Temp Water Temp Color Clarity Substrate mostly Subade substrate coatine								
Ste	col. Code	site info	County Ecoregion	n Lat.	Long. Drainage	Date St	et Time End	ine Weather	Local land use	Physical modifications	Aquatic	Riparian	Upland	Mand collecting	Dip netting (min) Surber Manned L	T Unmanned LT	Air Temp	Nater Temp Color	Clarity	Substrate mostly	%shade	substrate coating
Brian Branch (LFC)-E Luk Con	UL-2017-007	unamed Rd (maybe N4615) off HWY259 SW of Hochatown	McCurtain 36	16 34,134708	-94.794949 Little	8/9/17	17:34 NA	Partly cloudy, light wind, humid	forest	bridge	0008	trees	deciduous trees	lots.	13 10 00	1151	29	24.27 N/A	N/A	pebble	N/A	detribus
Cedar Creek-71300	UL-2018-005	off HWY259, long drive to the west located on 71300	McCurtain NA	34.176226	-94.908756 Little	5/17/18	11:55 NA	sunny, light wind, humid	forested, public access	bridee	floating, emergent	forest	NA	lona.	12 yes 100	3753	28	24 clear	clear	eravel, pebble, cobble	41 to 60	diatom
Cloudy Creek-1858 Rd	UL-2017-003	on 1858 just north of Cloudy Rd off HWY3 north of Rattan	Pushmataha 30	16 34.324604	4 -95.223442 Little	8/8/17	15:27	5:22 Partly cloudy	wildlife management	bridge	emergent, submergent	trees	forest	lona.	13.33 to no	3753	27	25.7 brown	law.	travel	0 to 10	diatom
Cloudy Creek-1858 Rd	UL-2018-003	on 1858 just north of Cloudy Rd off HWY3 north of Rattan	Pushmataha 30	16 34.324604	4 -95.223442 Little	5/16/18	17.05	7:32 clear, no wind	forest	bridee	emerrent	trees, shrubs	forest	lona.	10 10 10	3753	30	28 brown	medium	N/A	41 to 60	diatoms, detribus
Cloudy Creek-1858 Rd	UL-2018-003-SUN	f on 1858 just north of Cloudy Rd off HWY3 north of Rattan	Pushmataha 30	16 34.324604	4 -95.223442 Little	7/17/18	9.55	0:22 cloudy, calm	forest	bridee	emergent	forest	forest	lona.	10 10 10	LUES.	27	29 brown	NUDEDO	NA	21 to 40	filamentous aleae, green aleae (not filamentous), globular aleae, diatorns
Crum Creek-4240	KIA-2017-007	on 4240/Crum Creek Loop) off HWY2 south of Stanley	Pushmataha 36	16 14 527141	-95.479677 Gamichi	7/8/17	13-22	4:44 partly cloudy	NA	bridge	emergent	deciduous and pine forest	cesidential fields	0.003	45 00 00	1000	28	24.49 may	mark-hist	cobble, bedrock	61 to 80	diatoms
Crum Creek-4240	(14.2018.002	on 4240/Crum Creek Loop) off HWY2 south of Stanley	Pushmataha 36	16 14 527141	1 -95.479677 Kiamichi	5/15/18	12-15	2:56 partly cloudy, light wind	fromt	small bridge	emergent	deciduous trees, shrubs	forest	0.003	10 00 00	2003	25	24 mm	high	robble	NA	diatoms, detribus
Dry Creek - N1650	(14-2017-001		Pushmataha 16		.95 241 246 Elamichi			5:30 Partly cloudy	forest, nearby pasture	low water crossing	floating, emergent	trees (willow, sycamore, cedar)	forest	Lots .	NA cera bora	00	20	245 0000	rlear	eravel, pebble	11 to 40	filamentous aleae, diatoms
Dry Creek - N1650	(14.2017.001.2	on N1650 off HWY271 east of Tuskahoma	Pushmataha 366	34 62 70 75	-95,241246 Klamichi			5:40 partly cloudy, heavy rain	forest, fields	tone	emergent	trees	forest and fields	LOT 1	415 00 00	0.00	20	24.85 gray/blue	high-clea			erren aleae, datoms
Dry Creek - N1650	(14-2018-004	on N1650 off HMX221 east of Tuskaborna	Dunhmataha 16		-95,241246 Klamichi	5/15/18		7:55 cloudy storms	forest shrub	forest	emergent	forest shrub	Forest	200	5 40 00	0.00	MA D	10 DOOR	clear	nebble		diatorn, detritus
Dry Creek - N1650	(14.2018.002.518	M on N1650 off HWY271 east of Tuskahoma	Pushmataha 36		.95 241 246 Elamichi	7/10/18		5:05 partly cloudy, calm	freest	low water x	floating	fromt	Forest	0000	10 cm	100	31	30.544	clear	nebble		diatoms, green attached algae
Gipver Biver-HWY3		at HWY 3 NW of Broken Bow	McCurtain 36b	24 007708	-94.902528 Little	8/0/11		0:33 Monthy clear, humid, calm	forest highway		emergent	forest/highway	forest.	105	10 44	100	33	22.02	high	enhibite	2010	dialoge .
Giover River-HWY3		at HWY 3 NW of Broken Bow	McCurtain 36b	34.007708	-94.902528 Little			7:22 partly cloudy, calm	forest, highway	large bridge, beach for swimming		fromt	Forest		10 40 10	110	21	22,03 010 011	clear	cobble	0 to 10	distant.
Girver Boar MAYS			McCurtain 36b		-94.902528 Little	7/17/18		7.48 partly cloudy, carrier	forest, reprinary	large bridge	emergent	fromt	interest interest	pes	10 40 40	110		23 0 0 1	high	nebhle	01020	filamentous aleae, diatoms
Elemichi Eleer.MAY252	(14.2017.002		Le fiore 16		7 .04 654458 Elamichi	7/17/12	14:21		forest		emergent	TOP BIS	interest interest	pes	NA ves-nothing found no	yes	34	22.45 minu	medium		61 to 80	
Klamichi River-NF6028			Le Flore 16		-94.615854 Klamichi	7/1/17		8:00 clear (rain night before/early morning	1 forest	bridge bridges	emergent	Li eves	interest interest	pes	22.5 um	110	28.5	25.94 light brown		cobble		mostly diatoms. Ittle detritus
Karrichi River-NF6028	(14-2018-003		Le flore 1/2		-94.615854 Elamichi			5:02 partly cloudy, no wind	[] Increase	at rages		deciduous forest	in the second se	ites .	22.7 pm	yes	48.7	20.94 Ign crown	1. NW	COVOR.	41 to 60	
Elemichi River-MI6028			Le Flore 1//					2:41 partly cloudy, no wind	forest	tone	emergent floatine	deciduous forest	forest	yes	10 yes 910	yes	21	24 mone	clear	coopie		diatorni, elobular attached aleae
			Le Flore 1//		9 -95.126988 Little				88	86		torest	forest	Nes	10 yes	no	28	27 194		coopie		
Litte River Nolia						7/11/18			forest some residential	bridge	emergent	forest		10	10 yes 100	yes	27	29 NA	medium	cobble		flamentous algae, diatoms
Little River Luciow	UL-2018-001		Le Flore 36É		3 -94.847926 Little	5/16/18		2:50 Partly cloudy, light wind	forest, few houses	bridge, modification of vegetation	submerged, emergent/very little	e deciduous trees, shrubs	forest	yes	NA to ves-nothin	ng no	27	19.5 gray	high	cobble		flamentous algae, diatoms
Little River Luciow			Le Flore 36É		1 -95.223442 Little			2:04 warm, partly cloudy, scattered showe	rs NA	bridge	none	forest	forest	yes	10 yes 100	yes	30	25 gray		cobble		filamentous algae, diatoms, green algae substrate not fillamentous globular algae
Little River Nolia			Pushmataha 36É		9 -95.126988 Little			4:08 Partly cloudy, light wind	forest	bridge	submerged, emergent	forest, shrub	forest	yes	10 to	no	28	25 gray	medium			flamentous algae, diatoms, detritus
Little River-Ludiow	UL-2017-001		Le Flore 36		3 -94.847926 Little			1:26 Partly cloudy	forest, some residents and fields		emergent	trees and shrubs	forest and fields	yes	57 to no	yes	26	21.67 gray/brow				diatorm
Little River-Nolia	LIL-2017-002		Le Flore 36		9 -95.126988 Little		12:26		forest some residential	bridge	emergent	trees	forest	yes	30 no no	yes	NA	25.04 gray		cobble		diatorm
Lukfata Creek-Opah	LIL-2017-005		McCurtain 38			8/9/17		6:57 Partly cloudy, light wind, humid	forest	bridge	emergent	trees	deciduous trees	yes	10 no no	yes	30	29.79 N/A	clear			filamentous algae, diatoms, detritus
Lukfata Creek-Opah	LIL-2018-005	unamed Rd (maybe N4615) south of Lukfata Creek Trail off HWY259 Hochatown	McCurtain 38		7 -94.814849 Little	5/17/18		4:42 partly cloudy, calm	forest-timber	bridge	floating, emergent	forest, shrub	forest	yes	10 no no	yes-disturbed	30	25 NA	clear	cobble	11 to 20	
Lukfata Creek-Opah		f unamed Rd (maybe N4615) south of Lukfata Creek Trail off HWY259 Hochatown			7 -94.814849 Little			5:40 partly cloudy, calm	forest	low water crossing	emergent	forest	forest	yes	10 no yes	no	35	33 NA	clear	pebble, bedrock		filamentous algae, diatoms
Middle One Creek-One Crk Rd	K1A-2017-005	1 Creek Rd off HWY 271 NW of Cloudy, OK	Pushmataha 30		1 -95.371165 Klamichi			0:40 partly cloudy	forest	bridge	emergent	deciduous and pine forest	forest	yes	34.5 to yes	no	28.5	24.19 brown	low-med			diatorns
Middle One Creek-One Crk Rd	K1A-2018-005	1 Creek Rd off HWY 271 NW of Cloudy, OK	Pushmataha 30		3 -95.370748 Klamichi		15:11		forest	NA	emergent	shrubs, deciduous trees	forest	yes	10 no no	yes	25	24.5 gray	medium			diatorns, detritus
Mountain Fork River-Polk Rd 95			Le Flore 36					\$:05 Partly cloudy, light wind	forest	small bridge	none	shrubs and trees	forest	yes	10 yes no	no	27	22 grav	high	cobble		filamentous algae, diatoms, very little detritus
Mountain Fork River-Smithville	UL-2018-005-5UN	f off HWY 259 on HWY4 just east of Smithville, OK	McCurtain 36		3 -94.635766 Little			4:34 partly cloudy, calm	forest	large bridge	emergent	deciduous forest	Deciduous forest	yes	10 yes no	no	33	34 NA	clear	cobble, bedrock	0-10	diatoms, black filamentous algae
Peal Creek -Minnetonka	KIA-2017-003	located at Camp Minnetonka	Pushmataha 36	34.567052	2 -95.338558 Riamichi	5/17/17	19:13	0:00 clear	church camp, forest	bridge, low water crossing	floating, emergent	trees	church camp	yes	NA to yes	no	26	24.45 blue/gray	kaw.	bedrock.	11 to 20	filamentous algae, diatoms
Pine Creek-1794	KIA-2017-004	on 1794 off HWV2 south of Eubanks	Pushmataha 36	34.408902	2 -95.60351 Riamichi	7/1/17	11:45	3:30 clear (rain night before)	forest	bridge, private property near	submerged, floating, emergent	forest	forest	no	22.5 yes yes	no	26	26.97 N/A	clear	pebble, bedrock	0 to 10	filamentous algae, diatoms
Pine Creek-1794	KIA-2018-001	on 1794 off HWV2 south of Eubanks	Pushmataha 36	34.408902	2 -95.60351 Riamichi	5/15/18	10:50	1:45 partly cloudy	deciduous trees, some pine	small bridge	emergent	shrubs and trees	forest	yes	10 no yes	no	24	25 gray	high	pebble, bedrock	NA	diatoms
Pine Creek-1794	KIA-2018-003-5U8	M on 1794 off HWY2 south of Eubanks	Pushmataha 36	34.408902	2 -95.60351 Riamichi				NA	bridge	floating	forest	forest	yes	10 yes no	yes	27	32 NA	clear	cabble	0 to 20	
South Holly Creek-Holly Crk RD	UL-2017-004	on Holly Creek Rd (aka Cloudy Rd) east of Cloudy, OK	Pushmataha 30	16 34.329398	-95.1502 Little	8/8/17	16:59	7:58 Partly cloudy, light wind	NA	bridge	emergent, bank vegetetation	trees	Morobia WMA forest	yes	12 no no	yes	31	26.34 N/A	N/A	pebble, cobble	0 to 10	diatoms
South Holly Creek-Holly Crk RD	UL-2018-004	on Holly Creek Rd (aka Cloudy Rd) east of Cloudy, OK	Pushmataha 30	16 34.329428	-95.150169 Little	5/16/18	17:45	8:22 clear, no wind	forest	bridge	emergent	trees, shrub	forest	no	NA to no	yes	29	27 N/A	N/A	cabble	N/A	diatoms
South Holly Creek-Holly Crk RD		f on Holly Creek Rd (aka Cloudy Rd) east of Cloudy, OK	Pushmataha 30	16 34.329428	-95.150169 Little	7/17/18	10:45	1:10 cloudy, calm	forest	bridge	floating	forest	forest	yes	10 no no	yes-stalen?	27	30 gray	medium	NA	41-60	diatoms
Spring Creek HWY 82A	SPR-2018-002	park at intersection of HWYE2A and New Rd	Cherokee NA	35.144034	4 -94.907672 Spring	5/23/18	15:23	5:49 cloudy, calm	park, forest, small HWY	large bridge, park	emergent	trees, shrubs	forest	yers.	10 no no	no	22	20 NA	clear	pebble	11 to 20	diatoms
Spring Creek HWY 82A	SPR-20185-002	park at intersection of HWY82A and New Rd	Cherokee NA	35.144034	4 -94.907672 Spring	8/10/18	14:50	5:30 partly cloudy, warm, calm	park	NA	emergent	forest, HWY, park, shrub, decid	uforest	yers.	10 yes no	no	31	25 q	NA	pebble		diatoms, attached green algae
Spring Creek Oaks	SPR-2018-001	off HWY412A turn west on E580 Rd	Delaware 35		1 -94.862513 Spring	5/23/18		4:35 light rain	forest and fields	low water crossing	none	trees and shrubs	forest and fields	yers.	10 no yes	no	21	20 NA	clear	pebble	61 to 80	diatoms
Spring Creek Oaks	SPR-20185-001	off HWY412A turn west on E580 Rd	Delaware 35	19 35.175163	1 -94.862513 Spring	8/10/18	13:30	4:30 partly cloudy, warm, calm	NA	NA	0008	forest	forest	loga .	10 cm 00	02	34	23 NA	clear	pebble	41 to 60	diatoms, attached green algae
Spring Creek Off E0510 Rd	SPR-2018-005	Off HWY 82, turn west at filling station (Ear Bob Rd), site pulloff on N4380 Rd	Mayes NA	36.126235	-95 208209 Spring	5/24/18		1:45 clear, calm	forest and farms		very little emergent	trees, shrubs	forest	tora	10 vm mp	0.2	27	20 NA	clear	pebble		diatorm
Spring Creek Off E0510 Rd	SPR-20185-005		Mayes NA		-95.208209 Spring	8/11/18		clear, caim, warm	camping location	NA	0000	shrubs, deciduous trees	forest	lora .	10 mm mp	1123	27	21 NA	clear	pebble		diatoms, attached ereen aleae
Spring Creek Swim Beach	SPR-2018-004	off HWY82, turn east on E635 RD then left at T, swim beach near Cave Spring	Cherokee NA	35.104054	4 -95.0961 Spring	5/24/18	9:05	9:53 clear, calm	forest, some residents	medium sized bridee	emergent	trees, shrubs	forest	lora .	10 mm 000	015	26	20 NA	clear	pebble	0 to 10	diatorm
Spring Creek Swim Beach	SPR-20185-004	off MWY82, turn east on E635 RD then left at T, swim beach near Cave Spring			4 -95.0961 Spring	8/11/18	8.55 NA	clear, caim, warm	swim hole	NA	emerrent	deciduous trees, shrubs	forest	lora	10 mm	02	21	21 NA	clear	pebble	11 to 20	diatoms, attached ereen aleae
Spring Creek Termitia	\$28,2018,003	412A to E 630 Rd turn west, stay right at Y onto E626 Rd then left on 4485 Rd		35,0905/95		5/21/18		7.05 partly cloudy, calm	front	low water crossing	emerrent	trees, shrubs	Forest	Loga .	10 00 00	100	25	20.04	clear	nebble	0 to 10	
Spring Creek Teresita	CP8.2018C.003	4124 to E 630 kit turn west, stay right at 1 onto E626 kit then left on 4485 kit		36,0305,05		*/10/18	16-30 NA		forest	low water crossing	emerrent	10.0	144	Law .	10	100	2/	77.000	NA.	nehhla	20.00	diatorn, attached ereen aleae
Unnamed storam-N4615	UL-2018-003		McCurtain NA			#/17/18		5:35 partly cloudy, warm, calm	format	tow water crossing	and the second se	100	100	less.	A STREET AND	pes .	20	11 100	risar	people	100 111 to 100	diatoms, attached green agae fiatoms, debthis
Canhamed stream-N4615	UL-2018-007		McCurtain NA					5:35 Partly cloudy, cam 5:30 Partly cloudy, light wind, humid	forest, logging activity on road	hridan	emergent, bank vegetetation	inter and a second s	deridanus trees	ines.	100		32	44 MA	Long Contract	COVOR.		diatomi, detritus diatomi, detritus
Tashau Creek -N4615	UL-2017-005	unamed Rd (maybe N4015) north of Nochatown RV Park (first left) off HW1259 I unamed Rd (maybe N4015) north of Nochatown RV Park (first left) off HW1259			-94.765475 Little			mostly sunny, humid, light wind	forest, logging activity on road	onoge	emergent, bask vegetetation	trees	deciduous trees	yes	12 10 10	yes	30	25.01 brownygra 25 clear	y righ clear	proces gravel, pebble	61 to 80	
Lanuary Creek -04012	DC-2010-008	parameter and foredate states of mount of constraining to have (used with) out time (750 hill	10.00 Million 10.00	1 201013/1	+1 -minute (1996)	3747/18	10.00 PA	proving manage matting, sight wind	Inc. and A	fer selle	Personal Person	lu ees	100	Ites	alles ho	Betrail60	21	e cear	weat	E- #***, y=0000	101 10 80	wide set the

												Site number							
Taxon	1	2	3	4	5	6	7	8	9	10	11	12	13	14					
Cernotina calcea																			
Cernotina oklahoma																			
Cernotina spicata																			
Cernotina unidentified																			
Hydroptila ajax			1		16	5	6	1	2	4		143		1					
Hydroptila species nr ajax												298							
Hydroptila amoena																			
Hydroptila angusta		5			2	5			6	4		162							
Hydroptila arctia																			
Hydroptila argosa																			
Hydroptila armata	1	1	1		2	6			1	1		28							
Hydroptila consimilis	3	3		1	5	12	5	1	2			58	13	1					
Hydroptila grandiosa							1												
Hydroptila hamata		2				6	1	10		6									
Hydroptila melia			2	4															
Hydroptila sp 08 (nr melia)		1	2	4									1						
Hydroptila modica																			
Hydroptila protera																			
Hydroptila tarsalis																			
Hydroptila waubesiana		1	1		1	9	1		7	6		467	3	1					
Hydroptila sp 09																			
Hydroptila unidentified										2									
Mayatrichia ayama																			
Mayatrichia ponta					1	1						3							
Mayatrichia unidentified										1									
Metrichia nigritta	1			12															
Neotrichia edalis																			
Neotrichia minutisimella																			
Neotrichia okopa																			
Neotrichia osmena																			
Neotrichia vibrans																			
Neotrichia unidentified																			
Ochrotrichia capitana																			
Ochrotrichia spinosa				1															
Ochrotrichia stylata																			
Ochrotrichia nr stylata				56				1				2	1						
Ochrotrichia tarsalis			1		7	16			4	4		112	9	1					
Ochrotrichia unidentified																			
Orthotrichia aegerfasciella				3						1		12	9	7					
Orthotrichia cristata	3	8	1					1	3										
Orthotrichia unidentified	\downarrow																		
Oxyethira aculea					1							6							
Oxyethira pallida			2	3	1				26	27		341	31	91					
Oxyethira unidentified	\downarrow	1																	
Hydroptilidae unidentified																			

	Site numbe													
Taxon	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Cernotina calcea														
Cernotina oklahoma														
Cernotina spicata														
Cernotina unidentified														
Hydroptila ajax			1			2			5	9	26			8
Hydroptila species nr ajax		1	5				1				6			3
Hydroptila amoena											1			
Hydroptila angusta			21	2	1	5			9	7				
Hydroptila arctia		5												
Hydroptila argosa														
Hydroptila armata			13		1	2			5	17				1
Hydroptila consimilis				1										6
Hydroptila grandiosa														
Hydroptila hamata						1		1		2				2
Hydroptila melia		1		1		1		3	62	18				
Hydroptila sp 08 (nr melia)		13	18	7		10								
Hydroptila modica														
Hydroptila protera					3			1			14			3
Hydroptila tarsalis			121											
Hydroptila waubesiana			19	1	3	1		1	8	5				2
Hydroptila sp 09			2											
Hydroptila unidentified					141	24		56						
Mayatrichia ayama									2	2				
Mayatrichia ponta		5			5			1	3	1				
Mayatrichia unidentified														
Metrichia nigritta	1		3											
Neotrichia edalis									3	2				
Neotrichia minutisimella														
Neotrichia okopa									6					
Neotrichia osmena														
Neotrichia vibrans								1						
Neotrichia unidentified										1	2			
Ochrotrichia capitana					129	1		1						
Ochrotrichia spinosa														1
Ochrotrichia stylata		27		12		1	2	14	5	10				
Ochrotrichia nr stylata			1		1									
Ochrotrichia tarsalis		4			1	1			24	15				1
Ochrotrichia unidentified														
Orthotrichia aegerfasciella			9	1	14	1		7	3	6				
Orthotrichia cristata														
Orthotrichia unidentified														
Oxyethira aculea														
Oxyethira pallida				2	94	37		14	16	7	1			
Oxyethira unidentified														
Hydroptilidae unidentified									500	300				

	Site number																
Taxon	29	30	31	32	33	34	35		37	38	39	40	41	42			
Cernotina calcea	3	12		2													
Cernotina oklahoma						24											
Cernotina spicata		4															
Cernotina unidentified		5										2					
Hydroptila ajax				1		17		3		1							
Hydroptila species nr ajax																	
Hydroptila amoena																	
Hydroptila angusta	3	1						1									
Hydroptila arctia	1																
Hydroptila argosa																	
Hydroptila armata	1							2									
Hydroptila consimilis		3		1		1											
Hydroptila grandiosa																	
Hydroptila hamata			6	1		37		1									
Hydroptila melia		2															
Hydroptila sp 08 (nr melia)																	
Hydroptila modica		2															
Hydroptila protera		10	1	10													
Hydroptila tarsalis																	
Hydroptila waubesiana	6	2	1			1	2	7		2				1			
Hydroptila sp 09																	
Hydroptila unidentified			52									13		10			
Mayatrichia ayama	3	8	6			8	24										
Mayatrichia ponta		96				23											
Mayatrichia unidentified																	
Metrichia nigritta																	
Neotrichia edalis																	
Neotrichia minutisimella							1										
Neotrichia okopa		1															
Neotrichia osmena																	
Neotrichia vibrans																	
Neotrichia unidentified																	
Ochrotrichia capitana																	
Ochrotrichia spinosa																	
Ochrotrichia stylata																	
Ochrotrichia nr stylata																	
Ochrotrichia tarsalis	1					5											
Ochrotrichia unidentified																	
Orthotrichia aegerfasciella		1	1	4			7	5					5	5			
Orthotrichia cristata		7		2		1	5			2	1			1			
Orthotrichia unidentified												8					
Oxyethira aculea																	
Oxyethira pallida	22	49	7	3	1	18		400		3	2	7	4	30			
Oxyethira unidentified																	
Hydroptilidae unidentified		250		65		212	85			60							

							number							
Taxon	43	44	45	46	47	48	49	50	51	52	53	54	55	56
Cernotina calcea														
Cernotina oklahoma														
Cernotina spicata												1		
Cernotina unidentified		1												
Hydroptila ajax	5					1	5							
Hydroptila species nr ajax														
Hydroptila amoena														
Hydroptila angusta					1	1								4
Hydroptila arctia														
Hydroptila argosa														
Hydroptila armata	3									1				
Hydroptila consimilis	5													
Hydroptila grandiosa														
Hydroptila hamata	1	2	1											
Hydroptila melia														
Hydroptila sp 08 (nr melia)														
Hydroptila modica														
Hydroptila protera														
Hydroptila tarsalis														
Hydroptila waubesiana	1	2					2	1	2	3				1
Hydroptila sp 09														
Hydroptila unidentified						1								
Mayatrichia ayama														
Mayatrichia ponta														
Mayatrichia unidentified														
Metrichia nigritta														
Neotrichia edalis														
Neotrichia minutisimella														
Neotrichia okopa														
Neotrichia osmena														
Neotrichia vibrans														
Neotrichia unidentified														
Ochrotrichia capitana														
Ochrotrichia spinosa														
Ochrotrichia stylata			1											
Ochrotrichia nr stylata														
Ochrotrichia tarsalis		1												
Ochrotrichia unidentified	1													
Orthotrichia aegerfasciella	1		1			1			1	15		37	7	
Orthotrichia cristata	1	1										23	1	2
Orthotrichia unidentified	7	11												23
Oxyethira aculea														
Oxyethira pallida	56	28				3	4			4		3		2
Oxyethira unidentified														
Hydroptilidae unidentified														

	Site number 57 58 59 60 61 62 63												
Taxon	57	58	59	60	61	62	63	64					
Cernotina calcea								1					
Cernotina oklahoma													
Cernotina spicata				1	2	1		5					
Cernotina unidentified							1						
Hydroptila ajax				1	1								
Hydroptila species nr ajax													
Hydroptila amoena													
Hydroptila angusta			2	2			2	78					
Hydroptila arctia													
Hydroptila argosa						1							
Hydroptila armata													
Hydroptila consimilis													
Hydroptila grandiosa													
Hydroptila hamata			1										
Hydroptila melia				5									
Hydroptila sp 08 (nr melia)													
Hydroptila modica													
Hydroptila protera			1	1	2								
Hydroptila tarsalis													
Hydroptila waubesiana	1	1	4		2			2					
Hydroptila sp 09													
Hydroptila unidentified								41					
Mayatrichia ayama						1		16					
Mayatrichia ponta				5									
Mayatrichia unidentified													
Metrichia nigritta													
Neotrichia edalis													
Neotrichia minutisimella								2					
Neotrichia okopa				82									
Neotrichia osmena					5								
Neotrichia vibrans								1					
Neotrichia unidentified	1												
Ochrotrichia capitana													
Ochrotrichia spinosa													
Ochrotrichia stylata													
Ochrotrichia nr stylata													
Ochrotrichia tarsalis		1		1				2					
Ochrotrichia unidentified	1				1		1						
Orthotrichia aegerfasciella	17	16	6	15	2	10	4	13					
Orthotrichia cristata	4	7	3	13	5	4	1	3					
Orthotrichia unidentified		15	15	26	5	16		49					
Oxyethira aculea													
Oxyethira pallida	6	5	9	22	10	2	1	36					
Oxyethira unidentified													
Hydroptilidae unidentified													

			Hydroptila							Oxyethira					Orthotrichia	Mayatrichia	Ithytrichia	Protoptila	Neotrichia		Cernotina	Ochrotrichia	
			H. armata	H. hamata	H. grandiosa	H. angusta	H. amoena	H. waubesiana	H. sp	Ox. sp.	Ox. pallida	Ox. aculea	Ox. novasota	Or. aegaerfas	ciella Or. cristata	M. ayama	I. clavata	P. lega	N. sp.	C. sp.	C. calcea	Oc. sp.	
Nature Serve	e Conservation Rank			G5	G5	G5	G5	G5			G5	G5	G4/G5	G5	G5	G5	G5				G5		
Site Drainage	Site Info	Date	male female total	male female total	male female total	male female tot	al male female total	I male female tota	I male female tot	al male female tota	I male female to	tal male female tota	I male female tota	I male female	total male female to	tal male female tota	al male female total	male female total	male female total	male female to	otal male female total	nale female total	
1 Little River	Ludlow	7/9/17		1 10 1	L 19 1	9 1	1 4 4	4		17 1	7 1 7	8		3	3								63
2 Little River	Nolia	7/9/17																					0
3 Little River	Cloudy Creek	8/8/17		4 269 27	3 1 253 25	4		1	1 1 0	1 15 1	5 2	2		2 13	15 4	4 1 2	3						568
4 Little River	South Holly Creel	k 8/8/17		2	2 5	5							1 3	4									11
5 Little River	Yashau Creek	8/9/17			22 2	2		1	1	1	1	1	1	1 1	2								27
6 Little River	Lukfata Creek	8/9/17	1 6 7	5	5 19 1	9		5	5	3	3												39
7 Little River	Briar Branch (LFC) 8/9/17																					0
8 Little River	Glover River	8/9/17		1	1 1 6	7																	8
9 Kiamichi Rive	er Dry Creek	5/16/17			11 1 1	2																	12
10 Kiamichi Rive	er Peal Creek	5/17/17		1 1	2 2 41 4	3		1	1		2 8	10		2	2		1 1						59
11 Kiamichi Rive	er Big Cedar	5/17/17																					0
9 Kiamichi Rive	er Dry Creek	6/8/17	3 3	3 17 2	507 50	7		1 2	3	1 22 2	3			3 1	4			1 1					561
12 Kiamichi Rive	er Pine Creek	7/3/17		1	1 1	1													1 1				3
13 Kiamichi Rive	er E. Big Cedar	7/3/17		42 4.	2 2 52 5	4				32 3	2		4	4 1	1	4 7 :	11				6 2 8	2 2	2 154
14 Kiamichi Rive	er Middle One Cree	k 7/8/17		9	6 0	6								1	1					3	3		19
15 Kiamichi Rive	er Crum Creek	7/8/17			1	1																	1
																							0
	Totals		10	36	5 95	D	1 4	4 1	1	1 9	1	20	1	8	28	4 :	14 1	1	1		3 8	2	2 1525