

An Annotated List of Aquatic Insects of Fort Sill, Oklahoma, Excluding Diptera with Notes on Several New State Records

ROBERT E. ZUELLIG,¹ BORIS C. KONDRATIEFF,² JASON P. SCHMIDT,² RICHARD S. DURFEE,³
DAVID E. RUITER,⁴ AND INEZ E. PRATHER²

ABSTRACT: Qualitative collections of aquatic insects were made at Fort Sill, Lawton, Oklahoma, between 2002 and 2004. Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera, aquatic Heteroptera, Neuroptera, and Megaloptera were targeted. Additional records are included from a survey that took place in 1999. More than 11,000 specimens from more than 290 collections were examined. Based on the current understanding of aquatic insect systematics, 276 taxa distributed over 8 orders, 46 families, and 141 genera were identified. Twenty-three of the 276 taxa, *Plauditus texanus* Wiersema, *Tricorythodes allectus* (Needham), *Palmacorixa nana walleyi* Hungerford, *Climacia chapini* Parfin and Gurney, *Oxyethira forcipata* Mosely, *Oxyethira janella* Denning, *Triaenodes helo* Milne, *Ylodes frontalis* (Banks), *Acilius fraternus* Harris, *Coptotomus loticus* Hilsenhoff, *Coptotomus venustus* (Say), *Desmopachria dispersa* Crotch, *Graphoderus liberus* (Say), *Hydrovatus pustulatus* (Melsheimer), *Hygrotus acaroides* (LeConte), *Liodessus flavicollis* (LeConte), *Uvarus texanus* (Sharp), *Gyrinus woodruffi* Fall, *Haliplus fasciatus* Aube, *Haliplus lewisii* Crotch, *Haliplus tortilipenis* Brigham & Sanderson, *Chaetarthria bicolor* Sharp, *Epimetopus costatus* complex, and *Hydrochus simplex* LeConte are reported from Oklahoma for the first time. The three most diverse orders included Coleoptera (86 species), Odonata (67 species) and Trichoptera (59 species), and the remaining taxa were distributed among Heteroptera, (30 species), Ephemeroptera (21 species), Plecoptera (6 species), Megaloptera (4 species), and Neuroptera (3 species). Based on previous published records, many of the species collected during this study were expected to be found at Fort Sill; however, 276 taxa of aquatic insects identified from such a small geographic area is noteworthy, especially when considering local climatic conditions and the relatively small size of Fort Sill (38,300 ha). Despite agricultural practices in Oklahoma, the dust bowl days, and the development of water-based recreation at Fort Sill, a high percentage of the total known aquatic insect fauna of Oklahoma can be found in a small geographic area.

KEY WORDS: Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera, Heteroptera, Neuroptera, Megaloptera, Fort Sill, Oklahoma

Extensive loss of aquatic habitat and associated biodiversity has occurred in most areas of the United States despite legal mandates and massive expenditures. Only 42 high-quality, free-flowing streams remain in the contiguous United States due to human alteration (Benke, 1990). Exploitation of water resources, pollution, dredging, channelization, damming, and dewatering has led to biotic reduction and loss of unique ecological characteristics of many streams in the United States (Masteller, 1993). In a study of Oklahoma streams, Porter *et al.* (2000) indicated that 74% of the streams in central Oklahoma had some level of water-quality impairment. Additionally, the drought-assisted dust bowl of the 1920's and 1930's likely impacted Oklahoma's aquatic environments (Bonnifield, 1979).

The majority of papers published on the aquatic insects of Oklahoma concern specific streams or areas and usually report most taxa to the generic level (Bass, 1990, 1994, 1995; Bryant and Wilhm, 1990; Cheper, 1985; Harrel, 1969; Hoover, 1990; Margraf and Plitt, 1982; McKinley *et al.*, 1972; Morris and Madden, 1978; Orth *et al.*, 1982; Reisen, 1975, and

¹ U. S. Geological Survey, Denver Federal Center, MS 415, Denver, Colorado 80225.

² Department of Bioagricultural Sciences and Pest Management, Colorado State University, Fort Collins, Colorado 80523.

³ 329 Canyon Creek Road, Hamilton, Montana 59840.

⁴ 6260 South Grant Street, Centennial, Colorado 80121.

Wilhm *et al.*, 1979). Excellent surveys of Odonata, Plecoptera, and Trichoptera have been completed in Oklahoma. Bird (1932), Bick and Bick (1957), and Abbott and Stewart (1998) reported 132 species of dragonflies and damselflies from Oklahoma. Stark and Stewart (1973a, b), Stewart *et al.* (1974), and Poulton and Stewart (1991) have studied the stoneflies of Oklahoma with emphasis on the eastern part of the state. Additionally, Bowles and Mathis (1992) and Moulton and Stewart (1996) reported 146 caddisflies from Oklahoma.

Inventories of aquatic insects are important for several reasons. First, aquatic insects have varying degrees of sensitivity to environmental stressors (e.g., siltation, flooding, pollution), which make them excellent indicators of water quality. Second, aquatic insects play a critical role in aquatic food webs by processing algae and leaf litter at lower trophic levels, and also by serving as food for fish and other organisms at higher levels in an aquatic food web. Third, many aquatic insect species spend the adult portion of their life-cycle in the terrestrial environment, thereby subsidizing terrestrial food webs as a plentiful food source for bats, birds, and riparian spiders. Inventories of aquatic insects are also important for the management of military lands. Knowledge of species occurrence facilitates planning by managers, minimizing conflicts between military testing and training activities and natural resource conservation. Our study had two main objectives: first, to qualitatively document the aquatic insects of Fort Sill, excluding Diptera, and second, to contribute to the knowledge of the distribution of aquatic insects of Oklahoma.

Study Site

Fort Sill Military Reservation is located in southwestern Oklahoma, approximately 160 km southeast of Oklahoma City. The City of Lawton is on the south side of Fort Sill, and the Wichita Mountains National Wildlife Refuge borders the northern and western boundaries of the military installation. Fort Sill encompasses an area of approximately 38,300 ha, extending 37 km east-west and 13 km north-south, all of which is in Comanche County. The eastern and southwestern portions are rolling upland grasslands, whereas the southeastern end of the Wichita Mountains extends into the northwestern and central portion of Fort Sill. Elevations of these hilly and rocky slopes range from 329 m in the East Cache Creek Valley to 673 m on Mt. Sherman. The rolling grasslands are developed on Permian redbeds, red shales, and sandstones with intercalated layers of gypsum. The Wichita Mountains and associated elevated areas consist of a Pre-Cambrian crystalline igneous core surrounded by outcrops of Paleozoic limestone and sandstone. The topography is gently rolling, with perennial and ephemeral tributaries of the Red River traversing the landscape. Several reservoirs and lakes have been constructed by damming ephemeral or perennial streams to provide water-based recreation. Grasses such as *Schizachyrium scoparium* var. *frequens* (little bluestem), *Bouteloua gracilis* (blue grama), *B. hirsuta*, (hairy grama), and *Andropogon gerardii* (big bluestem) and various forbs are the dominant vegetation (Johnson *et al.*, 1990). On extensive sandy areas, scrub oak forest or oak savanna represents a western extension of the *Quercus stellata* – *Q. marilandica* (post oak-blackjack oak, Fagaceae) forest association. Additionally, small-interspersed groves of *Celtis reticulata* (netleaf hackberry, Ulmaceae) occur along the edges of the grasslands, especially in the eastern part of Fort Sill. The streams of the Wichita Mountain region of Fort Sill are very different from the more deeply incised silted streams of the eastern rolling grasslands area. Flow in many of the smaller streams is intermittent in late summer and fall or even completely dry along some stretches. Associated riparian areas of this region adjacent to Fort Sill and the Wichita Mountains National Wildlife Refuge have been substantially altered by agricultural practices.

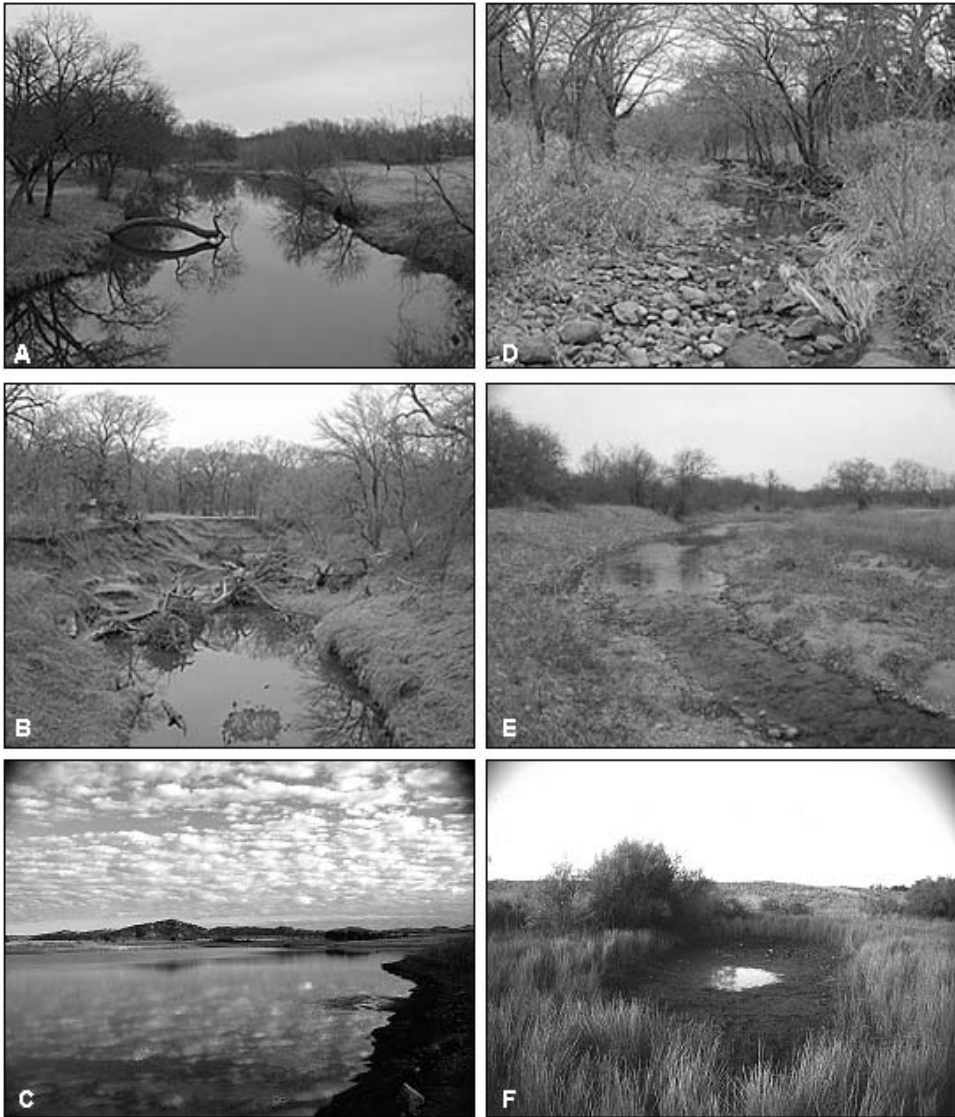


Fig. 1. Photos showing typical aquatic habitats sampled at Fort Sill. Medicine Creek (A), East Cache Creek (B), Pottawatomie Pond (C), Quannah Creek (D), Blue Beaver Creek (E), small temporary pond near Pottawatomie Pond (F), Fort Sill, Comanche County, Oklahoma.

Methods

Qualitative collections focusing on adults were made to provide a list of species from typical aquatic habitats associated with Fort Sill, Lawton, Oklahoma (Fig. 1). Ephemeroptera, Plecoptera, Trichoptera, Odonata, Coleoptera, aquatic Heteroptera, aquatic Neuroptera, and Megaloptera were targeted on 39 collecting trips between 2002 and 2004. The 2- to 5-day trips were planned to obtain maximal seasonal coverage of the varying life histories of the species expected to occur in the region. All months were sampled several times except November, December, and January. Specific locations were selected to

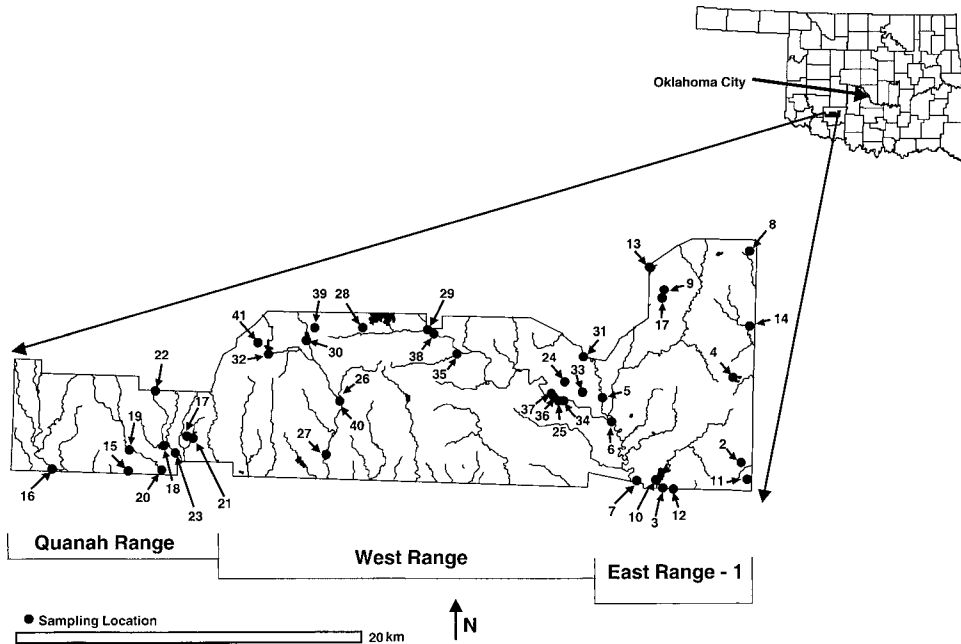


Fig. 2. Map showing collection sites, Fort Sill, Oklahoma Counties, and Oklahoma. Base map credits are as follows: State of Oklahoma and county outlines from Environmental Systems Research Institute, Inc. Redlands, California, USA, Series issue: 2000.

include the variety of habitats present at Fort Sill. Forty-one sampling locations were established over the course of the study (Fig. 2). Table 1 presents a list of collection site information where aquatic insects were collected. Bridges, low water crossings, short hikes, and unimproved two-track roads provided access to stream-sampling areas. Road accessible lakes, ponds, and associated seeps and temporary ponds were also sampled. Access to some of the lakes and temporary ponds required short hikes.

Techniques used to collect specimens included the use of beating sheets, sweep nets, dip nets (1-mm mesh), portable ultra-violet light traps, kick nets (1-mm mesh), and hand-picking from submerged or exposed substrate. Multiple ultraviolet light traps were deployed from sunset to sunrise during each collecting trip, and ethyl acetate was used as a killing agent. For identification purposes, immature mayflies, stoneflies, and caddisflies were reared to adulthood in the laboratory at Colorado State University when possible. All material was preserved in 80% ethanol and transported to the laboratory for additional sorting and identification. Material collected during this study was deposited in the C. P. Gillette Museum of Arthropod Diversity, Colorado State University, Fort Collins, with representative caddisfly specimens deposited in the personal collection of David E. Ruiter, Centennial, Colorado.

Results and Discussion

More than 11,000 specimens from more than 290 collections from Fort Sill were examined during this study. Based on the current understanding of aquatic insect systematics, 276 taxa distributed over 8 orders, 46 families, and 141 genera were identified. Of these 276 taxa, 22 are reported from Oklahoma for the first time. The most diverse orders included Coleoptera (86 species), Trichoptera (59 species), and Odonata

Table 1. Collection sites sampled at Fort Sill, Comanche County, Oklahoma between 1999 and 2004. Site ID numbers (1–41) correspond to site locations in Fig. 2. Status provides general information regarding the permanency of each aquatic habitat. PER = perennial and INT = intermittent.

Site ID	Location	Status
1	E Range	
2	E Range, 0.8 km east of Menoher Hill	
3	E Range, 0.8 km southeast of Parks Hill on unnamed Rd. to Parks Hill near Lake George	
4	E Range, Clear Lake East Boundary Rd. East of Austin Ridge	PER
5	E Range, E Cache Creek, Peachtree Crossing	PER
6	E Range, East Cache Creek, Hoyle Bridge	PER
7	E Range, East Cache Creek, South Boundary Rd.	PER
8	E Range, Elgin Pond, near East Boundary Rd.	PER
9	E Range, Frisco Tank, Southeast of Frisco Ridge	PER
10	E Range, Lake George	PER
11	E Range, Lark Pond, West of East Boundary Rd.	PER
12	E Range, Parks Hill	
13	E Range, Pond, Elgin Rd. 3 km South Southwest of Frisco Ridge	PER
14	E Range, small pond, 4 km north of Bald Ridge Rd.	PER
15	Quanah Range, Jackson Hole Pond, 0.8 km east of South Boundary Rd.	PER
16	Quanah Range, Post Oak Creek, South Boundary Rd.	INT
17	Quanah Range, Pottawatomie Pond	PER
18	Quanah Range, Quanah Creek, South Boundary Rd.	INT
19	Quanah Range, Rock Creek, 1.25 km North of South Boundary Rd.	INT
20	Quanah Range, Rock Creek, South Boundary Rd.	INT
21	Quanah Range, small temporary pond near Pottawatomie Pond	INT
22	Quanah Range, W Cache Creek, border of Wichita Mountains National Wildlife Refuge	PER
23	Quanah Range, W Cache Creek, South Boundary Rd.	PER
24	W Range, Apache Gate Rd., north of Natural Resource Building	
25	W Range, Apache Gate Rd., White Wolf Bridge	
26	W Range, Blue Beaver Creek, Blue Beaver Valley Rd.	INT
27	W Range, Blue Beaver Creek, McKenzie Hill Rd.	INT
28	W Range, Lake Elmer Thomas at Pratt Hill	PER
29	W Range, Lake Elmer Thomas near Rabbit Hill Airfield, North of North Boundary Rd.	PER
30	W Range, Engineer Pond	PER
31	W Range, Hwy 49 entrance	
32	W Range, Ketch Lake	PER
33	W Range, Knob Hill Rd. near Chatto Ridge	
34	W Range, Medicine Creek	PER
35	W Range, Medicine Creek, 4 mile Crossing, Tower Two Rd.	PER
36	W Range, Medicine Creek, Archery Range, West of Hand Hill	PER
37	W Range, Medicine Creek, Medicine Bluffs	PER
38	W Range, Medicine Creek, North Boundary Rd.	PER
39	W Range, near Engineer Pond	
40	W Range, near junction of Blue Beaver Valley Rd. and Deer Creek Rd.	
41	W Range, pond, 0.5 km North of Engineer Pond	PER

(67 species) (Table 2). The remaining 65 taxa were distributed between Heteroptera, (30 species), Ephemeroptera (21 species), Plecoptera (6 species), Megaloptera (4 species), and Neuroptera (3 species). One additional mayfly taxa was reported by Vaughn and Obermeyer (2002), which we did not collect, that we included in the total number of aquatic insect taxa excluding Diptera occurring at Fort Sill (Table 2). A discussion of the major groups of aquatic insects collected during this study follows with special attention toward the 22 new state records.

Table 2. Aquatic insect species excluding Diptera collected at the Fort Sill Military Installation, Comanche County, Oklahoma, between 1999 and 2004. Orders are arranged phylogenetically followed by the alphabetical listing of families, genera, and species.

ORDER EPHEMEROPTERA (8 families)

Family Baetidae (10 species)

- Baetis intercalaris* McDunnough: 7, 38.
Callibaetis floridanus Banks: 7, 28.
Callibaetis montanus Eaton: 7.
Callibaetis species: 7.
Falleon quilleri (Dodds): 7, 35, 38.
Plauditus dubius (Walsh): 1, 7, 35, 38.
¹*Plauditus texanus* Wiersema: 7, 29.
Procloeon species: 7.
Pseudocloeon dardanum (McDunnough): 7, 35, 38.
Pseudocloeon ephippiatum (Traver): 35.

Family Caenidae (5 species)

- Brachycercus lacustris* (Needham): 30.
Caenis amica Hagen: 4, 7, 10, 17, 23, 24, 25, 30, 35.
Caenis latipennis Banks: 10, 16, 38.
Caenis punctata McDunnough: 35.
Caenis species: 38.

Family Ephemeridae (1 species)

- Hexagenia limbata* (Serville): 7, 8, 10, 22, 25, 28, 30.

Family Heptageniidae (1 species)

- Stenonema femorata* (Say): 1, 5, 7, 17, 21, 22, 23, 27, 29, 35, 38, 40.

Family Isonychiidae (1 species)

- Isonychia rufa* McDunnough: 1, 6, 7, 37, 25, 28, 35, 38.

Family Leptohyphidae (2 species)

- ¹*Tricorythodes allectus* (Needham): 7.
Tricorythodes species: 38.

Family Leptophlebiidae (1 species)

- Neochoroterpes oklahoma* (Traver): 7, 5.

Family Polymitarcyidae (1 species)

- Tortopus puella* (Pictet): 7.

ORDER ODONATA (7 Families)

Family Calopterygidae (3 species)

- Calopteryx maculata* (Beauvois): 25.
Hetaerina americana (Fabricius): 1, 7, 29, 41.
Hetaerina titia (Drury): 7, 29, 41.

Family Coenagrionidae (21 species)

- Argia apicalis* (Say): 10, 23, 35.
Argia fumipennis (Burmeister): 27.
Argia immunda (Hagen): 27, 38.
Argia moesta (Hagen): 1, 7, 10, 22, 23, 27, 28, 35, 38.
Argia sedula (Hagen): 7, 27, 35, 38.
Argia translata Hagen in Selys: 22, 27, 35, 38.
Enallagma aspersum (Hagen): 17.
Enallagma basidens Calvert: 1, 10, 5, 15, 17, 23, 35, 38.
Enallagma civile (Hagen): 7, 9, 10, 12, 15, 17, 21, 23, 27, 28, 32, 35, 38.
Enallagma divagans Selys: 23, 38.
-

Table 2. Continued.

<i>Enallagma exsulans</i> (Hagen): 7, 17, 27.
<i>Enallagma praevarum</i> (Hagen): 27.
<i>Enallagma signatum</i> (Hagen): 10, 17, 30, 32, 35.
<i>Enallagma vesperum</i> Calvert: 28.
<i>Ischnura demorsa</i> (Hagen): 17, 28.
<i>Ischnura denticollis</i> (Burmeister): 35.
<i>Ischnura hastata</i> (Say): 21.
<i>Ischnura perparva</i> McLachlan in Selys: 21, 28, 40.
<i>Ischnura posita</i> (Hagen): 5, 7, 20, 23, 28, 32, 35.
<i>Ischnura verticalis</i> (Say): 1, 7, 10, 23, 35.
<i>Telebasis salva</i> (Hagen): 7, 35.
Family Lestidae (2 species)
<i>Lestes alacer</i> Hagen: 17, 21.
<i>Lestes disjunctus australis</i> Walker: 7, 17.
Family Aeshnidae (2 species)
<i>Anax junius</i> (Drury): 7, 10, 17, 25, 29, 35.
<i>Basiaeschna janata</i> (Say): 28, 38.
Family Cordulegastridae (1 species)
<i>Cordulegaster obliqua</i> (Say): 1.
Family Gomphidae (10 species)
<i>Dromogomphus spinosus</i> Selys: 7, 23, 27, 38.
<i>Dromogomphus spoliatus</i> (Hagen in Selys): 7, 10, 11, 30, 38.
<i>Erpetogomphus designatus</i> Hagen in Selys: 7, 10, 22, 23, 27, 35, 38.
<i>Gomphus externus</i> Hagen in Selys: 7, 27.
<i>Gomphus militaris</i> Hagen in Selys: 1, 7, 10, 11, 17, 20, 22, 23, 27, 28, 38.
<i>Gomphus ozarkensis</i> Westfall: 7.
<i>Hagenius brevistylus</i> Selys: 38.
<i>Phyllogomphoides stigmatus</i> (Say): 4, 17, 23, 27, 28, 35, 38.
<i>Progomphus obscurus</i> (Rambur): 1, 7, 16, 20, 23, 27, 38.
<i>Stylurus plagiatus</i> (Selys): 7.
Family Libellulidae (28 species)
<i>Brechmorhoga mendax</i> (Hagen): 5, 22, 38.
<i>Celithemis eponina</i> (Drury): 1, 4, 7, 10, 15, 17, 28, 35.
<i>Celithemis fasciata</i> Kirby: 13, 28, 38.
<i>Didymops transversa</i> (Say): 22, 23, 30.
<i>Dythemis fugax</i> Hagen: 7, 13, 17, 23, 27, 28, 35.
<i>Dythemis velox</i> Hagen: 7, 23, 27, 28, 35, 38.
<i>Epitheca petechialis</i> (Muttkowski): 4, 7, 20, 23, 28.
<i>Epitheca princeps</i> Hagen: 4, 10, 11, 17, 27, 28, 38.
<i>Epitheca semiaquea</i> (Burmeister): 7.
<i>Erythemis simplicicollis</i> (Say): 4, 7, 9, 11, 15, 17, 23, 28, 32, 35, 38, 40.
<i>Erythrodiplax umbrata</i> (Linnaeus): 38.
<i>Ladona deplanata</i> (Rambur): 28.
<i>Libellula incesta</i> Hagen: 32.
<i>Libellula luctuosa</i> Burmeister: 1, 5, 7, 10, 11, 15, 23, 27, 28, 35, 38.
<i>Libellula lydia</i> Drury: 7, 10, 38.
<i>Libellula pulchella</i> Drury: 7, 10.
<i>Macromia illinoiensis georgina</i> (Selys): 29, 38.
<i>Macromia pacifica</i> Hagen: 38, 40.
<i>Orthemis ferruginea</i> (Fabricius) 15, 31.
<i>Pachydiplax longipennis</i> (Burmeister) 7, 10, 17, 27.
<i>Pantala flavescens</i> (Fabricius) 5, 17, 27, 28.

Table 2. Continued.

Pantala hymenaea (Say) 28.
Perithemis tenera (Say) 7, 10, 13, 15, 27, 32, 28, 35.
Somatochlora linearis (Hagen): 19.
Sympetrum corruptum (Hagen) 1, 7, 9, 15, 27, 30, 28.
Sympetrum vicinum (Hagen) 27.
Tramea lacerata Hagen 4, 7, 10, 13, 15, 17, 28, 38.
Tramea onusta Hagen 2, 10, 15.

ORDER PLECOPTERA (5 families)

Family Capniidae (1 species)
Allocaupnia granulata (Claassen): 5, 18, 20, 22, 23, 27, 38, 40.

Family Leuctridae (1 species)
Zealeuctra claasseni (Frison): 18, 22, 23, 27, 38.

Family Perlidae (2 species)
Neoperla choctaw Stark & Baumann: 20, 22, 23, 27, 29.
Perlesta decipiens (Walsh): 1, 4, 6, 7, 20, 22, 23, 25, 27, 38, 40.

Family Perlodidae (1 species)
Hydroperla crosbyi (Needham & Claassen): 7, 22, 23.

Family Taeniopterygidae (1 species)
Taeniopteryx burksi Ricker and Ross: 22, 38.

ORDER HETEROPTERA (10 families)

Family Belostomatidae (1 species)
Belostoma fluminea Say: 4, 7, 30, 36.

Family Corixidae (8 species)
Corisella edulis (Champion): 27.
Hesperocorixa obliqua (Hungerford): 4, 15, 17, 23, 41.
Morphocorixa compacta (Hungerford): 24.
¹*Palmacorixa nana walleyi* Hungerford: 30.
Sigara alternata (Say): 1, 3, 4, 15, 17, 20, 22, 23, 25, 26, 27, 29, 41.
Sigara modesta (Abbott): 41.
Trichocorixa calva (Say): 3, 5, 7, 23, 27, 29, 36.
Trichocorixa kanza Sailer: 22, 23, 27.

Family Gelastocoridae (1 species)
Gelastocoris oculata (Fabricius): 1, 7, 10, 17, 20, 28, 30.

Family Gerridae (6 species)
Gerris marginatus Say: 7, 17, 20, 41.
Gerris remigis Say: 20, 32.
Gerris species: 20, 32.
Neogerris hesione (Kirkaldy): 7, 15, 27, 32, 35, 36, 38.
Trepobates knighti Drake & Harris: 20, 22.
Trepobates subnitidus Esaki: 27, 32.

Family Hydrometridae (1 species)
Hydrometra martini Kirkaldy: 6, 32.

Family Mesoveliidae (1 species)
Mesovelia mulsanti White: 15, 25, 30, 32.

Family Nepidae (1 species)
Ranatra nigra Herrich-Schaffer: 5, 6, 7, 15, 20, 32, 38.

Table 2. Continued.

 Family Notonectidae (6 species)

- Buenoa confusa* Truxal: 15.
Buenoa margaritacea Torre-Bueno: 21.
Buenoa scimitra Bare: 22, 24.
Buenoa species: 22, 31, 38.
Notonecta indica Linnaeus: 15, 21, 24.
Notonecta undulata Say: 15.

Family Pleidae (1 species)

- Neoplea striola* (Fieber): 4, 7, 10, 20, 30, 32.

Family Veliidae (4 species)

- Microvelia paludicola* Champion: 26.
Microvelia species: 5, 20.
Rhagovelia choreutes Hussey: 7.
Rhagovelia knighti Drake & Harris: 7.

ORDER MEGALOPTERA (2 families)

Family Corydalidae (2 species)

- Chauliodes rastricornis* Rambur: 1, 3, 4, 7, 17, 23, 25, 27.
Corydalus cornutus (Linnaeus): 1, 7, 22, 25, 36, 38.

Family Sialidae (2 species)

- Sialis itasca* Ross: 4, 28.
Sialis mohri Ross: 10.

ORDER NEUROPTERA (1 family)

Family Sisyridae (3 species)

- Climacia areolaris* (Hagen): 25.
¹*Climacia chapini* Parfin & Gurney: 38.
Sisyra vicaria (Walker): 3.

ORDER TRICHOPTERA (7 families)

Family Helicopsychidae (3 species)

- Helicopsyche borealis* (Hagen): 1, 5, 7, 25, 27, 29, 38.
Helicopsyche limnella Ross: 25.
Helicopsyche piroa Ross: 5, 7.

Family Hydropsychidae (12 species)

- Cheumatopsyche analis* (Banks): 1, 5, 13, 20, 22, 23, 25, 27, 29, 37, 38, 40.
Cheumatopsyche campyla Ross: 1, 3, 5, 7, 12, 13, 22, 24, 25, 27, 28, 29, 37, 38, 40.
Cheumatopsyche lasia Ross: 1, 7, 12, 22, 24, 25, 27, 29.
Cheumatopsyche pasella Ross: 2.
Hydropsyche bidens Ross: 1, 7, 25, 29, 37.
Hydropsyche orris Ross: 3, 7, 13, 22, 24, 25, 27, 37, 38, 40.
Hydropsyche rossi Flint, Voshell, & Parker: 27.
Hydropsyche scalaris Hagen: 25, 27, 38.
Hydropsyche simulans Ross: 2, 5, 7, 24, 25, 29, 38.
Potamyia flava (Hagen): 1, 7, 22, 24, 25, 27, 37.
Smicridea fasciatella McLachlan: 5, 25, 29.
Smicridea signata (Banks): 38.

Family Hydroptilidae (15 species)

- Hydroptila ajax* Ross: 5, 10, 23, 27, 37.
Hydroptila angusta Ross: 5, 7, 25.
Hydroptila armata Ross: 5.
Hydroptila consimilis Morton: 27.
-

Table 2. Continued.

Hydroptila hamata Morton: 7, 27.
Hydroptila perdita Morton: 5, 23.
Hydroptila waubesiana Betten: 7, 38.
Ochrotrichia tarsalis (Hagen): 5, 7, 25.
Orthotrichia aegerfasciella (Chambers): 1, 5, 23, 27, 28.
Orthotrichia cristata Morton: 28, 35.
Oxyethira azteca (Mosely): 27.
¹*Oxyethira forcipata* Mosely: 5, 32.
¹*Oxyethira janella* Denning: 5, 27.
Oxyethira pallida (Banks): 5, 23, 25, 28, 40.
Oxyethira zeronia Ross: 5, 27, 28, 32.

Family Leptoceridae (19 species)

Ceraclea cancellata (Betten): 25, 27.
Ceraclea maculata (Banks): 1, 5, 7, 22, 23, 25, 27, 28, 38.
Ceraclea punctata (Banks): 24, 25.
Leptocerus americanus (Banks): 7, 22, 25, 28, 29, 40.
Nectopsyche candida (Hagen): 27.
Nectopsyche pavidata (Hagen): 7, 38.
Nectopsyche species: 5, 6, 22, 24, 25, 27, 28, 29, 37, 38.
Oecetis avara (Banks): 1, 5, 7, 12, 22, 24, 25, 28, 29, 35, 40, 38.
Oecetis cinerascens (Hagen): 1, 3, 5, 7, 10, 15, 22, 24, 25, 27, 28, 29, 35, 38, 40.
Oecetis ditissa Ross: 1, 5, 11, 17, 29, 37.
Oecetis inconspicua (Walker): 1, 3, 5, 6, 7, 12, 13, 15, 22, 23, 24, 25, 27, 28, 29, 37, 38, 40.
Oecetis nocturna Ross: 1, 5, 7, 10, 22.
Oecetis persimilis (Banks): 5, 25, 29.
¹*Triaenodes helo* Milne: 1, 7, 25, 22, 27, 40.
Triaenodes injustus (Hagen): 1, 5, 22, 25, 27, 28, 29, 38.
Triaenodes marginatus Sibley: 38
Triaenodes perna Ross: 25.
Triaenodes tardus Milne: 1, 3, 7, 22, 24, 25, 27, 28, 29, 38, 40.
¹*Ylodes frontalis* (Banks): 1.

Family Limnephilidae (1 species)

Pycnopsyche lepida (Hagen): 5, 27.

Family Philopotamidae (3 species)

Chimarra angustipennis Banks: 37.
Chimarra feria Ross: 22, 27, 29, 40.
Chimarra obscura (Walker): 1, 3, 5, 7, 22, 23, 24, 25, 27, 29, 38, 40.

Family Polycentropodidae (6 species)

Cernotina calcea Ross: 5, 10, 17, 22, 28.
Cernotina spicata Ross: 27, 28, 38.
Cyrnellus fraternus (Banks): 1, 22, 25, 27, 28, 32.
Paranyctiophylax affinis (Banks): 5, 22, 23, 25, 28, 29.
Paranyctiophylax moestus Banks: 7, 23.
Polycentropus centralis Banks: 5, 20.

ORDER COLEOPTERA (6 families)

Family Dryopidae (2 species)

Helichus suturalis LeConte: 7, 35, 38.
Pelonomus obscurus LeConte: 7, 13, 17, 25, 27, 28, 36, 38.

Family Dytiscidae (31 species)

¹*Acilius fraternus* Harris: 20.
Agabus disintegratus (Crotch): 4, 38, 41.

Table 2. Continued.

<i>Agabus semivittatus</i> LeConte: 1, 7, 20, 27, 41.
<i>Agabus</i> species: 38.
<i>Celina hubbelli</i> Young: 17.
<i>Copelatus chevrolati renovatus</i> Guignot 1, 3, 5, 7, 17, 20, 22, 25, 26, 27, 28, 29.
<i>Copelatus glypticus</i> (Say): 7.
¹ <i>Coptotomus loticus</i> Hilsenhoff: 27.
¹ <i>Coptotomus venustus</i> (Say): 7, 29.
<i>Cybister fimbriolatus</i> (Say): 1, 7, 17.
¹ <i>Desmopachria dispersa</i> Crotch: 27, 29.
<i>Eretes explicitus</i> Miller: 17, 32.
¹ <i>Graphoderus liberus</i> (Say): 14.
<i>Heterosternuta diversicornis</i> (Sharp): 22, 23, 27, 29.
<i>Heterosternuta</i> species: 35.
<i>Hydaticus bimarginatus</i> (Say): 17.
¹ <i>Hydrovatus pustulatus</i> (Melsheimer): 27.
¹ <i>Hygrotus acaroides</i> (LeConte): 30.
<i>Laccophilus fasciatus rufus</i> Melsheimer: 5, 7, 14, 17, 29, 36.
<i>Laccophilus pictus insignis</i> Sharp: 29.
<i>Laccophilus proximus</i> Say: 1, 23, 30, 38.
<i>Laccophilus quadrilineatus quadrilineatus</i> Horn: 17, 22.
¹ <i>Liodessus flavicollis</i> (LeConte): 23, 32.
<i>Neobidessus pullus</i> (LeConte): 17.
<i>Neoporus dimidiatus</i> (Gemminger & Harold): 1, 3, 5, 6, 7, 20, 23, 25, 27, 28, 29, 35, 36, 38.
<i>Neoporus undulatus</i> (Say): 3, 20, 27, 29, 41.
<i>Neoporus</i> species: 5, 12, 38.
<i>Thermonectes ornatocollis</i> Aube: 14, 17, 25, 36.
<i>Thermonectes basillaris</i> (Harris): 3, 4, 7, 17, 22.
<i>Uvarus lacustris</i> (Say): 27.
¹ <i>Uvarus texanus</i> (Sharp): 27.
Family Elmidae (4 species)
<i>Stenelmis cheryl</i> Brown: 7, 12, 27, 29, 28.
<i>Stenelmis occidentalis</i> Schmude & Brown: 5, 7.
<i>Stenelmis sexlineata</i> Sanderson: 38.
<i>Stenelmis</i> species: 22, 23.
Family Gyrinidae (6 species)
<i>Dineutus assimilis</i> Kirby: 1, 4, 5, 6, 15, 17, 22, 23, 25, 27, 33, 36, 38.
<i>Dineutus ciliatus</i> (Forsberg): 20, 23, 27, 35, 38.
<i>Dineutus horni</i> Roberts: 27.
<i>Gyretes sinuatus</i> (LeConte): 38.
<i>Gyrinus parvus</i> Say: 7, 15, 17, 20, 24, 27, 38, 41.
¹ <i>Gyrinus woodruffi</i> Fall: 23.
Family Haliplidae (8 species)
<i>Haliplus deceptus</i> Matheson 7, 25
¹ <i>Haliplus fasciatus</i> Aube: 30.
¹ <i>Haliplus lewisii</i> Crotch: 1.
¹ <i>Haliplus tortilipenis</i> Brigham & Sanderson: 7.
<i>Haliplus triopsis</i> Say: 14, 15, 23, 30, 32, 38, 41.
<i>Peltodytes duodecimpunctatus</i> (Say): 7, 5, 20, 23, 27, 34, 35.
<i>Peltodytes litoralis</i> Matheson: 4, 5, 7, 12, 20, 23, 25, 27, 29, 32, 34, 36, 38, 41.
<i>Peltodytes sexmaculatus</i> Roberts: 5, 7, 10, 12, 23, 25, 27, 32, 38.
Family Hydrophilidae (35 species)
<i>Berosus exiguus</i> (Say): 5, 26, 27, 29.
<i>Berosus infuscatus</i> LeConte: 1, 3, 7, 10, 15, 17, 22, 25, 27, 28, 29, 36, 38, 39, 41.

Table 2. Continued.

Berosus miles LeConte: 17, 25, 27, 30.
Berosus pantherinus LeConte: 12, 27.
Berosus peregrinus (Herbst): 1, 3, 5, 7, 10, 17, 20, 22, 23, 25, 27, 28, 29, 30, 36, 38, 41.
Berosus stylifer Horn: 1, 16, 17.
¹*Chaetarthria bicolor* Sharp: 22, 26, 27.
Chaetarthria species: 38.
Crenitis species: 20.
Cymbiodyta beckeri Smetana: 3, 22, 26, 29.
Dibolocelus ovatus (Gemminger & Harold): 7, 25.
Enochrus cinctus (Say): 28, 36.
Enochrus hamiltoni (Horn): 3, 7, 17, 23, 27, 38.
Enochrus ochraceus (Melsheimer): 3.
Enochrus pygmaeus (Fabricius): 1, 3, 5, 7, 17, 20, 22, 23, 26, 27, 29, 38.
Enochrus sayi Gunderson 1, 5, 10, 17.
¹*Epimetopus costatus* complex: 22, 27.
Helochares maculicollis Mulsant: 20.
Hydrochara leechi Smetana: 1, 17, 25.
Hydrochara occulta (d'Orchymont): 27.
Hydrochara soror Smetana: 1, 3, 6, 7, 12, 17, 25, 28.
Hydrochara spangleri Smetana: 6, 7, 12, 20, 25, 27, 36.
Hydrochara species: 17, 27.
¹*Hydrochus simplex* LeConte: 27.
Hydrophilus triangularis Say: 10, 17, 25.
Hydrovatus pustulatus (Melsheimer): 27.
Laccobius minutoides Orchymont: 20.
Laccobius teneralis Cheary: 5.
Paracymus confusus Wooldridge: 26, 27.
Paracymus species: 7, 10, 27, 38.
Tropisternus blatchleyi Orchymont: 25.
Tropisternus collaris (Fabricius): 1, 4, 5, 7, 10, 13, 14, 17, 20, 23, 25, 27, 29, 28, 36, 38, 39.
Tropisternus ellipticus (LeConte): 7, 20, 36, 38.
Tropisternus lateralis nimbatus (Say): 1, 5, 7, 10, 15, 22, 23, 24, 25, 29, 30, 38, 41.
Tropisternus natator d'Orchymont: 15, 36.

¹ Designates a new state record for Oklahoma.

Order Ephemeroptera

McCafferty *et al.* (1997), Baumgardner and Kennedy (2000), and Kondratieff (2000) report at least 89 species of mayflies from Oklahoma. A relatively high diversity of mayflies occurs in the western Ozarks. For example, Baumgardner and Kennedy (2000) listed 56 species in 29 genera and 11 families from the Kiamichi River watershed where most of its upper portion is located in the Ouachita Mountains in southeastern Oklahoma. Reisen (1975) listed only 10 mayfly taxa from Honey Creek, a stream in the Arbuckle Mountains in nearby Murray County. The more sluggish or intermittent streams of the mixed and tall-grass prairies of Oklahoma support a relatively low diversity of species. Additionally, Bass (1990) reported only four mayfly taxa from the continuous Wichita Mountains, which forms the western boundary of Fort Sill. Twenty-one species of mayflies are reported from Fort Sill (Table 2), representing 25% of the known Oklahoma fauna. Vaughn and Obermeyer (2002) reported 11 species previously from Fort Sill, of which one was not collected during this study, *Tortopus puella* (Pictet).

Several species, *Stenonema femorata* (Say), *Pseudocloeon dardanum* (McDunnough), and *Isonychia rufa* McDunnough are common in the larger streams of Fort Sill. The

burrowing mayfly, *H. limbata* (Serville) is common in Lake Elmer Thomas and the larger lakes of the Fort. Often the surrounding hillsides of Lake Elmer Thomas and Engineer Pond had large numbers of adults hanging on vegetation throughout the summer. Additionally, most lakes and ponds of Fort Sill support several species of *Caenis* and *Callibaetis*. *Brachycercus lacustris* (Needham) was collected from Engineer Pond. Twelve species were collected from only one or two locations (Table 2).

New State Records

FAMILY BATIDAE: *Plauditus texanus* Wiersema: This species was described from the Hill Country region of central Texas (Wiersema, 1999). At Fort Sill, this species was collected from similar habitats described by Wiersema (1999), small- to medium-sized streams with cobble substrate, macrophytes, shallow riffles, cool temperatures, and clear water. Wiersema also indicates that this species is probably restricted to the central plains area of Texas and possibly Oklahoma and Kansas. This species was collected from East Cache Creek and Medicine Creek (Table 2).

FAMILY LEPTOHYPHIDAE: *Tricorythodes allectus* (Needham): This species was originally described from Ithaca, New York, and is considered an eastern United States species (Alba-Terceder and Flannagan, 1995).

Order Odonata

Approximately 440 species from 11 families have been recorded from North America (Paulson and Dunkle, 1999). Bird (1932) and Bick and Bick (1957) reported 126 species of dragonflies and damselflies from Oklahoma. Recently, Abbott and Stewart (1998) listed 132 species, not including *Gomphus* (*Gomphurus*) *ozarkensis* Westfall. This species was included as part of the Oklahoma fauna by Needham *et al.* (2000). Bick and Bick (1957) included 48 species of dragonflies and damselflies from Comanche County, Oklahoma. Vaughn and Obermeyer (2002) listed seven species from Fort Sill. Sixty-seven species were identified from this study (Table 2). Remarkably, these 67 species represent 50% of the known Oklahoma fauna (Bick and Bick, 1957; Abbott and Stewart, 1998).

The most diverse dragonfly and damselfly communities were found at Medicine Creek (36 species) and Lake Elmer Thomas (23 species). East Cache Creek apparently supports unique populations of three species, *Epitheca semiaquea* (Burmeister), *G. ozarkensis*, and *Stylurus plagiatus* (Selys) (Table 2). Other sites such as Post Oak Creek (*Calopteryx maculata* (Beauvois)) and Rock Creek (*Somatochlora linearis* (Hagen)) also support unique species (Table 2).

Bick and Bick (1957) reported an additional 9 species from Comanche County that we did not collect: *Arigomphus submedianus* (Williamson), *Nasiaeschna pentacantha* (Rambur), *Erythrodiplax minuscula* (Rambur), *Libellula comanche* Calvert, *L. croceipennis* Selys, *Archilestes grandis* (Rambur), *Argia plana* Calvert, and *A. vivida* Hagen in Selys. It is expected that several of these species may be collected at Fort Sill in the future. Abbott (2005) recently treated all noted species from Fort Sill.

Order Plecoptera

Six species of stoneflies were collected at Fort Sill during this study (Kondratieff and Zuellig, 2003), all of which are considered common to the region. Stark and Stewart (1973a) and Stewart *et al.* (1974) previously reported four of these species from Comanche

County: *Allocapnia granulata* (Claassen), *Zealeuctra claasseni* (Frison), *Taeniopteryx burksi* Ricker and Ross, and *Hydroperla crosbyi* (Needham and Claassen). *Allocapnia granulata* and *Z. claasseni* were found in almost every small tributary of West Cache Creek and Medicine Creek. *Allocapnia granulata*, *T. burksi*, and *H. crosbyi* typically were found in the larger perennial streams of the eastern portion of Fort Sill. *Perlesta decipiens* (Walsh) was found in both intermittent and perennial flowing streams of Fort Sill. Most of the stoneflies collected during this study are cold or cool season species, emerging in the winter or early spring when the intermittent streams of Fort Sill are flowing. Blue Beaver Creek supported the highest stonefly diversity (Table 2). Much of the portion of Blue Beaver Creek at Fort Sill below Ketch Lake becomes dry during the late summer months. *Allocapnia granulata*, *Z. claasseni*, and *T. burksi* were found in other streams of southwestern Oklahoma as isolated populations from their principal eastern ranges (Stewart *et al.*, 1974). Stark and Stewart (1973a) reported *Strophopteryx fasciata* (Burmeister) from West Cache Creek just downstream from Fort Sill. *Strophopteryx fasciata* may be collected at Fort Sill in the future.

Order Heteroptera

Oklahoma records for 10 hemipteran families—Belostomatidae, Corixidae, Nepidae, Notonectidae, Pleidae, Gerridae, Hydrometridae, Veliidae, Gelastocoridae and Mesoveliidae—are available in Henry and Froeschner (1988) and Arnold (2003b). The latter provides a summary of the species previously recorded by Schaefer and Drew (1964, 1966, 1967, 1969a, b). Thirty species of aquatic and semiaquatic bugs were collected from Fort Sill during this study (Table 2), representing nearly 40% of the known Oklahoma fauna. This is a remarkable number considering the relatively small area of Fort Sill in relation to the state of Oklahoma.

New State Record

FAMILY CORIXIDAE: *Palmarixia nana walleyi* Hungerford: This subspecies was originally described from Douglas County, Kansas (Hungerford, 1948), and is also recorded from New Mexico and Texas. Specimens were collected from a single locality, Engineer Pond (Table 2). Previous to this study, only *Sigara modesta* (Abbott) was reported from Comanche County, Oklahoma (Schaefer and Drew, 1969a).

Order Megaloptera

The subfamily Chauliodinae includes three eastern genera of fishflies: *Chauliodes*, *Neohermes*, and *Nigronia*. Only *Chauliodes rastricornis* Rambur is common in Oklahoma (Tarter *et al.*, 1976; Arnold and Drew, 1987). Larvae of this species are common in ponds, lakes, and stream backwater areas of Fort Sill (Table 2).

The Corydalinae contain some of the largest insects in the world, with wing spans exceeding 15 cm. One species, *Corydalus cornutus* (Linnaeus), the common eastern North American species (Contreras-Ramos, 1998), is found abundantly in the perennial streams of Fort Sill, Medicine Creek and East Cache Creek (Table 2).

The Sialidae or alderflies are represented in North America by 24 species (Ross, 1937; Arnold and Drew, 1987; Whiting 1991a, b). Whiting (1991a) summarized the distribution of *Sialis* in North America, recording five species from Oklahoma. Two species were collected from standing water habitats at Fort Sill (Table 2).

Order Neuroptera

The order Neuroptera includes only one strictly aquatic family, the Sisyridae. The larvae are well-known parasites of freshwater sponges (Parfin and Gurney, 1956). Females deposit eggs into a crevice or depression on objects that overhang the water. After hatching the first instar larvae drop to the surface of the water, penetrate the surface film and seek out a sponge host. The larvae insert their elongate style-like mouthparts into sponges to feed. Upon completion of development, larvae migrate out of the water to seek a site to spin a silken cocoon. Two species of spongilla-flies were previously known from Oklahoma, *Sisyra vicaria* (Walker) and *C. areolaris*. Both species are rather widespread over North America (Parfin and Gurney, 1956).

New State Record

FAMILY SISYRIDAE: The collection of *C. chapini* Parfin and Gurney adults at the end of September from Medicine Creek represents a new state record. This spongilla fly is considered rare, known previously only from Texas, New Mexico, and Mexico (Parfin and Gurney, 1956; Flint, 1998).

Order Trichoptera

Approximately 1360 species of caddisflies are found in North America. Bowles and Mathis (1992) reported 145 caddisflies from Oklahoma, and Moulton and Stewart (1996) listed 146; both studies emphasized the more mountainous eastern portion of the state. Vaughn and Obermeyer (2002) previously reported 34 species from Fort Sill. In this study we report 59 species of caddisflies from Fort Sill (Table 2), including four new state records for Oklahoma: *Oxyethira janella* Denning, *O. forcipata* Mosely, *Triaenodes helo* Milne, and *Ylodes frontalis* (Banks). The greatest diversity was in the families that are case makers or net spinners as immatures: Leptoceridae (19 species), Hydroptilidae (15 species), and Hydropsychidae (12 species).

Twenty-seven species of the total number of 229 caddisfly species known from Interior Highlands of North America, which includes the Ozark, Ouachita, Arbuckle, and Wichita mountains of Missouri, Arkansas, and Oklahoma, are considered endemics (Allen, 1990; Moulton and Stewart, 1996). None of these endemic species, however, are known from the Wichita Mountains. A continuation of this area is included in the western edge of Fort Sill. Moulton and Stewart (1996) reported six species from these mountains, *Helicopsyche borealis* (Hagen), *Paranyctiophylax affinis* (Banks), *Oecetis cinerascens* (Hagen), *Oecetis nocturna* Ross, *T. injustus* (Hagen), and *T. tardus* Milne, all of which were collected during this study.

The aquatic habitats of Fort Sill support more than 37% of the total caddisflies known to be in Oklahoma. Species collected during this study, such as *Leptocerus americanus* (Banks), *T. marginata* Sibley, *Orthotrichia cristata* Morton, and *Chimarra angustipennis* Banks are considered rare in this region of Oklahoma.

New State Records

FAMILY HYDROPTILIDAE: *Oxyethira forcipata* Mosely: This widespread micro-caddisfly (Moulton and Stewart, 1996) was previously identified from the neighboring states of Arkansas and Missouri. Kelley (1986) indicated that larvae of this species frequent slower-moving sections of streams and prefer depositional areas. Specimens were collected from Medicine Creek and Ketch Lake (Table 2).

Oxyethira janella Denning: Originally described from Florida, this species ranges from southeastern United States to the Amazon (Kelley, 1986). Moulton and Stewart (1996) reported *O. janella* for the first time from adjacent Arkansas. Specimens were collected from Medicine Creek and Blue Beaver Creek; the latter creek becomes intermittent during late summer.

FAMILY LEPTOCERIDAE: *Triaenodes helo* Milne: This species was originally described from North Carolina and has been reported from Alabama and Florida (Harris, *et al.*, 1991; Glover, 1996). The Fort Sill specimens represent a significant range extension. This species resembles *T. pernus* Ross, previously recorded from Oklahoma by Bowles and Mathis (1992). Most specimens were collected at the lights of the Natural Resources Building at Fort Sill (Fig. 2).

Ylodes frontalis Banks: This widespread species is known from Alaska south to Colorado, and east to Michigan. Larvae are associated with aquatic plants in ponds and lakes. Three specimens were collected from the East Range, Fort Sill (Table 2).

Order Coleoptera

The beetles are the most diverse group of organisms on Earth (Arnett *et al.*, 2001; White and Brigham, 1996; Lawrence, 1991). There are more than 350,000 species of beetles recognized worldwide, with 25,000 of those being represented in North America north of Mexico (Lawrence, 1991). Five thousand North American species are recognized as being “aquatic,” which includes fully aquatic species, semi-aquatic species, and species that have a life stage that is fully or semi-aquatic (White and Brigham, 1996).

Combining the information from Archangelsky (1997), Archangelsky and Durand (1992), Arnold (2003a), Brown (1983; 1972), Ciegler (2003), and Testa and Lago (1994), Larson *et al.* (2000), Smetana (1988; 1980), Oygur and Wolfe (1991), Wallis (1974), Wallis (1933), and Zimmerman (1970), it is estimated that about 145 species of Dryopidae, Dytiscidae, Elmidae, Gyrinidae, Haliplidae, and Hydrophilidae are in Oklahoma. Species of Noteridae, Hydraenidae, Lutrochidae, and Psephenidae also occur in Oklahoma, but were not collected during this study. During this study at least 84 species of aquatic beetles distributed within 6 families were collected from Fort Sill. These 84 species represent 55% of the total Oklahoma fauna. Sixteen species are reported from Oklahoma for the first time (Table 2). The families Hydrophilidae and Dytiscidae had the greatest diversity, with at least 35 and 31 species respectively.

Several species of aquatic beetles, *Copelatus chevrolati renovatus* (Guignot), *Neoporos dimidiatus* (Gemming and Harold), *Dineutus assimilis* Kirby, *Peltodytes litoralis* Matheson, *Berosus infuscatus* LeConte, *Berosus pergrinus* (Herbst), *Tropisternus collaris* (Fabricius) and *T. lateralis nimbatus* (Say) were commonly collected in nearly every aquatic habitat at Fort Sill. Of the aquatic habitats sampled, Medicine Creek had the highest diversity, supporting at least 35 species, followed by Blue Beaver Creek with 34, East Cache Creek with 31, and Pottawatomie Pond with 25 species.

New State Records

FAMILY DYTISCIDAE: *Acilius fraternus* Harris: This species ranges from New York south to Florida and Texas. It is found in shaded woodland pools (Larson *et al.*, 2000). Specimens were collected from a single locality on Rock Creek (Table 2), a stream that has intermittent flow during the summer months.

Coptotomus loticus Hilsenhoff: This species is distributed in the United States from Wisconsin south to Texas, east to Maine and Florida, and in Canada from Ontario to Quebec

(Larsen *et al.*, 2000). Its habitat preference is vegetated margins of flowing waters (Larsen *et al.*, 2000). One specimen was collected from Blue Beaver Creek at McKenzie Hill Road (Table 2).

Coptotomus venustus (Say): Previously known from Virginia south to Florida and west to Texas and Mexico (Larsen *et al.*, 2000; Ciegler, 2003), this beetle is found in a wide variety of habitats, from rivers to lakes and ditches to gravel pits (Ciegler, 2003). This species was collected from two sites at Fort Sill (Table 2).

Desmopachria dispersa Crotch: This genus of small beetles ranging from 1.3–1.7 mm is largely Neotropical in distribution. In the United States this beetle occurs from Texas to California.

Graphoderus liberus (Say): This species is distributed from Minnesota southeast to Florida and west to Washington and Idaho. It is known to be very localized in distribution throughout its range and prefers habitats of boggy ponds, lakes, sinks, and rivers (Ciegler, 2003; Larson *et al.*, 2000). Only one specimen was collected from an unnamed pond located approximately 4 km north of Bald Ridge Road on the East Range, Fort Sill (Table 2). This collection significantly extends the known range of this species.

Hydrovatus pustulatus (Melsheimer): This species is distributed from Texas east to Maine, Florida, and Ontario and Quebec (Larsen *et al.*, 2000) where it is usually associated with organic debris in lotic habitats (Ciegler 2003).

Hygotus acaroides (LeConte): This species is distributed throughout the central United States from North Dakota east to Ohio, south to Texas and Alabama, and in southern Manitoba, Canada. Records exist from Montana and a single record from Oregon. They may be found in vegetated pools created by slow moving streams or in muddy-bottomed ponds (Larsen *et al.*, 2000). One specimen was collected in mid-September from the West Range, Engineer Pond.

Liodessus flavicollis (LeConte): Previously known in the United States from New Hampshire south to Florida and west to Missouri, and in Canada from southern Quebec, Ontario, to Manitoba (Larsen *et al.*, 2000; Ciegler, 2003; Whiteman and Sites, 2003), these beetles are most commonly collected from deep, clear-water pools and ponds with sandy substrates (Larsen, *et al.*, 2000). Adults are usually found in algal mats. At Fort Sill, one specimen was collected from Ketch Lake, West Range, and 11 additional specimens were collected from West Cache Creek along the junction of South Boundary road in late April.

Uvarus texanus (Sharp): Very little is known about this species. Specimens were collected from the West Range, Blue Beaver Creek at McKenzie Hill Road (Table 2).

FAMILY GYRINIDAE: *Gyrinus woodruffi* Fall: This beetle can be found from New York south through the Southeastern United States, and west to Texas (Ciegler, 2003). It is most often associated with lotic habitats but may be collected from lentic habitats (Ciegler, 2003; Oygur and Wolfe, 1991). Three specimens were collected from the Quannah Range, West Cache Creek junction South Boundary Road.

FAMILY HALIPLIDAE: *Halipilus fasciatus* Aube: This species occurs throughout the eastern United States from Wisconsin south to Texas and east to Maine and Florida where it occurs in a variety of habitat types including slow-moving streams, creeks, ponds, lakes, and swamps (Ciegler, 2003). One specimen was collected from the West Range, Engineer Pond.

Halipilus lewisii Crotch: Wallis (1933) reported this species from Texas and included records from Wisconsin and Indiana, which he determined as doubtful. One specimen was collected from a light trap placed on the East Range of Fort Sill.

Halipilus tortilipenis Brigham and Sanderson: This species is known from Wisconsin, South Dakota, Kansas, and Illinois, and recently was reported from Colorado (Durfee and Kondratieff, 2005) and Missouri (Whiteman and Sites, 2003). Brigham and Sanderson

(1972) report the first collections of this species from a clay-bottomed cemetery pond with heavy emergent vegetation in both the center and at the margins. Subsequent reports of collections were made from similar pond habitats with varying degrees of surrounding vegetation cover. One specimen was collected from the flowing waters of East Cache Creek at South Boundary Road, East Range (Table 2). This portion of East Cache Creek is very slow moving and the substrate consists of sand and mud. There is thick emergent vegetation on the margins and thick algal mats on the bottom.

FAMILY HYDROPHILIDAE: *Chaetarthria bicolor* Sharp: This southwestern species has been recorded from California, New Mexico, Arizona, and Texas, and south to Costa Rica (Miller, 1974). At the generic level, these beetles are easily identified by their small size (1.1 to 2.5 mm) and the presence of a common, bilobed excavation on the first two abdominal sterna, which contains a hyaline mass that is covered with long, golden hairs. Species-level identification is difficult and usually requires examination of the male aedeagus. Little biological information exists on this species but, as a whole, this genus is known to inhabit the sandy banks of slow moving streams where they spend the day in borrows and emerge at night. They prefer clean sand with little silt/mud (Miller, 1974). A large series of individuals was collected along the margin of Blue Beaver Creek, West Range (Table 2).

***Epimetopus costatus* complex:** Four species of *Epimetopus* have been recorded from the United States. They are all southwest in distribution from Arizona east to Texas (Van Tassell, 2001). No specimens of this genus have been previously recorded in Oklahoma (Perkins, 1979; Van Tassell, 2001). Eight female specimens were collected from Blue Beaver Creek on the West Range (Table 2). Male specimens are required to place a specific name.

***Hydrochus simplex* LeConte:** This species is known from Arizona, Louisiana east to Florida north to North Carolina. It is found in a variety of aquatic habitats from rivers to ponds and is attracted to ultraviolet lights (Young, 1954; Ciegler, 2003).

Acknowledgements

Funding for this project was provided by Fort Sill, Lawton Oklahoma, in a grant to B. C. Kondratieff at Colorado State University. Glen Wampler, Natural Resource Administrator; Toni Hodgkins, Natural Resources; Kevin McCurdy, Wildlife Technician; and other members of the Natural Resources and Enforcement Division, Fort Sill, provided invaluable assistance throughout this project. Bill P. Stark, Mississippi College, Clinton, Mississippi, verified Plecoptera identifications. Matthew Garhardt, Colorado State University, assisted with field collections. David Baumgardner, Texas A & M University, provided the identification of *Tricorythodes allectus*; Luke Jacobus, Purdue University, identified *Plauditus texanus*.

Literature Cited

- Abbott, J. C. 2005. Dragonflies and Damselflies of Texas and the South-Central States: Texas, Louisiana, Arkansas, Oklahoma, and New Mexico. Princeton University Press, Princeton, New Jersey. 424 pp.
- Abbott, J. C., and K. W. Stewart. 1998. Odonata of the south central Nearctic region, including northeastern Mexico. *Entomological News* 109:201–212.
- Alba-Tercedor, J. and J. Flannagan. 1995. Two new Canadian species of the genus *Tricorythodes* Ulner, with additional studies on other North American species (Insecta, Ephemeroptera: Leptohephidae). *Canadian Journal of Zoology* 73:1588–1598.
- Allen, R. T. 1990. Insect endemism in the Interior Highlands of North America. *Florida Entomologist* 73: 539–569.

- Archangelsky, M. 1997. Studies on the biology, ecology, and systematics of the immature stages of New World Hydrophiloida (Coleoptera: Staphyliniformia). *Bulletin of the Ohio Biological Survey, New Series*, 12: 207 pp.
- Archangelsky, M., and M. E. Durand. 1992. Description of the preimaginal stages of *Dibolocelus ovatus* (Gemminger and Harold, 1868) (Coleoptera, Hydrophilidae, Hydrophilinae). *Aquatic Insects* 14:107–116.
- Arnett, R. H., M. C. Thomas, P. E. Skelley, and J. H. Frank. 2001. *American Beetles. Archostemata, Myxophaga, Adepaga, Polyphaga: Staphyliniformia*. Vol. 1. CRC Press, Boca Raton, Florida.
- Arnold, D. C. 2003a. Checklist of the Coleoptera of Oklahoma. <http://entopl.okstate.edu/museum/coleoptera.htm>. Version 1, Feb 2005.
- Arnold, D. C. 2003b. Checklist and bibliography of the Hemiptera of Oklahoma. <http://entopl.okstate.edu/museum/hemiptera.htm>. Version 1, Feb 2005.
- Arnold, D. C., and W. A. Drew. 1987. A preliminary survey of the Megaloptera of Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 67:23–26.
- Bass, D. 1990. A survey of aquatic invertebrates from Wichita Mountains streams. *Proceedings of the Oklahoma Academy of Sciences* 70:35–36.
- Bass, D. 1994. Community structure and distribution patterns of aquatic macroinvertebrates in a tall grass prairie stream ecosystem. *Proceedings of the Oklahoma Academy of Sciences* 74:3–10.
- Bass, D. 1995. Species composition of aquatic macroinvertebrates and environmental conditions in Cucumber Creek. *Proceedings of the Oklahoma Academy of Sciences* 75:39–44.
- Baumgardner, D. E., and J. H. Kennedy. 2000. Mayflies (Insecta: Ephemeroptera) of the Kiamichi River Watershed, Oklahoma. *Journal of the Kansas Entomological Society* 72:297–305.
- Benke, A. C. 1990. A perspective on America's vanishing streams. *Journal of the North American Benthological Society* 9:77–88.
- Bick, G. H., and J. C. Bick. 1957. The Odonata of Oklahoma. *The Southwestern Naturalist* 2:1–18.
- Bird, R. D. 1932. Dragonflies of Oklahoma. *Publications of the University of Oklahoma Biological Survey* 4:51–57.
- Bonnifield, P. 1979. *The Dust Bowl*. University of New Mexico Press, Albuquerque. 232 pp.
- Bowles, D. E., and M. L. Mathis. 1992. A preliminary checklist of the caddisflies (Insecta: Trichoptera) of Oklahoma. *Insecta Mundi* 6:29–35.
- Brigham, W. U., and M. W. Sanderson. 1972. A new species of *Haliplus* from Illinois and South Dakota (Coleoptera: Haliplidae). *Transactions of the Illinois Academy of Sciences*, 65:17–22.
- Brown, H. P. 1972. *Biota of Freshwater Ecosystems Identification Manual No. 6. Aquatic Dryopoid Beetles (Coleoptera) of the United States*. Water Pollution Control Research Series, U.S. Environmental Protection Agency, Washington, D.C. 82 pp.
- Brown, H. P. 1983. *A Catalog of the Coleoptera of America North of Mexico. Family Elmidae*. United States Department of Agriculture. *Agriculture Handbook No. 529-50*. 23 pp.
- Bryant, R., and J. Wilhm. 1990. Species diversity of benthic macroinvertebrates in Salt Creek, Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 70:9–12.
- Cheper, N. J. 1985. Survey of aquatic invertebrates of south-central Oklahoma I. Lotic animals. *Proceedings of the Oklahoma Academy of Sciences* 65:35–37.
- Ciegler J. C. 2003. *Water Beetles of South Carolina (Coleoptera: Gyrinidae, Haliplidae, Noteridae, Dytiscidae, Hydrophilidae, Hydraenidae, Scirtidae, Elmidae, Dryopidae, Limnichidae, Heteroceridae, Psephenidae, Ptilodactylidae, and Chelonariidae)*. *Biota of South Carolina*. 3. Clemson University, Clemson, South Carolina. 207 pp.
- Contreras-Ramos, A. 1998. *Systematics of the dobsonfly genus Corydalis (Megaloptera: Corydalidae)*. Thomas Say Publications in Entomology, Monographs. 360 pp.
- Durfee, R. S., and B. C. Kondratieff. 2005. Colorado Haliplidae (Coleoptera): biogeography and identification. *Journal of the Kansas Entomological Society* 78:41–71.
- Flint, O. S., Jr. 1998. New species of *Climacia* from the Neotropics (Neuroptera: Sisyridae). *Acta Zoologica Fennica* 209:107–117.
- 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*. 11: 89 pp.
- Harrel, R. C. 1969. Benthic invertebrates of the Otter Creek drainage basin, north-central Oklahoma. *Southwestern Naturalist* 14:231–248.
- Harris, S. C., P. E. O'Neil, and P. K. Lago. 1991. Caddisflies of Alabama. Geological Survey of Alabama. Biological Resources Division, Bulletin 142. 442 pp.
- Henry, T. J., and R. C. Froeschner (eds.). 1988. *Catalog of the Heteroptera, or True Bugs of Canada and Continental United States*. E. J. Brill, Leiden, Netherlands. 958 pp.

- Hoover, J. J. 1990. Larval midges (Diptera: Chironomidae) from northeastern Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 70:39–40.
- Hungerford, H. B. 1948. The Corixidae of the Western Hemisphere (Hemiptera). *University of Kansas Science Bulletin* 32:1–827.
- Johnson, F. L., R. A. Thompson, R. Rudman, J. R. Estes, G. D. Schnell, and K. D. Harris. 1990. Floral Inventory of Fort Sill. Oklahoma. Oklahoma Biological Survey, University of Oklahoma, Norman.
- Kelley, R. W. 1986. Revision of the micro-caddisfly genus *Oxyethira*. Part III: subgenus *Holaractotrichia*. *Proceedings of Entomological Society Washington* 88:777–785.
- Kondratieff, B. C. (coordinator). 2000. Mayflies of the United States. Jamestown, ND: Northern Prairie Wildlife Research Center Online. <http://www.npwrc.usgs.gov/resource/distr/insects/mfly/chklist/states/ok.htm> (Version 12 Dec 2003).
- Kondratieff, B. C., and R. E. Zuellig. 2003. Stoneflies of Fort Sill, Oklahoma, USA. *Perla* 21:13–17.
- Larson, D. J., Y. Alarie, and R. E. Roughley. 2000. Predaceous Diving Beetles (Coleoptera: Dytiscidae) of the Nearctic Region, with Emphasis on the Fauna of Canada and Alaska. *Monographs in Biodiversity*, NRC Press, Ottawa, Ontario. 982 pp.
- Lawrence, J. F. 1991. Order Coleoptera. *In* F. W. Stehr (ed.), *Immature Insects*, pp. 144–184. Vol. 2. Kendall/Hunt, Dubuque, Iowa. 975 pp.
- Margraf, F. J., and D. W. Plitt. 1982. The aquatic macrofauna and water quality of Cottonwood Creek, Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 62:1–6.
- Masteller, E. C. 1993. Endangered aquatic habitats: introduction. *Aquatic Conservation Marine and Freshwater Ecosystems*. 3:287–288.
- McCafferty, W. P., R. K. Heth, and R. D. Waltz. 1997. The Ephemeroptera of Spring Creek, Oklahoma, with remarks on notable records. *Entomological News* 108:193–200.
- McKinley, R. E., R. Prins, and L. E. Jech. 1972. Occurrence and distribution of arthropods in Platt National Park, Murray County, Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 52:49–52.
- Miller, K. B. 1974. Revision of the New World *Chaetarthria* (Coleoptera: Hydrophilidae). *Entomologica Americana* 49:1–123.
- Morris, W. K., and M. P. Madden. 1978. Benthic macroinvertebrate communities and water quality evaluation of the Washita River. *Proceedings of the Oklahoma Academy of Sciences* 58:93–97.
- Moulton, S. R., and K. W. Stewart. 1996. Caddisflies (Trichoptera) of the Interior Highlands of North America. *Memoirs of the American Entomological Institute* 56: 313 pp.
- Needham, J. G., M. J. Westfall, Jr., and M. May. 2000. *Dragonflies of North America*. Scientific Publishers, Gainesville, Florida. 939 pp.
- Orth, D. J., R. N. Jones, and O. E. Maughan. 1982. Species composition and relative abundance of benthic macroinvertebrates in Glover Creek, southeast Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 62:1–6.
- Oygur S., and G. W. Wolfe. 1991. Classification, distribution, and phylogeny of North American (North of Mexico) species of *Gyrinus* Müller (Coleoptera: Gyrinidae). *Bulletin of the American Museum of Natural History*, New York. 207:1–97.
- Parfin, S. I. and A. B. Gurney. 1956. The spongilla-flies, with special reference to those of the Western Hemisphere (Sisyridae, Neuroptera). *Proceedings of the United States National Museum* 105:421–529.
- Paulson, D. R., and S. W. Dunkle. 1999. A Checklist of North American Odonata Including English Name, Etymology, Type Locality, and Distribution. *Slater Museum of Natural History, University of Puget Sound. Occasional Paper Number* 56: 86 pp.
- Perkins, P. D. 1979. Six new species of Neotropical species of aquatic beetles in the *Epimetopus* complex (Hydrophilidae: Epimetopinae). *Coleopterists Bulletin* 33:319–325.
- Porter, C. M., D. R. Butler, and D. M. Janz. 2000. Central Oklahoma bioassessment study: evaluation of stream health using fish and macroinvertebrate communities as biological indicator. *Proceedings of the Oklahoma Academy of Sciences* 80:61–70.
- Poulton, B. C., and K. W. Stewart. 1991. The Stoneflies of the Ozark and Ouachita Mountains (Plecoptera). *Memoirs of the American Entomological Society* No. 38: 116 pp.
- Reisen, W. K. 1975. The ecology of Honey Creek, Oklahoma: spatial and temporal distributions of the macroinvertebrates. *Proceedings of the Oklahoma Academy of Sciences* 55:25–31.
- Ross, H. H. 1937. Studies of the Nearctic aquatic insects. I. Nearctic alderflies of the genus *Sialis* (Megaloptera: Sialidae). *Bulletin of the Illinois Natural History Survey* 21:57–78.
- Schaefer, K. F., and W. A. Drew. 1964. Checklist of aquatic and semiaquatic Hemiptera (Insecta) of Oklahoma. *Southwestern Naturalist* 9:99–101.

- Schaefer, K. F., and W. A. Drew. 1966. The aquatic and semiaquatic Hemiptera of Oklahoma. Part I, Nepidae. Part II, Notonectidae. Part III, Gerridae and Veliidae. *Proceedings of the Oklahoma Academy of Sciences* 47:125–134.
- Schaefer, K. F., and W. A. Drew. 1967. Hydrometridae and Mesoveliidae (Hemiptera) of Oklahoma. *Southwestern Naturalist* 12:486–487.
- Schaefer, K. F., and W. A. Drew. 1969a. The Corixidae (Hemiptera) of Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 48:71–79.
- Schaefer, K. F., and W. A. Drew. 1969b. The aquatic and semiaquatic Hemiptera (Belostomatidae and Saldidae) of Oklahoma. *Proceedings of the Oklahoma Academy of Sciences* 48:79–83.
- Smetana, A. 1980. Revision of the genus *Hydrochara* Berth. (Coleoptera: Hydrophilidae). *Memoirs, Entomological Society of Canada*. 111. 100 pp.
- Smetana, A. 1988. Review of the family Hydrophilidae of Canada and Alaska (Coleoptera). *Memoirs, Entomological Society of Canada*. 142. 316 pp.
- Stark, B. P., and K. W. Stewart. 1973a. Distribution of stoneflies (Plecoptera) in Oklahoma. *Journal of the Kansas Entomological Society* 46:563–577.
- Stark, B. P., and K. W. Stewart. 1973b. New species and descriptions of stoneflies (Plecoptera) from Oklahoma. *Entomological News* 84:192–197.
- Stewart, K. W., R. W. Baumann, and B. P. Stark. 1974. The distribution and past dispersal of southwestern United States Plecoptera. *Transactions of the American Entomological Society* 99:507–546.
- Tarter, D. C., W. D. Watkins, M. L. Little, and J. T. Goodwin. 1976. New state records of fishflies (Megaloptera: Corydalidae). *Entomological News* 87:223–228.
- Testa, S., III, and P. K. Lago. 1994. The Aquatic Hydrophilidae (Coleoptera) of Mississippi. Department of Information Services, Division of Agriculture, Forestry, and Veterinary Medicine, Mississippi State University, Mississippi State, Mississippi. 57 pp.
- Van Tassell, E. R. 2001. 13. Hydrophilidae Latreille, 1802. *In* R. H. Arnett and M. C. Thomas (eds.), *American Beetles, Archostemata, Myxophaga, Adepaga, Polyphaga: Staphyliniformia*, pp. 187–208. Vol. 1. CRC Press, Boca Raton, Florida.
- Vaughn, C. C., and B. K. Obermeyer. 2002. Aquatic Invertebrates of Fort Sill Military Reservation. Final Report. Natural Resources and Enforcement. Directorate of Environmental Quality. Fort Sill Military Reservation, Fort Sill, Oklahoma.
- Wallis, J. B. 1933. Revision of the North American species (north of Mexico) of the genus *Haliplus*, Latreille. *Transactions of the Royal Canadian Institute* 19:1–76.
- Wallis, J. G. 1974. Distribution and recognition of United States whirligig beetles of the genus *Gyretes* (Coleoptera: Gyridae). *Studies in Arthropoda*. 1:1–10.
- White, D. S., and W. U. Brigham. 1996. Aquatic Coleoptera. *In* R. W. Merritt, and K. W. Cummings, (eds.), *An Introduction to the Aquatic Insects of North America*, pp. 399–473, 3rd ed. Kendall/Hunt Publishing Company, Dubuque, Iowa. 862 pp.
- Whiteman N. K., and R. W. Sites. 2003. Lentic beetles of the Missouri Prairie Region: habitat and regional associations, with keys to the Hydradephaga. *Transactions of the American Entomological Society* 129:185–243.
- Whiting, M. F. 1991a. A distributional study of *Sialis* (Megaloptera: Sialidae) in North America. *Entomological News* 102:50–56.
- Whiting, M. F. 1991b. A new species of *Sialis* (Megaloptera: Sialidae) from southern California. *Great Basin Naturalist* 51:411–413.
- Wiersma, N. A. 1999. *Plauditus texanus* (Ephemeroptera: Baetidae), a new small minnow mayfly from Texas. *Entomological News* 110:281–284.
- Wilhm, J. L., J. Cooper, and S. Burks. 1979. Species composition of algae and benthic macroinvertebrates in the Blue and Kiamichi rivers. *Proceedings of the Oklahoma Academy of Sciences* 59:85–88.
- Young, F. N. 1954. *The Water Beetles of Florida*. University of Florida Press, Gainesville. 238 pp.
- Zimmerman, J. R. 1970. A taxonomic revision of the aquatic beetle genus *Laccophilus* (Dytiscidae) of North America. *Memoirs of the American Entomological Society* 26:1–275.