



NEW STATE STONEFLY (PLECOPTERA) RECORDS FOR PENNSYLVANIA, WITH ADDITIONAL RECORDS AND INFORMATION ON RARE SPECIES

Jane I. Earle

Research Associate, Academy of Natural Sciences of Philadelphia,
Mailing address: 20 Red Fox Lane, Mechanicsburg, PA, 17050-1627, USA.
E-mail: janeearle7@msn.com

ABSTRACT

Four species are added: *Zealeuctra fraxina*, *Alloperla ideii*, *Sweltsa palearata*, and *Acroneuria kirchneri*; *Allocapnia wrayi* is returned to the Pennsylvania stonefly record, bringing the total to 139 described species. New records and information on 25 rare species are also presented.

Keywords: Plecoptera, Stoneflies, Pennsylvania, additional records, rare species

INTRODUCTION

The Pennsylvania stonefly list was last updated in 2004, with a total of 133 species reported (Earle 2004a). Since that time, four more species have been collected in Pennsylvania: *Zealeuctra fraxina* Ricker and Ross, *Alloperla ideii* (Ricker), *Sweltsa palearata* Surdick, and *Acroneuria kirchneri* Stark and Kondratieff. Additionally, *Allocapnia wrayi* Ross is returned to the list based on examination of new material; and with the recent description of a variant of *Sweltsa onkos* (Ricker) as a new species, *S. hoffmani* Kondratieff and Kirchner, (Kondratieff and Kirchner 2009), the Pennsylvania total is now 139 described stonefly species.

Pennsylvania has the second highest number of stoneflies of any state in the eastern United States; Virginia is first with 160 species and West Virginia is third with 135 species (Stark et al. 2009, Tarter and Nelson 2006). The richness of the Pennsylvania stonefly fauna is remarkable in a state with 12.4 million people and is indicative of the ecological and topographical diversity that includes 7 physiographic provinces and 23 subsections (Fig. 1), forests

covering nearly 60% the state's 117,400 sq. km, and over 138,500 km of streams, the majority of which are 1st to 3rd order creeks, within 5 major river basins, draining to the Atlantic Ocean via the Delaware and Chesapeake Bays, Lake Erie and St Lawrence Seaway, and to the Gulf of Mexico via the Ohio River. Due to the predominance of hilly terrain, 75 percent of Pennsylvania's streams are relatively high gradient, greater than 1% slope (Gerritsen and Jessup 2007). Also, the majority of Pennsylvania's streams are of good quality; eighty-two percent were listed as supporting aquatic life use in the 2008 Clean Water Act Section 305(b) Report (Pennsylvania Department of Environmental Protection 2008). Another factor in the high number of stonefly species confirmed in Pennsylvania is the number of other investigators who have collected or published stonefly records, R.F. Surdick, E.C. Masteller, and S.A. Grubbs.

This paper presents information on four new state records, reinstatement of one species, and presents site locations and habitat information for 25 rare species or species uncommonly collected as adults. For purposes of this paper, rare species are those that

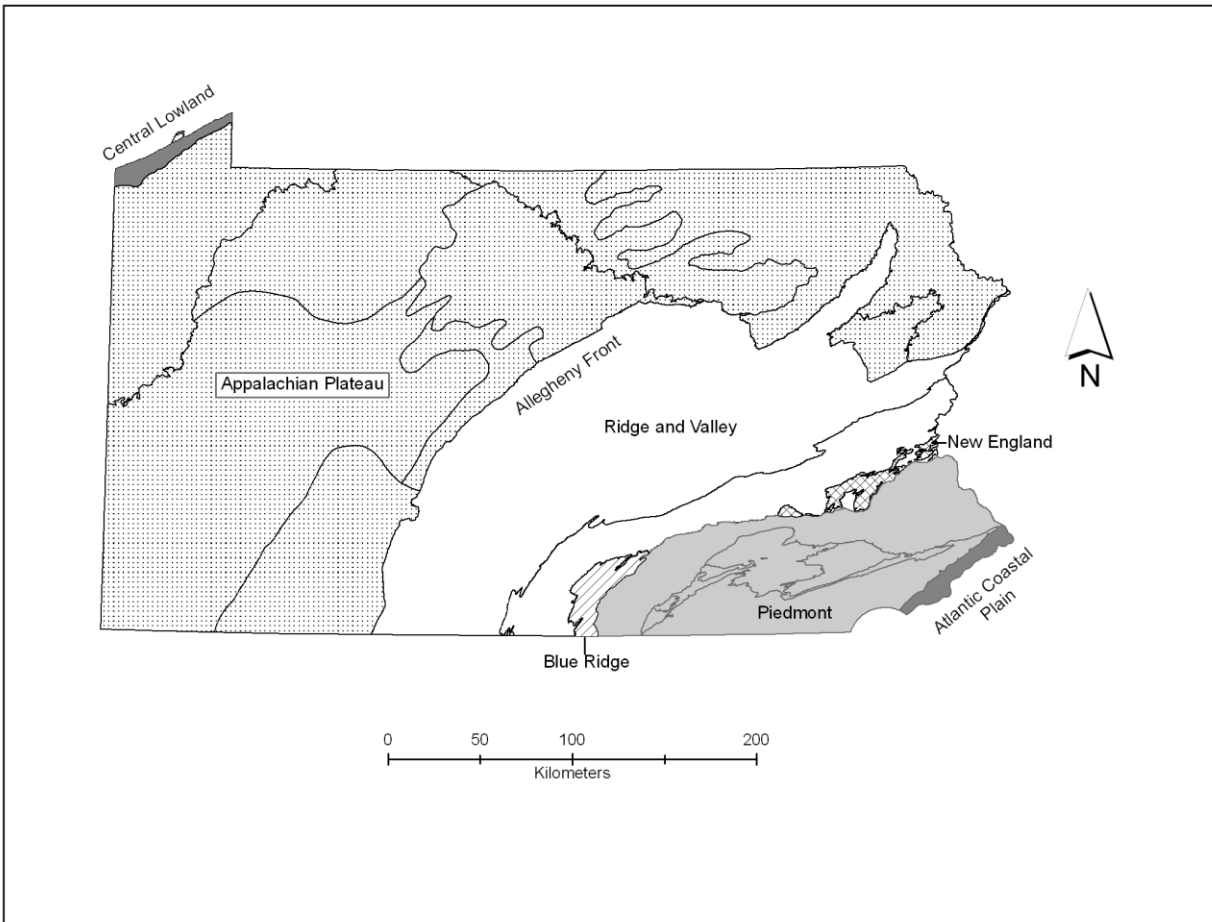


Fig. 1. Pennsylvania physiographic provinces.

have been reported from 10 or fewer Pennsylvania streams, generally have less than 5 new Pennsylvania records, or are rarely collected as adults. Information on rare species is given to provide a better understanding of their habitat requirements, promote additional collection efforts, and for potential conservation measures.

Not all the rare Pennsylvania species are in pristine streams. Based on Department of Environmental Protection information and personal data, some rare species locations have abandoned coal mine drainage, sewage discharges, or other sources of impairment affecting their watersheds. Catawissa Creek and Tomhicken Creek in Schuylkill County, in the Middle Anthracite Coal Field, are impaired by discharges from abandoned mine drainage tunnels and have acidic pH and slightly

elevated dissolved aluminum or iron concentrations. Back Run, Champion Creek, and Little Champion Creek in Fayette County, Long Run and Roaring Run in Armstrong County, and Little Yellow Creek in Indiana County receive net alkaline coal mine drainage but support diverse aquatic communities. Monastery Run in Westmoreland County is affected by urban runoff and leaky septic systems. Upper Mountain Creek in Cumberland and Adams Counties is acidic due to infertile geological conditions and acid deposition.

In the following presentation, all new species records are listed by county, with the county name in capital letters. A map of Pennsylvania counties is presented in Fig. 2. The letter in parentheses after the county name indicates the major river basin as follows: Delaware (D), Susquehanna (S), Potomac (P),

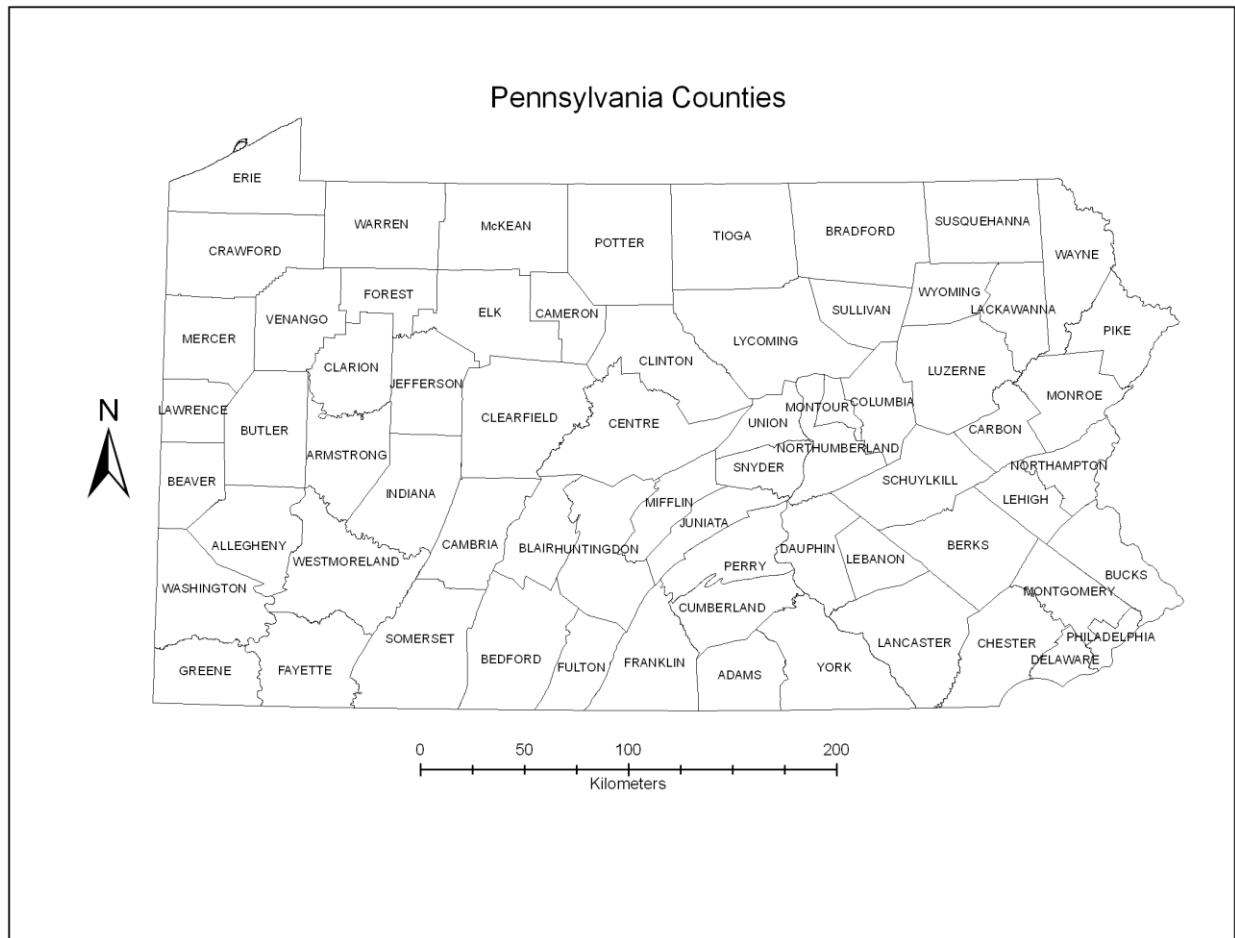


Fig. 2. Pennsylvania Counties.

and Ohio (O), which are shown in Fig. 3. Small creeks are generally 1st to 2nd order, medium creeks are 3rd to 4th order, and large creeks are over 4th. In Pennsylvania, the term river is used only for the largest streams, generally those that achieve 5th order and higher. Point coordinates for all locations are available by request.

All collections are by the author unless otherwise noted. Other collectors: (BS) Bo Schall, Leechburg, PA; (CL) Craig Liska, Marlton, NJ; (CM) Charles McGarrell and (GSm) Geoffrey Smith, Pennsylvania Fish and Boat Commission, Harrisburg, PA; (DB) Daniel Bogar, (MH) Michael Hutchinson, and (RR) Robert Ryder, Pennsylvania Department of Environmental Protection, Harrisburg, PA; (DEP) unknown collector, Pennsylvania Department of Environmental Protection; (GS) Guy Stottleyer,

Bedford County Conservation District, Bedford, PA; (JW) John Wallace, Millersville University, Millersville, PA; (LJ) Larry Jackson, Mechanicsburg, PA; (MB) Mike Boyer, Pennsylvania Department of Environmental Protection, Norristown, PA; (SJ) Steve Johnson, Sunbury, PA; (SRBC) unknown collector, Susquehanna River Basin Commission, Harrisburg, PA; (TD) Timothy Daley, (MW) Mark Warfel, and (TS) Thomas Stauffer, Pennsylvania Department of Environmental Protection, Wilkes Barre, PA; (TWS) Dr. Thomas W. Simmons, Indiana University of Pennsylvania, Indiana, PA; (WE) William Ettinger, Normandeau Associates, Stowe, PA. Stonefly specimens are presently in the collection of the author and will be deposited in the collections of the Academy of Natural Sciences of Philadelphia. North American stonefly ranges are from (Stark et al. 2009) unless otherwise indicated.

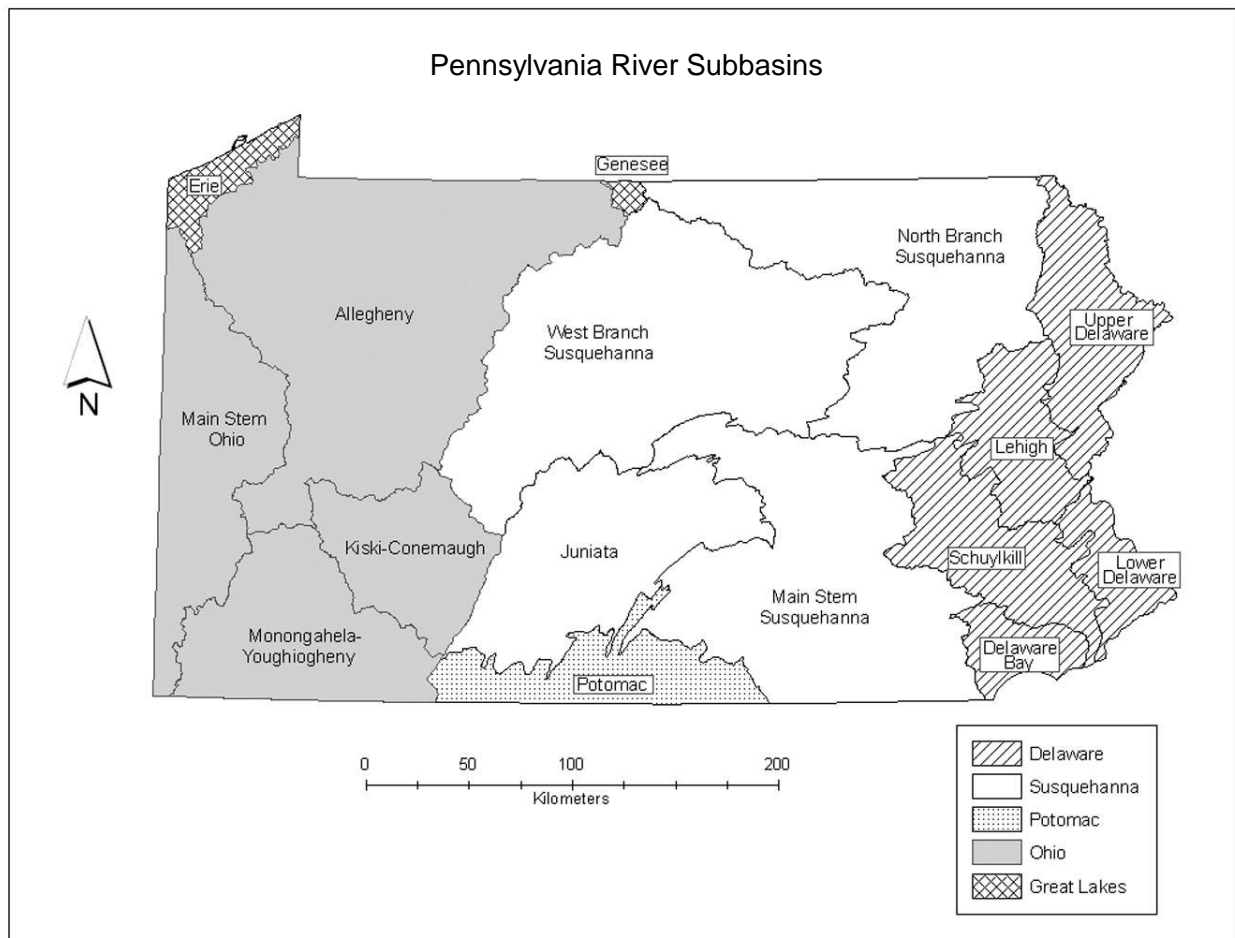


Fig. 3. Pennsylvania river basins and subbasins.

RESULTS AND DISCUSSION

New Pennsylvania Records

Leuctridae *Zealeuctra fraxina* Ricker and Ross

New record: MONTGOMERY (D): on the PA Rte. 29/73 bridge over Mine Run, Schwenksville, PA, near the confluence of Perkiomen Creek, 4 March 2006, 1♂ (CL). The reported range of *Z. fraxina* is from West Virginia west to Illinois and south to Tennessee. *Zealeuctra fraxina* was collected in southeastern Pennsylvania and is the farthest eastern known record for this Nearctic genus. The closest reported occurrence is in the Potomac River basin in the eastern panhandle of West Virginia, the only West Virginia record (Tarter and Nelson 2006), over 250 km away. The genus *Zealeuctra* is most common in

the midwestern United States south to Alabama and Texas, where several additional species are present and where the nymphs are most often associated with low order intermittent streams (Ricker and Ross 1969, Kondratieff and Zuellig 2004, Grubbs 2005). In the Ozarks, *Zealeuctra* are restricted to limestone-based intermittent streams (Poulton and Stewart 1991).

Chloroperlidae *Alloperla ideii* (Ricker)

New Record: HUNTINGDON (S): at light, 2.5 km south of Jackson Corner, 25 June 2009, 1♂ (SJ). This collection, presumably from the nearby Standing Stone Creek in the central Pennsylvania Ridge and Valley Physiographic Province, fills in a gap between its known range of Georgia and Alabama north to Maine, Ontario, and Quebec (Surdick 2004).

Baumann and Kondratieff (2009) noted that *A. idei* was more common in the northern part of its range and that individuals were often attracted to lights.

Chloroperlidae *Sweltsa palarata* Surdick

New records: BEDFORD: (P) Fifteenmile Creek, Old Big Mountain Road, 14 May 1999, 7♂, 1♀; spring run to an unnamed tributary of Blues Gap Run, 0.8 km north of Elbinsville, 14 May 1999, 1♂. Both sites are 1st order forested stream reaches. The spring run site is not delineated in blue on the 7.5 minute USGS topographic map and is likely dry in the summertime. One of several *Sweltsa* species whose ranges are limited to specific river basins, *S. palarata* reaches its northern limit in the main stem Potomac River basin of southcentral Pennsylvania. In West Virginia *S. palarata* is limited to the South Branch Potomac River tributaries, in Maryland to the main stem Potomac River tributaries, and in Virginia to the upper Potomac River basin and the North and South Forks of the Shenandoah River basin (Surdick 2004).

Perlidae *Acroneuria kirchneri* Stark and Kondratieff

New Record: CENTRE: (S) at light, approximately 2.5 km northeast of Martha Furnace, 2 July 1997, 1♀ (MH). The likely stream of origin is Bald Eagle Creek, about 2 km southeast of the collection site. *Acroneuria* adults are infrequently collected in PA except for the ubiquitous *Acroneuria abnormis* (Newman). This adult *A. kirchneri* was collected along with *A. abnormis* adults at a light trap set for terrestrial insects. This is a surprising addition to the Pennsylvania stonefly fauna; described in 2004, *A. kirchneri* was previously reported only from Kentucky, Virginia, and West Virginia. This new record is near the center of Pennsylvania, a distance of more than 250 km from the nearest recorded site, Preston County, in northeastern West Virginia.

Reinstatement

Capniidae *Allocapnia wrayi* Ross

Allocapnia wrayi was deleted from the Pennsylvania stonefly species list because previous records had been misidentified (Earle 2004a). Examination of new material, however, revealed several authentic records. This species reaches its northern limit in 1st to 3rd order creeks in the Potomac

and lower Susquehanna River basins of Pennsylvania.

New records: BEDFORD: (P) Blackberry Lick Run, PA Rte. 26, 20 January 2006, 10♂; Blues Gap Run, 0.8 km upstream of mouth, 20 January 2006, 2♂ 1♀; spring run to unnamed tributary to Blues Gap Run, 0.8 km north of Elbinsville, 20 January 2006, 1♂; Fifteenmile Creek, 1st bridge upstream of the Maryland state line, 20 January 2006, 1m; CUMBERLAND: (S) Doubling Gap Creek, 10 m downstream of the lake at Colonel Denning State Park, 7 December 1997, 7♂; FRANKLIN: (P) Broad Run, 30 m downstream of water supply reservoir, 24 Mar. 2006, 4♀; FULTON: (P) Sideling Hill Creek, PA Rte. 484, 20 January 2006, 1♂.

New Pennsylvania records and information on rare species

Capniidae

Capniidae is the largest family of Plecoptera in North America, consisting of 17 genera and approximately 250 mostly winter emerging species (Nations et al. 2007); however, only 2 genera, *Allocapnia* and *Paracapnia*, are found in the Mid-Atlantic/Appalachian region. The Pennsylvania fauna consists of 15 species of *Allocapnia* and one species of *Paracapnia*. Adults can be collected during the coldest months of the year along streams and on bridges, tree trunks, and buildings. Two to five species are normally collected at any one location in Pennsylvania. The most common species in Pennsylvania are *Allocapnia granulata* (Claassen), *A. nivicola* (Fitch), *A. pygmaea* (Burmeister), *A. rickeri* Frison, *A. recta* (Claassen), and *Paracapnia angulata* Hanson.

The following species are infrequently collected or have a limited range in Pennsylvania.

Allocapnia aurora Ricker is limited to small, mostly forested or rural coldwater creeks in the lower Susquehanna River basin and the extreme eastern portion of the Potomac River basin in southcentral Pennsylvania. *Allocapnia aurora* was previously confirmed from only 10 Pennsylvania creeks (Masteller 1996). Although not as rare as certain other Pennsylvania *Allocapnia*, it is included here to correct earlier misidentifications. Males can be difficult to separate from *A. pygmaea* and *A. nivicola*.

Male *Allocapnia* from Indian Creek in Westmoreland County and French Creek in Chester County that were identified as *A. aurora* (Earle 1994 and 2003) were actually *A. nivicola*. The *A. aurora* records from Muddy Creek in York County (Masteller 1996) were also misidentified and were actually *A. pygmaea*.

New records: CUMBERLAND: (S) Doubling Gap Creek, Elk Hill Rd. at PA Rte. 233, 31 January 2001, 7♂, 11♀; same location, 10 March 1997, 6♂, 4♀; Mountain Creek, Mount Holly Springs, 8 January 1997, 1♂; DAUPHIN: (S) Rattling Creek, in mountain gap at Lykens Borough Park, 28 December 2005, 3♂, 1♀; LANCASTER: (S) Trout Run, Pennsy Rd., 1 February 1997, 1♂; JUNIATA: (S) Delaware Creek, PA Rte. 333 near Thompsontown, 4 February 1994, 1♂; PERRY: (S) Fishing Creek, New Valley Rd. west of Marysville, 2 February 1999, 1♂; Laurel Run, tributary to Tuscarora Creek, PA Rte. 850, 3 January 2001, 6♂; same location, 3 March 1995, 2♀; McCabe Run, Barkley Rd., 11 April 1993, 3♀; Shaeffer Run, 2nd Narrows Rd., 24 March 1994, 1♀ (LJ).

Allocapnia frisoni Ross and Ricker is distributed west of the Allegheny Front from New York south to Tennessee and west to Wisconsin. In Pennsylvania it is most commonly collected in the Youghiogheny River drainage and in Lake Erie tributaries (Masteller 1996) where it often replaces the similar *A. granulata*.

New records: FAYETTE: (O) Back Creek, 800 m upstream of mouth, 27 December 1996, 4♂; same location, 30 January 1997, 4♂, 1♀, same location, 1 March 1995, 1♂; Little Champion Creek, SR 1050, 20 December 1997, 1♂.

Allocapnia vivipara (Claassen) has been most commonly collected in the Lake Erie tributaries in northwestern PA, but has also occasionally been found in the lower Allegheny River and lower Delaware River basins (Masteller 1996). *Allocapnia vivipara* is the most common *Allocapnia* species in Illinois, where it lives in a variety of streams, from small pristine creeks to large clay bottomed rivers and streams with livestock waste (Webb 2002). The Pennsylvania records also indicate a tolerance to a variety of pollution sources including urban and agricultural runoff, alkaline coal mine drainage, and leaky septic systems.

New records: ARMSTRONG: (O) Long Run, PA Rte. 506, 9 February 2002, 2♂ (BS); Pine Run, SR 4071, 23 January 2002, 14♂ (BS); same location, 25 February

2002, 9♂, 2♀ (BS); Roaring Run, SR 2051, 9 February 2002, 1♀ (BS). WESTMORELAND: (O) Monastery Run, 15 m downstream of US Rte. 30, 30 January 1997, 3♂, 1♀.

Allocapnia zola Ricker ranges from New Brunswick south to Virginia and Kentucky. The only previous Pennsylvania records are from 3 small forested creeks in Carbon, Perry, and Westmoreland Counties (Masteller 1996). *Allocapnia zola* is found mainly in small clean cold water creeks; however, in Pennsylvania it also has been found in medium creeks and in streams receiving alkaline coal mine drainage. Most records are from Blue Mountain in southcentral Pennsylvania, the southern-most ridge in the Ridge and Valley Physiographic Province.

New records: BEDFORD: (P) Fifteenmile Creek, 1st bridge upstream of Maryland state line, 20 January 2006, 2♂; Piney Creek, PA Rte. 26, 6 February 2005, 2♂; FAYETTE: (O) Little Champion Creek, SR 1050, 24 February 1997, 1♂; Champion Creek, 50 m downstream of Little Champion Creek, 24 February 1997, 1♂, 1♀, FULTON: (P) Trough Run, PA Rte. 484, 24 March 2006, 1♂.

Leuctridae

Leuctridae nymphs are important components of the benthos of small to medium creeks throughout Pennsylvania; 13 species in 4 genera are present. The most common Pennsylvania species is *Leuctra ferruginea* (Walker). Adult *L. duplicata* Claassen, *L. sibleyi* Claassen, *L. tenuis* (Pictet), and *Paraleuctra sara* (Claassen) are also commonly collected in Pennsylvania. Most of the Pennsylvania species are acid tolerant (Earle 2004b).

Leuctra alexanderi Hanson has been previously recorded from only 5 small cold forested creeks or spring runs in Pennsylvania (Earle 2004b, Masteller 1996). The Pennsylvania distribution of *L. alexanderi* is the Potomac River basin, west and north of the Allegheny Front through the Ohio and upper West Branch Susquehanna River basins, and east to the upper Delaware River basin in northeastern Pennsylvania. *Leuctra alexanderi* is not as widely distributed in North America as other *Leuctra* species, having been confirmed from only 5 states from Pennsylvania south to Tennessee. *Leuctra alexanderi* is common in small spring-fed creeks in western Maryland (Grubbs 1997).

New Records: BEDFORD: (P) Fifteenmile Creek, Old Big Mountain Rd., 24 May 2002, 1♂, 1♀; spring run to an unnamed tributary to Blues Gap Run, 800 m north of Elbinsville, 6 June 2001, 2♂; FAYETTE: (O) Back Creek, 800 m upstream of mouth, 4 June 1996, 2♂; WESTMORELAND: (O) Grove Run, 75 m upstream of mouth, 13 June 2009, 2♂; spring run to Indian Creek, PA Rte. 381, 1 km north of PA Rte. 31, 4 June 1996, 1♂.

Leuctra variabilis is one of the few stoneflies reported from unusual habitats for stoneflies, bogs with imperceptible flow and pitcher plants (Nelson et al. 2002). *Leuctra variabilis* emerges rather late compared to most other *Leuctra* species, from late September to early December. Only 2 previous Pennsylvania records exist, from Susquehanna and Wyoming Counties in northeastern Pennsylvania (Masteller 1996). *Leuctra variabilis* has been reported from New England south to Maryland.

New record: CARBON: (D) unnamed tributary to Lizard Creek, 20 m upstream of T-334, 16 October 2003, 1♂ (TD).

Nemouridae

Nemouridae are common stoneflies found mostly in small to medium creeks, seeps, springs, and spring runs. Seventeen species in 6 genera have been recorded in Pennsylvania. The most commonly collected Pennsylvania species are *Amphinemura nigritta* (Provancher), *A. wui* (Claassen), and *Prostoia similis* (Hagen).

Amphinemura appalachia Baumann is a relatively recent addition to the PA stonefly fauna, previously collected from only two small forested creeks in northeastern Pennsylvania, in the upper Delaware and North Branch Susquehanna River basins, one of which is the paratype location (Baumann 1996, Masteller 1996). *Amphinemura appalachia* as the name suggests is found in the Appalachians from Pennsylvania south to Georgia.

New records: BERKS: (D) Northkill Creek, most downstream bridge in state game lands, 22 April 1994, 1♂; SCHUYLKILL: (S) Catawissa Creek, 10 m upstream of Audenreid Tunnel discharge, 20 April 2005, 5♂, 2♀.

Nemoura trispinosa Claassen was a recent addition to the Pennsylvania stonefly fauna based on one adult and numerous nymphs from one creek in

Monroe County (Earle 2004a). In Pennsylvania, *N. trispinosa* appears to be limited to small, low gradient swampy creeks. *Nemoura trispinosa* is found from the Canadian Maritimes south to Pennsylvania and west to Manitoba and Wyoming. New record: CLINTON: (S) Swamp Branch of Big Run, Haynes Township, 17 May 2004, late instar nymph (CM).

Ostrocerca nymphs are rarely collected during routine water quality monitoring; however, they can be common in small acidic, often intermittent creeks and spring runs (Earle 2004b). Adults can also be collected alongside small to medium cold water creeks, presumably emerging from nearby springs or seepage areas. The most common Pennsylvania species is *O. albidipennis* (Walker).

Ostrocerca complexa (Claassen), which ranges from the Canadian Maritimes west to Ontario and south through the Appalachians to Virginia, was previously reported from only one small creek in Pennsylvania, Spring Brook in Lackawanna County, in northeastern Pennsylvania in 1945 (Masteller 1996). Three additional sites are now added in northcentral and northeastern Pennsylvania.

New records: MONROE: (D) Two Mile Run, 20 m upstream of PA Rte. 115, 13 May 2008, 1♀; POTTER: (S) spring run to MacDonald Hollow, near mouth, 17 May 1976, 1♂; WAYNE: (D) third unnamed tributary downstream of Cobb Pond to Wagnum Creek, 23 May 2003, 1♂ (TD).

Taeniopterygidae

The Pennsylvania Taeniopterygidae fauna is represented by 11 species in 5 genera. The most commonly collected species are *Strophopteryx fasciata* (Burmeister), *Taeniopteryx burksi* Ricker and Ross, *T. maura* (Pictet), and *T. nivalis* (Fitch). Adults emerge in winter through early spring.

Bolotoperla rossi (Frison), the rarest Pennsylvania species in the family, was previously known from only few adults collected from 3 medium sized creeks in the Susquehanna River basin (Masteller 1996). This species has apparently not been documented in the nymph stage in Pennsylvania. Emergence begins in early April and continues through mid-May, later than most other members of the family. *Bolotoperla rossi* ranges from Maine south to North Carolina.

New records: DAUPHIN: (S) Manada Creek,

Furnace Road, 1 April 2000, 1♂ (CL); PIKE: (D) Dingmans Creek between falls and parking lot, 21 May 2000, 1♀ (CL).

Taeniopteryx metequi Ricker and Ross is one of the rarest Pennsylvania members of the genus, having been reported from only four counties (Masteller 1996). Although a 1966 collection from one site in Snyder County in the Susquehanna River basin was included in Ricker and Ross (1968), all recent collections have been restricted to the Potomac and Monongahela River basins in PA. Interestingly, *T. metequi* has been reported in all river basins except the Potomac in West Virginia (Tarter and Nelson 2006) and only in the eastern Ridge and Valley portion of the Potomac River basin in Maryland (Grubbs 1997).

New Records: FULTON: (P) Sideling Hill Creek, PA Route 484, 6 February 2005, 2♂; Tonoloway Creek, SR 2004 at Johnsons Mill, 6 February 2005, 2♂.

Taeniopteryx ugola Ricker and Ross, which ranges through the Appalachians from Pennsylvania south to Georgia, is generally restricted to the headwaters of cold small and medium sized creeks in Pennsylvania. Only 3 previous records exist, from Cambria and Cumberland Counties (Masteller 1996). *Taeniopteryx ugola*, which appears to be the only *Taeniopteryx* species collected in Pennsylvania creeks with pH less than 5.5 and with summer-fall stream dry periods, has been most frequently collected from upper Mountain Creek in Cumberland County, Pennsylvania.

New records: LEBANON: (S) Indiantown Run, PA Rte. 443 at gap in mountain, 20 February 2004, 2♂; PERRY: (S) Shaeffer Run, 2nd Narrows Road, 24 March 1995, 1♀ (LJ); SCHUYLKILL: (S) Catawissa Creek, Girard Manor Road, 13 January 2004, 3♂; unnamed tributary to Tomhicken Creek, PA Rte. 934, 19 March 2003, 1♂.

Chloroperlidae

Most Chloroperlidae, except for *Alloperla atlantica* Baumann, *Sweltsa lateralis* (Banks), *S. onkos*, *S. hoffmani*, and *Haploperla brevis* (Ricker), have been little collected in the adult stage in Pennsylvania. Adults are bright yellow or pale green and can most often be seen soon after emergence flying over small to medium creeks or on instream rocks. Nymphs other than *Sweltsa* are uncommonly collected in

Pennsylvania except just before emergence due to their largely hyporheic habitat. The Pennsylvania fauna contains 19 species in 6 genera; 10 species are in the genus *Alloperla*. Many North American species of Chloroperlidae are regional endemics that are restricted to specific river basins or physiographic provinces (Surdick 2004).

Alloperla aracoma Harper and Kirchner was previously reported from only one Pennsylvania stream, Powdermill Run, Westmoreland County, in the Conemaugh River portion of the Ohio River basin (Grubbs 1996). Maryland and West Virginia are the only other states with records of *A. aracoma*, where it is restricted to the Allegheny Plateau and the Ridge and Valley Physiographic Provinces (Surdick 2004).

New record: SOMERSET: (S) Breastwork Run, first SR 1017 bridge south of US Rte. 30, 29 June 1994, 1♂. Breastwork Run is a small forested cold water creek in the upper Juniata River portion of the Susquehanna River basin, along the eastern flank of the Allegheny Front near the divide with the Ohio River basin.

Alloperla petasata Surdick replaces *Alloperla caudata* Frison in its northern and eastern range in North America including Pennsylvania (Surdick 2004). *Alloperla petasata* ranges from the Canadian Maritimes south to Georgia; its sister species, *A. caudata*, is now restricted to Illinois, the Ozark-Ouachita Highlands, and the Lower Tennessee River in Alabama (Surdick 2004) and Mississippi (Willett and Stark 2009).

New records: BEDFORD: (P) Blackberry Lick Run, PA Rte. 26, 9 June 2001, 1♂, 4♀; Blues Gap Run, 400 m east of Rte. T-323, 9 June 2001, 2♂, 3♀; INDIANA: (O) Little Yellow Creek, PA Rte. 259, 21 June 2000, 8♂, 3♀ (TWS), as *Alloperla* sp. in Yasik et al. (2002); PIKE: (D) Carley Brook, 1.5 km upstream of village of Carley Brook, 8 July 2003, 1♂ (TD). These sites are small forested creeks except for Little Yellow Creek, which is a 3rd order creek whose watershed has surface coal mines with alkaline mine drainage.

Rasvena terna (Frison) has only two previous confirmed adult records in Pennsylvania, a 1994 record from Grays Run in Lycoming County and a 1958 record of unknown location. Surdick (2004) reported that *R. terna* is restricted to the Appalachian Highlands of eastern North America, from Maine south to North Carolina and Tennessee.

New records: CLINTON: (S) North Branch Tangascootack Creek, near mouth, 13 May 1998, 1♀; FORREST: (O) Minister Creek, 100 m upstream of SR 2001, 14 April 2008, 5 late instar nymphs, (RR). These are the first confirmed collection of *Rasvena* nymphs in Pennsylvania. These records suggest a preference for small, clear coldwater creeks.

Utaperla gaspesiana Harper and Roy is extremely rare in Pennsylvania. Adults were collected in the 1970's by R. Surdick from Maul Spring and Powdermill Run, Westmoreland County, in southwestern Pennsylvania; however, four years of sampling in that watershed by Grubbs (1996) did not yield any additional specimens. Only one other previous Pennsylvania record exists, from Tancascootack Creek in Clinton County (Masteller 1996). Despite its rarity, benthic taxa lists for Pennsylvania streams assessments occasionally include *Utaperla* nymphs, which are most likely misidentifications of *Alloperla usa* Ricker, similar to the misidentifications discussed by Kondratieff et al. (1995) for North and South Carolina assessments. *Utaperla gaspesiana* ranges from Quebec and Maine south to West Virginia.

New record: MONROE: (D) Pocono Creek, Camelback Road, 22 May 2002, 1♀ (CL). Pocono Creek is a small coldwater creek in northeastern Pennsylvania.

Perlidae

The Perlidae in Pennsylvania are represented by 30 species in 9 genera; however, many species are restricted to medium to large warm water creeks and rivers and are rarely collected. Adults can be most frequently collected at outdoor lights.

Acroneuria: Although 11 species of *Acroneuria* have been reported from Pennsylvania, only 9 appear valid. Many records are from collections prior to the 1950's before major species revisions, or are based on difficult to identify nymphs and need to be confirmed. The species most commonly collected as nymphs are *A. abnormis* and *A. carolinensis* (Banks), which are found in small to medium sized, usually forested creeks. *Acroneuria abnormis*, the most commonly collected adult *Acroneuria*, is also found in rivers.

Acroneuria arenosa (Pictet) was originally described from Pennsylvania in 1841. The only valid

Pennsylvania records were collected prior to 1950 and confirmed by Stark and Gaufin (1976a). *Acroneuria arenosa* ranges from Quebec south to Florida.

New records: BERKS: (D) Schuylkill River near Douglassville, 17 May 1987, 1♀ (WE); JUNIATA: (S) Juniata River Thompsettown, 28 July 1989, 1♀ (LJ). Both sites are warm water rivers.

Correction: A female *Acroneuria perplexa* Frison collected at a light in Philadelphia (year unknown) and first reported in Frison (1937) has been of questionable status in Pennsylvania since this is the only Pennsylvania record and *A. perplexa* is a largely Southern and Midwestern U.S. species. The specimen was examined by Stark during his review of *Acroneuria* and determined to be *A. arenosa*; however, the corrected identification was not included in Stark and Gaufin (1976a) and the record was carried forward in some later publications including Stewart and Stark (2002) and Stark et al. (2009). This record should be changed to *A. arenosa*.

Attaneuria ruralis (Hagen) records in Pennsylvania are based on collections from 14 locations in 9 counties (Masteller 1996); however, most of these records are of adults collected prior to 1948 or nymphs collected and identified as part of stream bioassessments. Questions on the identification of *A. ruralis* nymphs by Pennsylvania aquatic biologists prompted me to examine nymph specimens of record at the Academy of Natural Sciences of Philadelphia and the Frost Entomology Museum of Pennsylvania State University, and additional material from the Pennsylvania Department of Environmental Protection, Harrisburg, PA, and United States Environmental Protection Agency, Wheeling, WV. Nymphs were also compared with *A. ruralis* nymphs from Iowa. All nymphs identified as *A. ruralis* in these collections and recorded in Masteller (1996) were determined to be *Paragnetina media* (Walker), a common stonefly found in small to large warm water creeks in Pennsylvania, except for one nymph from Pine Creek, Blackwell, Tioga County, which was an *Acroneuria*. Additionally, one adult from Fayette County in the Frost Museum collections identified as *A. ruralis* was an *Acroneuria*. The only valid Pennsylvania records for *A. ruralis*, therefore, appear to be the pre-1946 adult specimens from Cumberland, Dauphin, and Lebanon Counties noted

in Surdick and Kim (1976), which were confirmed by Stark in his review of the Perlidae genera (Stark and Gaufin 1976b) or cited in Needham and Claassen (1925). All but one of these records is from the Harrisburg area, likely from the Susquehanna River; the lone additional specimen is from an unspecified location in Lebanon County. Casual collections of adult stoneflies in the Harrisburg area during the past 20 years have not yielded any additional specimens of *A. ruralis*. Also, I have not been able to confirm the collection of any *A. ruralis* nymphs from Pennsylvania. Targeted collection efforts should be conducted in proper habitats to determine if this species is still present in Pennsylvania. Heimdahl et al. (2004) indicated that *A. ruralis* nymphs could be found on woody debris or boulders in the slower current of rivers in interior Iowa. Poulton and Stewart (1991) stated that *A. ruralis* nymphs could be collected in Ozark streams by pulling debris from the river bottom or disturbing rocks or riprap upstream from a net.

Hansonoperla appalachia Nelson is known from only a few small to medium forested cold water creeks in Pennsylvania and in the Appalachians from New Hampshire south to Virginia. Nymphs are rarely collected, and when present, usually only one or two individuals are found at any one site. Only one adult record from Pennsylvania exists (Masteller 1996). The most nymphs collected in Pennsylvania were from Babb Creek, Tioga County, which has been affected by abandoned coal mine discharges and has a pH of 5.0 and slightly elevated dissolved aluminum (Pennsylvania Department of Environmental Protection, unpublished data).

New records: SUSQUEHANNA: (S) Nick Creek, Auburn Township, 23 June 2000, one nymph (TS); unnamed tributary to Choconut Creek, near outlet of Lake Sophia, 21 June 2000, one nymph (SRBC).

Perlinella drymo (Newman) is the less commonly collected of the two Pennsylvania species of *Perlinella*. Both adults and nymphs are extremely elusive. Only two previous Pennsylvania adult records exist, one from Northampton County in 1931 and one from Cumberland County in 1949 (Masteller 1996). *Perlinella drymo* is a widespread North American species found from the Canadian Maritimes south to Florida and west to Minnesota and Texas.

New records: LUZERNE: (S) Nescopeck Creek, old foot bridge at lower end of Nescopeck State Park, 20 April 2001, 1 nymph (MW); MONTGOMERY: (D) unnamed tributary to Schuylkill River near Spring City, 9 February 2005, 1 nymph (MB). Based on these records, *P. drymo* appears to prefer smaller cooler creeks than *P. ephyre* (Newman), which inhabits large warm water creeks and rivers in Pennsylvania.

Perlodidae

The Pennsylvania Perlodidae fauna is represented by 27 species in 9 genera. The family is divided into 2 subfamilies, Isoperlinae which in Pennsylvania includes *Isoperla* and *Clioperla*, and Perlodinae, which includes the other genera. *Isoperla* has the most species of all the Pennsylvania stonefly genera, 17 described species and several undescribed species (Szczytko and Kondratieff unpublished). Perlodinae are most commonly collected in the forested mountainous regions of Pennsylvania. Although Perlodinae nymphs are often collected in the proper habitat, adults of most genera are rarely collected. Only new adult records are included for the following species.

Two species of *Diploperla* have been reported from Pennsylvania: *D. duplicata* (Banks), which ranges from Pennsylvania south to Georgia, and *D. robusta* Stark and Gaufin, which was split from *D. duplicata* in 1974 and ranges from Connecticut south to Indiana and Kentucky. Recent collections suggest that *D. duplicata* is restricted to eastern Pennsylvania and *D. robusta* to western Pennsylvania; however, several records predating 1974 need to be examined and additional specimens collected. Both species of *Diploperla* are found in small to medium creeks. *Diploperla* nymphs are especially common in small creeks in the Allegheny National Forest in northwestern Pennsylvania.

Diploperla duplicata

New record: CUMBERLAND: (S) Doubling Gap Creek, PA Rte. 233 and Elk Hill Rd., 22 June 1995, 1 ♀.

Diploperla robusta

New records: CAMBRIA: (O) Roaring Run, PA Rte. 160, 18 June 1998, 1 ♀; WESTMORELAND: (O) Powdermill Run, Bioblitz Site 1, 19 June 2003, 1 ♂ (JW).

Helopicus subvarians (Banks) has been collected mostly from medium to large creeks and rivers in

Pennsylvania. Previous adult records are from the Delaware River basin in Carbon County and the Susquehanna River basin in Huntingdon, Lycoming, and Union Counties. *Helopicus subvarians* is found from Maine and Quebec south to Florida.

New records: DAUPHIN: (S) Susquehanna River, on Market Street Bridge near downtown Harrisburg, 1 May 2000, 1♂, 1♀ (DB); Mifflin: (S) Penns Creek, near mouth of Swift Run, 20 May 1998, 1♂ (CL); same location, 22 May 2007, 1♀ (CL); WAYNE: (D) Delaware River, 1 km downstream of Stockport, 20 May 2007, 1♀ (TD); Delaware River, across from the New York State Forest Preserve at Bouchouxville Rd., 24 June 2007, 1♀ (TD).

Isogenoides hansonii (Ricker) nymphs have been most often collected in small to medium forested cold water creeks in northern and southwestern Pennsylvania. The type locality is Brodhead Creek, Monroe County, in northeastern Pennsylvania. Previous documentation of adults in Pennsylvania was limited to 6 creeks in Forest, McKean, Monroe, Potter, and Somerset Counties (Masteller 1996). *Isogenoides hansonii* ranges from the Canadian Maritimes south to Virginia.

New record: CLINTON: (S) Chatham Run, near village of Woolrich, 11 May 2003, 5♀ (GSm).

Yugus kirchneri Nelson nymphs can be collected in low order forested cold water Pennsylvania creeks, mostly commonly in northern and southwestern Pennsylvania; previous adult records were limited to two creeks in Potter and Westmoreland Counties (Masteller 1996). *Yugus kirchneri* ranges in the Appalachians from Pennsylvania south to Virginia.

New record: BEDFORD: (S) Pavia Run, near mouth, 10 June 2006, 1♀ (GS).

ACKNOWLEDGEMENTS

I thank R.W. Baumann, Brigham Young University, B.C. Kondratieff, Colorado State University, and B.P. Stark, Mississippi College, for confirmation of species identifications; B.C. Kondratieff and B.P. Stark for review of the manuscript; C.T. Hubbard, University of Iowa Hygienic Laboratory and D.P. Heimdal, Iowa Lakeside Laboratory, for the contribution of *Attaneuria* nymphs, and R.E. DeWalt, Illinois Natural History Survey, for checking the *A. perplexa* specimen. I also thank Craig Liska, Marlton, New

Jersey, and Tim Daley, Pennsylvania Department of Environmental Protection, Wilkes Barre, PA, for their continuing interest and collection of eastern Pennsylvania stoneflies.

REFERENCES

- Baumann, R.W. 1996. Three new species of *Amphinemura* (Plecoptera: Nemouridae) from Eastern North America. *Entomological News*, 107:249-254.
- Baumann, R.W. & B.C. Kondratieff. 2009. A study of the eastern nearctic *Alloperla* (Plecoptera: Chloroperlidae) with hirsute epiprocts using the scanning electron microscope. *Illiesia*, 5:99-107.
- Earle, J. 1994. New records of stoneflies (Plecoptera) from Pennsylvania. *Entomological News*, 105:80-84.
- Earle, J.I. 2003. Stonefly (Plecoptera) emergence patterns and flight periods in Indian Creek Watershed, Pennsylvania, USA. pp. 167-175. *In: Research Update on Ephemeroptera & Plecoptera 2003*, E. Gaino (Ed.), University of Perugia, Perugia, Italy. 488 pp.
- Earle, J.I. 2004a. New records and clarifications of the Pennsylvania stonefly (Plecoptera) fauna, with an annotated list of the stoneflies of Pennsylvania. *Entomological News*, 115:191-200.
- Earle, J.I. 2004b. Stonefly (Plecoptera) species of an acidic intermittent stream in southwestern Pennsylvania, USA, comparison with a circumneutral perennial stream and consideration of survival strategies. *Archiv für Hydrobiologie*, 159:97-114.
- Frison, T.H. 1937. Studies of Nearctic Insects. II. Descriptions of Plecoptera, with special reference to the Illinois species. *Bulletin of the Illinois Natural History Survey*, 21:78-99.
- Gerritsen, J. & B. Jessup. 2007. Identification of the biological condition gradient for freestone (non-calcareous) streams of Pennsylvania. Report prepared for United States Environmental Protection Agency, Office of Science and Technology, U.S. EPA Region 3, and the Pennsylvania Department of Environmental Protection, Harrisburg, PA. 52 pp.
- Grubbs, S.A. 1996. Stoneflies (Plecoptera) of the Powdermill Nature Reserve, Southwestern Pennsylvania. *Entomological News*, 107:255-260.

- Grubbs, S.A. 1997. New records, zoogeographic notes, and a revised checklist of stoneflies (Plecoptera) from Maryland. *Transactions of the American Entomological Society*, 123:1-84.
- Grubbs, S.A. 2005. *Zealeuctra talladega*, a new species of Leuctridae (Plecoptera) from Alabama, U.S.A. *Illiesia*, 1:40-42.
- Heimdal, D.P., R.E. DeWalt, & T.F. Wilton. 2004. Annotated checklist of the stoneflies (Plecoptera) of Iowa. *Proceedings of the Entomological Society of Washington*, 106:761-778.
- Kondratieff, B.C., R.F. Kirchner, & D.R. Lenat. 1995. A review of stonefly records (Plecoptera: Hexapoda) of North Carolina and South Carolina. *Brimleyana*, 23:25-40.
- Kondratieff, B.C. & R.F. Kirchner. 2009. A new species in the *Sweltsa onkos* complex (Plecoptera: Chloroperlidae). pp. 295-300, *In*: S.M. Roble and J.C. Mitchell (eds.). *A Lifetime of Contributions to Myriapodology and the Natural History of Virginia: A Festschrift in Honor of Richard L. Hoffman's 80th Birthday*. Virginia Museum of Natural History Special Publication, No. 16, Martinsville, VA. xvi+ 458 pp.
- Kondratieff, B.C. & R.E. Zuellig. 2004. A new species of *Zealeuctra* Ricker (Plecoptera: Leuctridae) and confirmation of *Hydroperla fugitans* (Needham and Claassen) (Plecoptera: Perlodidae) from Texas. *Proceedings of the Entomological Society of Washington*, 106:840-843.
- Masteller, E.C. 1996. Plecoptera Biodiversity of Pennsylvania. Report to the Pennsylvania Wild Resources Conservation Fund. Privately printed, E.C. Masteller, The Pennsylvania State University at Erie, The Behrend College. Erie, Pennsylvania, U.S.A. 2 Volumes.
- Nations, T.M., B.P. Stark, & M.B. Hicks. 2007. The winter stoneflies (Plecoptera: Capniidae) of Mississippi. *Illiesia*, 3:70-94.
- Needham, J.G. & P.W. Claassen. 1925. A monograph of the Plecoptera or stoneflies of America north of Mexico. Thomas Say Foundation, Entomological Society of America, 2:1-397.
- Nelson, C.H., R. Hamilton IV, & R.M. Duffield. 2002. Confirmed records of *Leuctra variabilis* and *Alloperla usa* in Maryland (Plecoptera: Leuctridae, Chloroperlidae), with additional comments on the former species. *Entomological News*, 113:137-139.
- Pennsylvania Department of Environmental Protection. 2008. Pennsylvania Integrated Water Quality Monitoring and Assessment Report, Clean Water Act Section 305(b) Report and 303(d) List. Pennsylvania Department of Environmental Protection, Harrisburg, PA.
- Poulton, B.C. & K.W. Stewart. 1991. The stoneflies of the Ozark and Ouachita Mountains. *Memoirs of the American Entomological Society*, No. 38:1-116.
- Ricker, W.E. & H.H. Ross. 1968. North American species of the *Taeniopteryx* (Plecoptera, Insecta). *Journal of the Fisheries Research Board of Canada*, 25:1423-1439.
- Ricker, W.E. & H.H. Ross. 1969. The genus *Zealeuctra* and its position in the family Leuctridae (Plecoptera, Insecta). *Canadian Journal of Zoology*, 47:1113-1127.
- Stark, B.P. & A.R. Gaufin. 1976a. The Nearctic species of *Acroneturia* (Plecoptera: Perlidae). *Journal of the Kansas Entomological Society*, 49:221-252.
- Stark, B.P. & A.R. Gaufin. 1976b. The Nearctic genera of Perlidae (Plecoptera). *Miscellaneous Publications of the Entomological Society of America*, 10:1-80.
- Stark, B.P., R.W. Baumann, & R.E. DeWalt. 2009. Valid stonefly names for North America: Updated February 19, 2009. Plecoptera Society of North America. URL address: (<http://plsai.inhs.uiuc.edu/plecoptera/validnames.aspx>).
- Stewart, K.W. & Stark, B.P. 2002. *Nymphs of North American Stonefly Genera (Plecoptera)*, 2nd Ed. The Caddis Press, Columbus, Ohio. 510 pp.
- Surdick, R.F. 2004. Chloroperlidae (The Sallflies). pp. 1-60. *In*: B.P. Stark and B.J. Armitage, editors. *Stoneflies (Plecoptera) of Eastern North America. Volume II. Chloroperlidae, Perlidae, and Perlodinae (Perlodidae)*. Ohio Biological Survey Bulletin New Series, Volume 14. Columbus, Ohio. 192 pp.
- Surdick, R.F. & K.C. Kim. 1976. Stoneflies (Plecoptera) of Pennsylvania. A synopsis. Pennsylvania State University Agricultural Experimental Station Bulletin, 808:9-73.
- Tarter, D.C. & C.H. Nelson. 2006. A revised checklist of the stoneflies (Plecoptera) of West Virginia (USA). *Proceedings of the Entomological Society of Washington*, 108:429-442.

Earle, Jane I. 2009. New state stonefly (Plecoptera) records for Pennsylvania, with additional records and information on rare species. *Illiesia*, 5(16):169-181. Available online: <http://www2.pms-lj.si/illiesia/papers/Illiesia05-16.pdf>

Webb, D.W. 2002. The winter stoneflies of Illinois (Insecta: Plecoptera): 100 years of Change. *Illinois Natural History Survey Bulletin*, 36:195-274.

Willett, M.R. & B.P. Stark 2009. The *Alloperla leonarda* group of eastern North America, with SEM images of four out-group species (Plecoptera: Chloroperlidae). *Illiesia*, 5:108-127.

Yasick, A.L., T.W. Simmons, & J.I. Earle. 2003. Parasitic water mite larvae (Acari: Stygothrombidiidae) associated with stonefly adults (Insecta: Plecoptera) from an Allegheny mountain stream. pp. 323-330. *In*: Smith, I.M. (Editor). An acarological tribute to David R. Cook: From Yankee Springs to Wheeny Creek. Indira Publishing House, West Bloomfield, Michigan. 331 pp.

Received 26 August 2009, Accepted 13 October 2009, Published 2 November 2009