

ANNOTATED CHECKLIST OF THE STONEFLIES (PLECOPTERA) OF IOWA

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Abstract.—Forty-three stonefly species including ten species from literature records are reported from Iowa. Stoneflies were present in all Iowa ecoregions. The Paleozoic Plateau/Coulee Section contained the greatest number of species (30) along with the most unique species (8). *Allocapnia pygmaea* (Burmeister), *Leuctra tenuis* (Pictet), *Amphinemura linda* (Ricker), *Nemoura trispinosa* Claassen, and *Soyedina vallicularia* (Wu) were confined to the Paleozoic Plateau/Coulee Section and should be considered for state protection. Western and southern Iowa have been poorly surveyed. Few species have been produced in these areas, presumably due to poor habitat conditions.

Key Words: stoneflies, Plecoptera, Iowa, ecoregion, imperiled species

Stoneflies (Plecoptera) are among the most environmentally sensitive group of aquatic insects (Hilsenhoff 1987, Lenat 1993). Recently, the Nature Conservancy and Association for Biodiversity Information ranked stoneflies as being one of the three most imperiled freshwater groups in the United States, with 43% of more than 600 species classified as "Vulnerable," "Imperiled," "Critically Imperiled," or "Presumed or Possibly Extinct" (Stein et al. 2000). According to total number of species imperiled, stoneflies were second only to fish in freshwater habitats and third across all habitats combined.

There is currently a gap in our knowledge of the distribution patterns and geographic affinities of stoneflies in Iowa. Stark (2001) listed only ten species from the state: *Allocapnia granulata* (Claassen), *A. rickeri* Frison, *A. vivipara* (Claassen), *Taeniopteryx burksi* Ricker and Ross, *Ac-*

roneuria abnormis (Newman), *Attaneuria ruralis* (Hagen), *Perlesta cinctipes* (Banks), *Perlinella drymo* (Newman), *Isoperla longiseta* Banks, and *Isogenoides doratus* (Frison). This number of species is far less than adjacent states' records: Illinois (76 species), Minnesota (54), Missouri (69), South Dakota (33), and Wisconsin (62) (Huntsman et al. 2001, Stark 2001, DeWalt et al. 2002). The low diversity of stoneflies in Iowa is probably the result of historically low collection effort.

Iowa is located in a transition zone of two major biotic provinces, the Eastern Deciduous Forest and the Prairie (Houghton et al. 2001). Nearly 85% of Iowa's 14,500,307 hectares were prairie prior to Euro-American settlement with the other 15% being forest and savanna (Thompson 1992). Over 30,577 kilometers of interior rivers and streams flow throughout the state with nearly 70% of the streams draining eastward to



Fig. 1. Ecoregions, counties, and major rivers of Iowa.

the Mississippi River and the other 30% southwest towards the Missouri River (Larimer 1957). Griffith et al. (1994) classified the state into four level III ecoregions, the Central Irregular Plains, the Western Corn Belt Plains, the Driftless Area, and the Interior River Valleys and Hills. Chapman et al. (2002) further refined these classifications by creating ten level IV ecoregions. The Iowan Surface (47c) and Paleozoic Plateau/Coulee Section (52b) (Fig. 1) have streams that occupy old valleys with high gradients, cool waters, and rocky substrates (Eckblad and Coon 1984). Bedrock outcrops, boreal microhabitats, and karst geologic features are attributes largely unique to these areas. The Rolling Loess Prairies (47f) and Loess Flats and Till Plains (40a) are most representative of the Iowa landscape (Prior 1991). These regions are well drained and flow through rolling hills of

row crops, grasslands, and woodlands. The Northwest Iowa Loess Prairies (47a), Des Moines Lobe (47b), Western Loess Hills (47m), and Steeply Rolling Loess Prairies (47c) were once tallgrass prairie that has since been converted to agriculture dominated and hydrologically modified landscape. These alterations have adversely impacted stream condition. The rivers of the Upper Mississippi Alluvial Plain (72d) and Missouri Alluvial Plain (47d) receive the drainage of most of Iowa's surface area prior to their entering the Mississippi and Missouri rivers (Prior 1991). Many rivers in these ecoregions have been dammed or channelized.

The objectives of this study were to document the stonefly fauna of Iowa, associate this fauna with the ten level IV ecoregions, and discuss the need for protection of habitats that support species rare to Iowa. We

hope the distribution information produced by this study also will add to the knowledge of post-glacial dispersal of several species, as there are presently vast disjunctions between taxa found in Minnesota, to the north, and the Interior Highlands, to the south (Poulton and Stewart 1991).

MATERIALS AND METHODS

Since 1991 the University of Iowa Hygienic Laboratory (UHL) and the Iowa Department of Natural Resources (Iowa DNR) have performed aquatic macroinvertebrate surveys at 337 stream and river locations as part of a statewide biological assessment project. The surveys used Hester-Dendy multi-plate samplers, a modified Hess sampler, and hand picking from aquatic substrates. The bioassessment project provided many stonefly nymphs for the current project. Adults were collected using ultra-violet light trapping, sweep netting, and hand picking to augment this source and to confirm nymphal identifications. The majority of the specimens reside in the Illinois Natural History Survey (INHS) collection, the information for which may be viewed at http://ctap.inhs.uiuc.edu/insect/search_inhs.asp. Collection data from UHL and the other institutions that provided material, Brigham Young University (BYU), Iowa State University (ISU), Colorado State University (CSU), University of Northern Iowa, Okoboji Lakeside Laboratory (OLL), and Mississippi College, can be obtained by contacting the senior author.

RESULTS

Stoneflies were collected from 274 of the 337 stream locations surveyed. A total of 43 species in 20 genera and seven families were either collected or found in museum holdings (Table 1). Thirty-three of these were new state records and some represented significant range extensions.

Perlidae (15), Perlodidae (12), and Nemouridae (7) contributed the greatest number of species. Peltoperlidae and Chloroperlidae were not found, although the latter taxon may yet be discovered. The greatest generic

species richness were *Isoperla* (8), *Perlesta* (6), and *Allocapnia* (4). Nymphal *Perlesta*, *Neoperla*, and *Pteronarcys* were unidentifiable to species, but have been included in Table 1 as they represented important location information at the generic level.

Stoneflies were present within each level IV ecoregion (Table 1). The Paleozoic Plateau/Coulee Section (30 species) had the highest diversity, followed by the Iowan Surface (26), Rolling Loess Prairies (22), and Des Moines Lobe (19). The other six ecoregions had a combined 14 species among them. The Paleozoic Plateau/Coulee Section also had the greatest number of unique species at eight (Table 1). Other ecoregions had no more than two unique species (Table 1).

The following discussions summarize Iowa distributions, habitat requirement observations, and known North American range for all stoneflies found within the state, both historically and contemporarily. County and stream information is given for all new state records with complete collection data for *Allocapnia pygmaea* (Burmeister), *Leuctra tenuis* (Pictet), *Amphinemura linda* (Ricker), *Nemoura trispinosa* Claassen, and *Soyedina vallicularia* (Wu).

Family Capniidae

Allocapnia granulata (Claassen)

Allocapnia granulata occurred throughout four ecoregions (Table 1) and was most common in the small, cobble-bottomed creeks of the Iowan Surface and Paleozoic Plateau/Coulee Section. Poulton and Stewart (1991) reported it from Arkansas, Missouri, Oklahoma, and Illinois, and associated with a variety of stream conditions. This species has been previously reported from Iowa (Ross and Ricker 1971) and is known from 26 other states/provinces (Stark 2001) including neighboring Minnesota and Wisconsin (Ross and Ricker 1971).

Allocapnia pygmaea (Burmeister)

Allocapnia pygmaea occurred in the large, cool-water rivers of the Paleozoic

Table 1. Iowa stoneflies distributed among ecoregions (see Fig. 1 for key to codes). Number of species within each family in parentheses after family names. New state records are in boldface.

Taxon	Ecoregions									
	40a	47a	47b	47c	47d	47e	47f	47m	52b	72d
CAPNIIDAE (4)										
<i>Allocapnia granulata</i>			X	X			X		X	
<i>A. pygmaea</i>									X	
<i>A. rickeri</i>									X	
<i>A. vivipara</i>	X		X	X			X		X	X
LEUCTRIDAE (1)										
<i>Leuctra tenuis</i>									X	
NEMOURIDAE (7)										
<i>Amphinemura delosa</i>									X	
<i>A. linda</i>									X	
<i>A. varshava</i>	X		X	X			X		X	
<i>Nemoura trispinosa</i>									X	
<i>Prostoia completa</i>				X					X	
<i>Shipsa rotunda</i>				X					X	
<i>Soyedina vallicularia</i>									X	
TAENIOPTERYGIDAE (3)										
<i>Strophopteryx fasciata</i>				X			X		X	
<i>Taeniopteryx burksi</i>	X	X	X	X		X	X		X	X
<i>T. nivalis</i>		X	X	X			X		X	
PERLIDAE (15)										
<i>Acroneuria abnormis</i>	X	X	X	X		X	X	X	X	X
<i>A. lycorias</i>			X	X					X	
<i>Attaneuria ruralis</i>			X	X		X	X	X		X
<i>Perlesta cinctipes</i>	X		X							
<i>P. decipiens</i>			X	X			X		X	
<i>P. golconda</i>	X		X				X			
<i>P. lagoi</i>	X		X	X			X			
<i>P. shubuta</i>				X			X			
<i>P. xube</i>	X						X			
<i>Perlesta sp.</i>	X	X	X	X	X	X	X	X		X
<i>Perlinella drymo</i>			X	X			X		X	
<i>P. ephyre</i>				X					X	
<i>Neoperla clymene</i>	X						X			
<i>N. osage</i>			X							
<i>Neoperla sp.</i>	X	X		X		X	X	X		X
<i>Agnentina capitata</i>		X	X	X			X		X	
<i>Paragnetina media</i>				X					X	
PERLODIDAE (12)										
<i>Clioperla clio</i>									X	
<i>Isoperla bilineata</i>	X		X	X			X		X	X
<i>I. dicala</i>				X					X	
<i>I. longiseta</i>			X							
<i>I. marlynia</i>				X			X		X	
<i>I. richardsoni</i>				X			X		X	
<i>I. signata</i>				X					X	
<i>I. slossonae</i>				X						
<i>I. transmarina</i>				X					X	
<i>Isogenoides doratus</i>		X	X							
<i>I. kurmholzi</i>							X			
<i>I. varians</i>							X			

Table 1. Continued.

Taxon	Ecoregions									
	40a	47a	47b	47c	47d	47e	47f	47m	52b	72d
PTERONARCYIDAE (1)										
<i>Pteronarcys pictetii</i>		X	X	X			X		X	
<i>Pteronarcys sp.</i>		X	X	X		X	X	X	X	X
Total Species	10	6	19	26	0	3	22	2	30	5
Total Unique Species	0	0	2	1	0	0	2	0	8	0
Total Collection Sites	12	18	62	72	1	8	39	3	54	5

Plateau/Coulee Section (Fig. 2). Ross and Ricker (1971) found this species in similar habitats. *Allocaupnia pygmaea* is a new state record and is known from 24 states/provinces (Stark 2001) including adjacent Minnesota, Missouri, and Wisconsin (Ross and Ricker 1971).

Records.—Clayton Co., Volga River, 1 km N Elkport, Co. Rd. X3C, 23 Feb 2000, 1 ♂ (INHS); Fayette Co., Turkey River, Eldorado, State Hwy. 150, 20 Mar 2000, 3 ♀ (INHS); 14 Feb 2002, 12 ♂, 13 ♀ (INHS).

Allocaupnia rickeri Frison

Allocaupnia rickeri was found in several, small, cold-water creeks of the Paleozoic Plateau/Coulee Section (Table 1). Ross and Ricker (1971) have previously reported *A. rickeri* from Iowa and it is known from 23 other states/provinces (Stark 2001) including adjacent Illinois, Minnesota, Missouri, and Wisconsin (Ross and Ricker 1971).

Allocaupnia vivipara (Claassen)

This species occurred in six ecoregions (Table 1). Collection sites varied from small, rapid creeks to large, turbid rivers. Poulton and Stewart (1991) found it in similar habitats in the Missouri Ozarks. Ross and Ricker (1971) previously reported *A. vivipara* from Iowa and Stark (2001) listed it from 20 other states/provinces, including adjacent Illinois, Minnesota, and Wisconsin (Ross and Ricker 1971).

Family Leuctridae

Leuctra tenuis (Pictet)

Adults of this species were collected from a single small cold-water creek of the

Paleozoic Plateau/Coulee Section (Fig. 2). Several unidentifiable nymphs were also found in June and October from the same stream. Poulton and Stewart (1991) reported that *L. tenuis* was almost exclusively found in permanent spring streams in Missouri. *Leuctra tenuis* is a new state record and has been reported from 21 states/provinces (Stark 2001), including adjacent Illinois (Frison 1942), Minnesota (Harden and Mickel 1952), and Wisconsin (Hilsenhoff and Narf 1972).

Records.—Clayton Co., West Fork Sny Magill Creek, 6.6 km SW McGregor, Justice Rd., 2 Sept 2003, 1 ♀ (UHL); 17 Sept 2003, 1 ♂, 1 ♀ (INHS).

Family Nemouridae

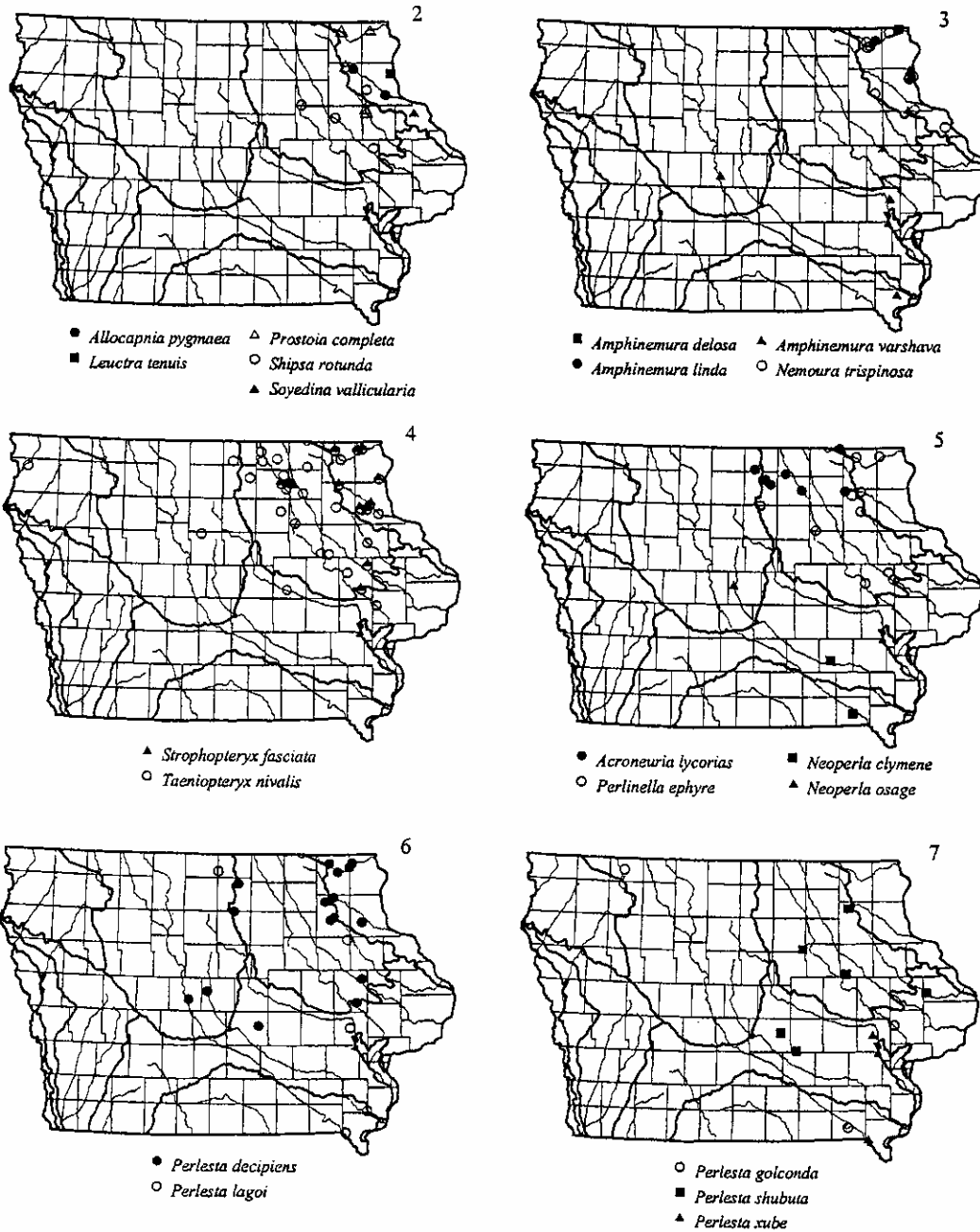
Amphinemura delosa (Ricker)

Adults of this species were collected from a single cold-water stream in the Paleozoic Plateau/Coulee Section (Fig. 3). *Amphinemura delosa* will likely be found throughout this region because Illinois reports it as common in the streams along the Mississippi River (DeWalt, unpublished data). Poulton and Stewart (1991) also report *A. delosa* as the most common nemourid in the Ozarks of Missouri. *Amphinemura delosa* is a new state record and has been reported from 19 states/provinces (Stark 2001), including adjacent Wisconsin (Hilsenhoff 1975).

Records.—Allamakee Co., Unnamed trib. to Waterloo Creek (INHS, UHL).

Amphinemura linda (Ricker)

This is one of Iowa's autumn emerging stoneflies. Adults were collected from a sin-



Figs. 2-7. Distribution of new state record stoneflies in Iowa. 2, *Allocapnia pygmaea* (circle), *Leuctra tenuis* (square), *Prostoia completa* (open triangle), *Shipsa rotunda* (open circle), *Soyedina vallicularia* (triangle). 3, *Amphinemura delosa* (square), *A. linda* (circle), *A. varshava* (triangle), *Nemoura trispinosa* (open circle). 4, *Strophopteryx fasciata* (triangle), *Taeniopteryx nivalis* (open circle). 5, *Acroneuria lycorias* (circle), *Perlina ephyra* (open circle), *Neoperla clymene* (square), *N. osage* (triangle). 6, *Perlesta decipiens* (circle), *P. lagoi* (open circle). 7, *Perlesta golconda* (open circle), *P. shubuta* (square), *P. xube* (triangle).

gle, large-volume springbrook in the Upper Iowa River watershed of the Paleozoic Plateau/Coulee Section (Fig. 3). Huntsman et al. (2001) reported this species from a similar relict habitat in South Dakota. This is a new state record and has been reported from 14 states/provinces including adjacent Wisconsin (Stark 2001).

Records.—Winneshiek Co., Dunning's Spring, Decorah, Ice Cave Rd., 30 Sept 1999, 3 ♂, 12 ♀, 1 N (INHS); 19 Sept 2000, 8 ♂, 3 ♀ (INHS).

Amphinemura varshava (Ricker)

This species represents a new state record and was collected from five eastern and central Iowa ecoregions (Fig. 3). This species occurred in small, wooded streams with abundant cobble and was abundant along the bluff streams of the Mississippi and Rock rivers in Illinois (DeWalt, unpublished data). Stark (2001) reported *A. varshava* from four states including adjacent Wisconsin.

Records.—Boone Co., Ledges St. Park (BYU); Clayton Co., Brownfield Creek (INHS), Unnamed trib. Sny Magill Creek (INHS); Johnson Co., Turkey Creek (INHS); Lee Co., Atman Creek (INHS); Linn Co., Horseshoe Falls Creek (UHL).

Nemoura trispinosa Claassen

This species is restricted to the springbrooks of the Paleozoic Plateau/Coulee Section (Fig. 3). Harden and Mickel (1952) reported *N. trispinosa* from bluff springbrooks in southeastern Minnesota. This is a new state record and is also known from 15 states/provinces including adjacent Illinois (Frison 1942), South Dakota (Huntsman et al. 2001), and Wisconsin (Stark 2001).

Records.—Allamakee Co., Unnamed spring of Waterloo Creek, Dorchester, State Hwy. 76 and Steinbach Rd., 13 Apr 1996, 13 N (BYU); 3 June 2003, 1 ♂, 1 ♀ (UHL); Clayton Co., West Fork Sny Magill Creek, 6.6 km SW McGregor, Justice Rd., 10 June 1999, 1 ♀ (UHL); Bridal Veil Falls, 3 km S McGregor, Pikes Peak State Park, 7 June

2001, 11 ♀, 1 N (UHL); Delaware Co., Unnamed spring of Grimes Hollow, 3.5 km E Colesburg, Voyager Rd., 1 May 2004, 1 N (UHL); Dubuque Co., Unnamed spring of Catfish Creek, 5 km SW Key West, Swiss Valley County Park, 28 Apr 2004, 1 N (UHL); Fayette Co., Unnamed spring of Grannis Creek, 5.2 km W Wadena, 19 June 2000, 1 ♀ (INHS); Winneshiek Co., Twin Springs, Decorah, Twin Springs City Park, 13 Apr 1996, 3 ♂, 4 ♀, 9 N (BYU); 19 Sept 2000, 6 ♂, 14 ♀ (INHS); Malanaphy Springs, 7.2 km NW Decorah, Co. Rd. W20, 10 May 2000, 6 N (INHS); 8 June 2000, 1 ♂, 3 ♀ (INHS); Dunning's Spring, Decorah, Ice Cave Rd., 30 Sept 1999, 1 ♂, 11 ♀ (INHS); 22 June 2000, 2 ♂, 5 ♀ (INHS); 19 Sept 2000, 1 ♂ (INHS).

Prostoia completa (Walker)

Prostoia completa is a spring-emerging species found in the Iowan Surface and Paleozoic Plateau/Coulee Section (Fig. 2), occurring in medium-to-large streams with clean, rock riffles. Harden and Mickel (1952) reported *P. completa* from similarly sized streams in Minnesota. This species is a new state record and has been reported from 22 states/provinces (Stark 2001) including adjacent Illinois (Harris and Webb 1995), Missouri (Poulton and Stewart 1991), and Wisconsin (Hilsenhoff and Narf 1972).

Records.—Allamakee Co., Upper Iowa River (INHS); Delaware Co., Maquoketa River (INHS); South Fork Maquoketa River (BYU, CSU); Fayette Co., Turkey River (INHS, UHL); Winneshiek Co., Upper Iowa River (INHS).

Shipsa rotunda (Claassen)

Shipsa rotunda was rare in Iowa, with records from three streams in the Iowan Surface and one stream in the Paleozoic Plateau/Coulee Section (Fig. 2). This species occurred in medium-to-large rivers with sandy substrates. This species is a new state record and is known from 18 states/provinces (Stark 2001), including adjacent

Minnesota (Harden and Mickel 1952), Wisconsin (Hilsenhoff and Narf 1972), and Illinois (Webb and Harris 1993).

Records.—Bremer Co., Cedar River (BYU); Buchanan Co., Wapsipinicon River (UHL); Clayton Co., Volga River (BYU); Linn Co., Buffalo Creek (INHS).

Soyedina vallicularia (Wu)

Nymphs and adults of *S. vallicularia* were collected from a small hillside seep within the Paleozoic Plateau/Coulee Section (Fig. 2). This species was also found from similar habitats in Wisconsin (Hilsenhoff 1975), where it is critically imperiled (Wisconsin Natural Heritage Inventory 2004). *Soyedina vallicularia* is a new state record and is known from 14 states/provinces (Stark 2001), including adjacent Illinois (Harris and Webb 1995).

Records.—Dubuque Co., Unnamed spring of Middle Fork Little Maquoketa River, 6.3 km SW Rickardsville, Park Hollow Rd., Bankston County Park, 15 Apr 2004, 1 N (UHL); 28 Apr 2004, 1 ♂ (UHL).

Family Taeniopterygidae

Strophopteryx fasciata (Burmeister)

Strophopteryx fasciata was collected in eastern Iowa across three ecoregions (Fig. 4). Specimens were most commonly collected along medium-sized streams with abundant cobbles. Webb (2002) reported that Illinois populations of this species experienced a drastic range reduction throughout the twentieth century. This species is a new state record and is known from 23 states/provinces (Stark 2001), including adjacent Minnesota (Harden and Mickel 1952), Missouri (Poulton and Stewart 1991), and Wisconsin (Hilsenhoff and Narf 1972).

Records.—Allamakee Co., Upper Iowa River (INHS); Yellow River (INHS); Chickasaw Co., Little Cedar River (BYU, UHL); Clayton Co., Turkey River (BYU, UHL); Volga River (BYU, UHL); Fayette Co.,

Turkey River (INHS); Floyd Co., Cedar River (BYU, CSU); Linn Co., Big Creek (INHS); Buffalo Creek (INHS); Winneshek Co., Upper Iowa River (INHS).

Taeniopteryx burksi Ricker & Ross

Eight of the ten ecoregions provided specimens of this commonly collected taeniopterygid (Table 1). Mature nymphs and adults were collected from logjams and overhanging brush along medium-to-large rivers with slow moving water. *Taeniopteryx burksi* was previously reported from Iowa by Ricker and Ross (1968) and is known from 27 other states/provinces (Stark 2001), including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), Missouri (Poulton and Stewart 1991), and Wisconsin (Hilsenhoff and Narf 1972). Webb (2002) reported that this species is still the most common taeniopterygid in Illinois streams.

Taeniopteryx nivalis (Fitch)

Taeniopteryx nivalis was collected with greatest frequency in small, clean streams in five ecoregions, but was also taken from some of the same rivers as *T. burksi* (Fig. 4). This is a new state record and has been reported from 19 states/provinces (Stark 2001) including adjacent Illinois (Ricker and Ross 1968), Minnesota (Harden and Mickel 1952), and Wisconsin (Hilsenhoff and Narf 1972). Webb (2002) reported that this species was increasing its range in Illinois to the extent that it is now common in the northern third of the state.

Records.—Allamakee Co., Upper Iowa River (INHS, UHL); Yellow River (INHS); Benton Co., Spring Creek (UHL); Bremer Co., Cedar River (BYU, CSU); Buchanan Co., Lime Creek (INHS); Butler Co., Shell Rock River (BYU, CSU); Cedar Co., Cedar River (INHS); Cerro Gordo Co., Winnebago River (INHS); Chickasaw Co., Little Cedar River (BYU); Wapsipinicon River (INHS, UHL); Clayton Co., Hewitt Creek (UHL); Turkey River (BYU); Volga River (BYU, INHS, UHL); Delaware Co., Ma-

quoketa River (UHL); Fayette Co., Turkey River (INHS); Volga River (INHS); Floyd Co., Cedar River (BYU, CSU, INHS); Little Cedar River (UHL); Hamilton Co., White Fox Creek (UHL); Howard Co., Crane Creek (BYU); Linn Co., Big Creek (INHS); Buffalo Creek (INHS); West Otter Creek (UHL); Mitchell Co., Burr Oak Creek (UHL); Deer Creek (UHL); Rock Creek (UHL); Sioux Co., Rock River (CSU); Tama Co., Iowa River (UHL); Winnebago Co., Upper Iowa River (BYU, INHS); Worth Co., Willow Creek (UHL).

Family Perlidae

Acroneuria abnormis (Newman)

This species was collected from nine of ten ecoregions (Table 1). The Missouri Alluvial Plain was the only region not to have *A. abnormis*. Specimens were found in small, rocky creeks to large, meandering rivers. This species appeared to tolerate moderate levels of organic pollution, as evidenced by its occurrence in the degraded streams of western Iowa. Stark and Gaufin (1976) previously reported *A. abnormis* from Iowa and it is known from 40 other states/provinces (Stark 2001) including all adjacent states (Frison 1935, Harden and Mickel 1952, Stark and Gaufin 1976, Huntsman et al. 2001).

Acroneuria lycorias (Newman)

Acroneuria lycorias occurs within the Paleozoic Plateau/Coulee Section, Iowan Surface, and Des Moines Lobe ecoregions (Fig. 5). Specimens were collected from small, cobble-bottomed creeks and the upper reaches of large, rocky rivers. Harden and Mickel (1952) reported it as widespread in Minnesota and as one of the few stoneflies collected in western prairie counties. *Acroneuria lycorias* is a new state record and was reported from 20 states/provinces (Stark 2001) including adjacent Wisconsin (Hilsenhoff and Narf 1972).

Records.—Cerro Gordo Co., Calmus Creek (UHL); Winnebago River (INHS,

UHL); Fayette Co., Little Turkey River (UHL); Floyd Co., Cedar River (BYU); Howard Co., Upper Iowa River (UHL); Mitchell Co., Rock Creek (UHL); Worth Co., Willow Creek (UHL).

Attaneuria ruralis (Hagen)

This species was collected in several interior rivers across six ecoregions (Table 1). *Attaneuria ruralis* typically occurred in large rivers on woody debris or boulders in slower current. This species has been previously reported from Iowa and 22 other states/provinces (Stark 2001) including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), Missouri (Poulton and Stewart 1991), and Wisconsin (Hilsenhoff 1975).

Perlesta cinctipes (Banks)

This species was recently found from a small, sometimes intermittent stream from the Loess Flats and Till Plains and Stark (1989) reported it from Story County in the Des Moines Lobe (Table 1). DeWalt et al. (2001) also collected this species from a similar stream in Illinois. *Perlesta cinctipes* has been reported from six other states (Stark 2001) including adjacent Missouri (Stark 1989) and Nebraska (Rhodes and Kondratieff 1996).

Perlesta decipiens (Walsh)

Perlesta decipiens was collected from a wide range of stream sizes and qualities in four ecoregions (Fig. 6), and was the most common *Perlesta* in the state. DeWalt et al. (2001) also reported it as the most widespread *Perlesta* in Illinois. *Perlesta decipiens* is a new state record and has been reported from 14 states including adjacent Missouri (Poulton and Stewart 1991), Nebraska (Stark 1989), South Dakota (Huntsman et al. 2001), and Wisconsin (Stark 1989).

Records.—Allamakee Co., Upper Iowa River (INHS); Boone Co., Ledges St. Park (ISU); Cerro Gordo Co., Winnebago River (INHS); Clayton Co., Volga River (INHS);

Fayette Co., Little Turkey River (INHS); Turkey River (INHS, UHL); Volga River (INHS); Jasper Co., North Skunk River (BYU, INHS); Linn Co., Big Creek (INHS); Buffalo Creek (INHS); Story Co., possibly South Skunk River (ISU); Winnebago Co., Canoe Creek (INHS); Dunning's Spring (INHS); Upper Iowa River (INHS).

Perlesta golconda DeWalt and Stark

This species occurred in the Rolling Loess Prairies, Loess Flats and Till Plains, and Des Moines Lobe ecoregions (Fig. 7). Collection sites are medium to large rivers with sand bottoms. DeWalt et al. (1998) described this species from the Ohio River in southern Illinois and has since been found in smaller rivers in Illinois and Nebraska (DeWalt et al. 2001). *Perlesta golconda* is a new state record and is also known from adjacent Missouri (Stark 2001).

Records.—Cedar Co., Cedar River (INHS); Dickinson Co., possibly Little Sioux River (OLL); Van Buren Co., Des Moines River (INHS, UHL).

Perlesta lagoi Stark

Perlesta lagoi was collected from four ecoregions (Fig. 6). Collection sites varied from clear running creeks with rocky substrates to channelized drainage ditches with silt bottoms. This species appears to tolerate a wide range of stream habitats. *Perlesta lagoi* is a new state record and is known from three states including adjacent Illinois, but it is probably more widespread throughout the midwestern United States (DeWalt et al. 2001).

Records.—Buchanan Co., South Fork Maquoketa River (INHS); Henry Co., Cedar Creek (INHS, UHL); Johnson Co., Clear Creek (INHS); Lee Co., Lick Creek (INHS); Worth Co., Beaver Creek (INHS).

Perlesta shubuta Stark

Perlesta shubuta occurred within the Iowan Surface and Rolling Loess Prairies (Fig. 7). This species was found in small

creeks to large rivers with sand bottoms. Currently, this species is the only *Perlesta* recognizable in the nymphal stage due to its freckled head mask. All other known nymphs have head masks of solid pigment. Poulton and Stewart (1991) reported that *P. shubuta* was restricted to the larger, permanent streams in Missouri. This species is a new state record and has been reported from five states (Stark 1989, Stark 2001), including adjacent Illinois (DeWalt et al. 2001).

Records.—Buchanan Co., Lime Creek (INHS, UHL); Butler Co., Beaver Creek (UHL); Fayette Co., Little Turkey River (INHS); Jackson Co., Maquoketa River (INHS); Jasper Co., North Skunk River (INHS); Poweshiek Co., North Skunk River (INHS).

Perlesta xube Stark and Rhodes

Perlesta xube is a new state record and was found in Loess Flats and Till Plains and Rolling Loess Prairie streams (Fig. 7). This species was collected from heavily shaded, cobble-bottomed creeks and open canopied, sand-bottomed streams. Stark and Rhodes (1997) described *P. xube* from a channelized stream in northern Nebraska. This species occurs in adjacent Illinois in habitats similar to that noted for Iowa (DeWalt et al. 2001) and in North Dakota (Kondratieff and Baumann 1999).

Records.—Johnson Co., Clear Creek (INHS); Lee Co., Lick Creek (INHS).

Perlinella drymo (Newman)

This species occurred in small-to-large rivers of four ecoregions (Table 1). Nymphs inhabited fine gravel substrates, often with abundant coarse organic material overlaid. Poulton and Stewart (1991) reported this species from similar habitats in Missouri. *Perlinella drymo* has been collected previously in Iowa (Stewart and Stark 2002) and 33 other states/provinces (Stark 2001) including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), and Wisconsin (Hilsenhoff 1975).

Perlinella ephyre (Newman)

Perlinella ephyre occurred in the Iowan Surface and Paleozoic Plateau/Coulee Section ecoregions (Fig. 5). All the collection sites were medium-to-large rivers with abundant rocky substrate. Most specimens were adults, the nymphs being rarely collected. In Missouri, *P. ephyre* nymphs occurred in fine gravel of shallow runs (Poulton and Stewart 1991). This species is a new state record and has been reported from 28 states (Stark 2001) including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), and Wisconsin (Hilsenhoff 1975).

Records.—Allamakee Co., Upper Iowa River (INHS); Bremer Co., Cedar River (UHL); Fayette Co., Little Turkey River (INHS); Turkey River (UHL); Volga River (INHS); Franklin Co., Baily Creek (UHL); Linn Co., Buffalo Creek (UHL); Cedar River (INHS); Wapsipinicon River (INHS); Winneshiek Co., Upper Iowa River (INHS).

Neoperla clymene (Newman)

Adult *N. clymene* were collected recently from the Loess Flats and Till Plains and the Rolling Loess Prairies (Fig. 5). *Neoperla* nymphs have been collected from five additional ecoregions (Table 1), but species determination was not possible. DeWalt et al. (2002) found that this species had undergone a dramatic range reduction in Illinois and is now limited to large rivers. This is a new state record and is known from 12 states (Stark 2001).

Records.—Keokuk Co., North Skunk River (INHS); Van Buren Co., Des Moines River (INHS, UHL).

Neoperla osage Stark and Lentz

One specimen from the INHS represents this new state record collected within the Des Moines Lobe (Fig. 5). There are no contemporary records for this species. Poulton and Stewart (1991) reported *N. osage* as endemic to the Ozark and Quachita mountain regions of Missouri and Arkan-

sas, but it was also collected from large rivers of the Gulf Coastal Plain. This species has been reported from three states (Stark 2001).

Records.—Story Co., possibly South Skunk River (INHS).

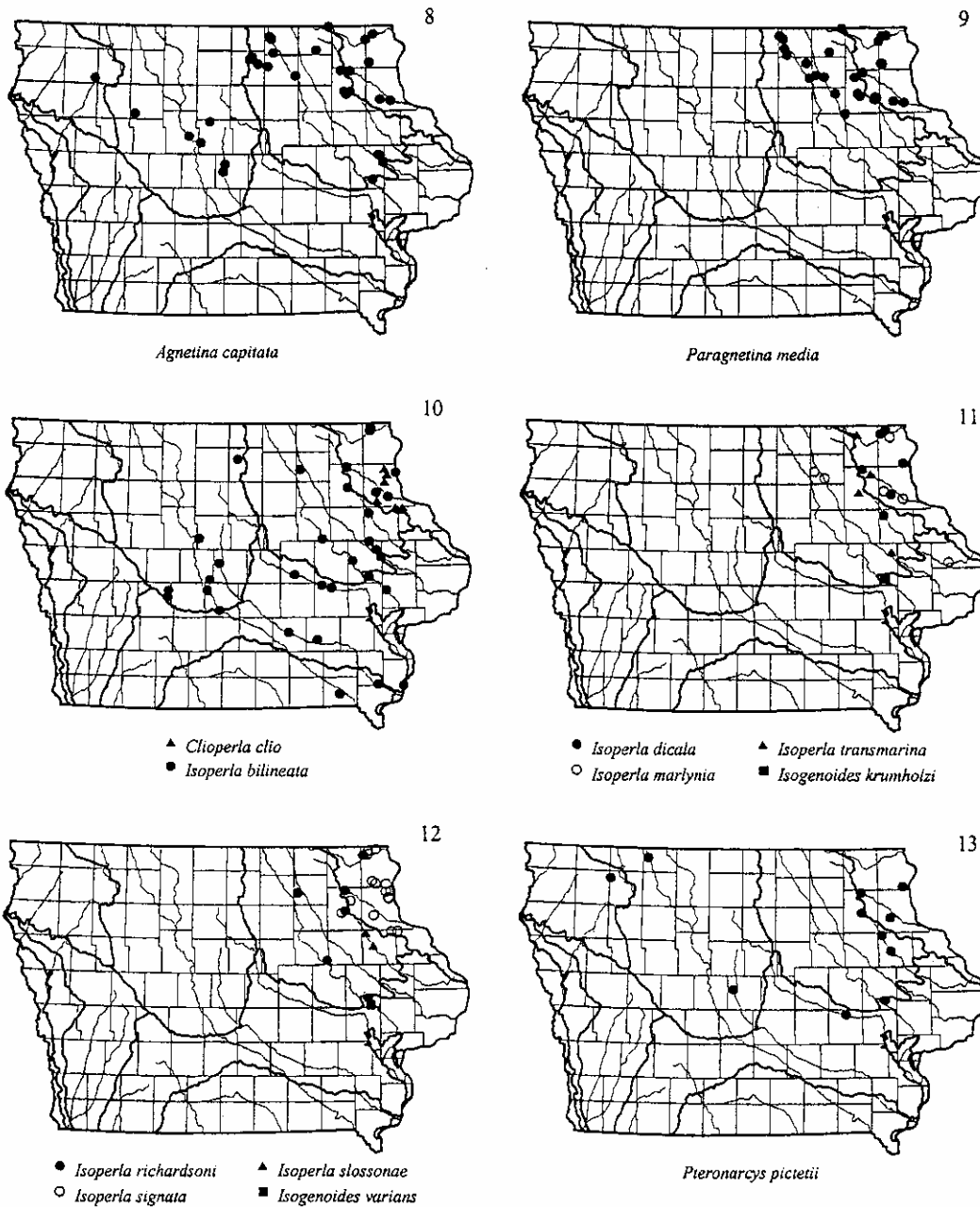
Aagnetina capitata (Pictet)

Aagnetina capitata is a new state record and was collected from several localities across five ecoregions (Fig. 8), but most prevalent in eastern regions of the state. Poulton and Stewart (1991) found *A. capitata* to be indicative of large groundwater inputs in Missouri Ozark streams. This species has been reported from 20 states/provinces (Stark 2001) including adjacent Minnesota (Harden and Mickel 1952) and Wisconsin (Hilsenhoff and Narf 1972).

Records.—Allamakee Co., Upper Iowa River (UHL); Yellow River (UHL); Cerro Gordo Co., Calmus Creek (UHL); Winnebago River (INHS, UHL); Clayton Co., Volga River (UHL); Fayette Co., Little Turkey River (UHL); North Branch Volga River (UHL); Turkey River (INHS, UHL); Volga River (INHS); Floyd Co., Cedar River (UHL); Shell Rock River (INHS); Hamilton Co., Boone River (UHL); White Fox Creek (UHL); Howard Co., Crane Creek (UHL); Upper Iowa River (UHL); Linn Co., Big Creek (INHS); Buffalo Creek (INHS); Wapsipinicon River (UHL); Mitchell Co., Cedar River (UHL); Deer Creek (UHL); Rock Creek (UHL); O'Brien Co., Waterman Creek (UHL); Pocahontas Co., Little Cedar Creek (UHL); Story Co., South Skunk River (ISU, UHL); Webster Co., Prairie Creek (UHL); Winneshiek Co., Canoe Creek (UHL).

Paragnetina media (Walker)

This species was confined to small creeks and medium-sized rivers of the Paleozoic Plateau/Coulee Section and Iowan Surface (Fig. 9). Nymphs and adults were collected from shaded, cool streams. Poulton and Stewart (1991) often found *P. media* in spring-fed streams in the Missouri Ozarks.



Figs. 8–13. Distribution of new state record stoneflies in Iowa. 8, *Aagnetina capitata*. 9, *Paragnetina media*. 10, *Clioperla clio* (triangle), *Isoperla bilineata* (circle). 11, *Isoperla dicala* (circle), *I. marlynia* (open circle), *I. transmarina* (triangle), *Isogenoides krumholzi* (square). 12, *Isoperla richardsoni* (circle), *I. signata* (open circle), *I. slossonae* (triangle), *Isogenoides varians* (square). 13, *Pteronarcys pictetii*.

This is a new state record and was reported from 23 states/provinces including adjacent Illinois (Frison 1935), Minnesota (Harden

and Mickel 1952), and Wisconsin (Hilsenhoff and Narf 1972).

Records.—Allamakee Co., Upper Iowa

River (INHS); Yellow River (UHL); Black Hawk Co., Buck Creek (UHL); Bremer Co., East Branch Wapsipinicon River (UHL); Chickasaw Co., Little Cedar River (UHL); Wapsipinicon River (UHL); Clayton Co., Volga River (UHL); Fayette Co., Brush Creek (INHS); Deep Creek (UHL); Little Turkey River (UHL); North Branch Volga River (UHL); Turkey River (INHS); Volga River (INHS); Floyd Co., Cedar River (UHL); Little Cedar River (UHL); Howard Co., Crane Creek (UHL); Upper Iowa River (UHL); Mitchell Co., Deer Creek (UHL); Rock Creek (UHL); Winneshiek Co., Canoe Creek (UHL).

Family Perlodidae

Clioperla clio (Newman)

Clioperla clio is a new state record and was limited to the Paleozoic Plateau/Coulee Section (Fig. 10). The collection sites were small, cold-water creeks in Clayton and Dubuque counties. Hilsenhoff and Billmyer (1973) also found *C. clio* in similar streams in Wisconsin. This species has been reported from 24 states (Stark 2001) including adjacent Illinois (Frison 1935) and Missouri (Poulton and Stewart 1991).

Records.—Clayton Co., North Cedar Creek (UHL); Mossy Glen St. Preserve (UHL); Unnamed trib. to Sny Magill Creek (UHL); West Fork Sny Magill Creek (INHS, UHL); Delaware Co., Grimes Hollow (UHL); Dubuque Co., White Pine Hollow Creek (UHL).

Isoperla bilineata (Say)

Isoperla bilineata was collected in medium-to-large rivers in six ecoregions (Fig. 10). This is a new state record and has been reported from 28 states/provinces (Stark 2001) including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), Missouri (Poulton and Stewart 1991), Nebraska (Rhodes and Kondratieff 1996), South Dakota (Huntsman et al. 2001), and Wisconsin (Hilsenhoff and Billmyer 1973).

Records.—Allamakee Co., Upper Iowa River (UHL); Waterloo Creek (INHS); Black Hawk Co., Wolf Creek (UHL); Boone Co., stream unknown (ISU); Cedar Co., Cedar River (INHS); Cerro Gordo Co., stream unknown (ISU); Chickasaw Co., Little Cedar River (UHL); Clayton Co., Bridal Veil Falls (INHS); Turkey River (UHL); Volga River (INHS); Delaware Co., Maquoketa River (INHS); Des Moines Co., Mississippi River (INHS); Fayette Co., Turkey River (UHL); Volga River (INHS); Guthrie Co., stream unknown (ISU); Hamilton Co., Boone River (UHL); Henry Co., Skunk River (BYU); Iowa Co., Iowa River (UHL); Johnson Co., Iowa River (UHL); Keokuk Co., North Skunk River (INHS); Linn Co., Buffalo Creek (INHS, UHL); Cedar River (INHS, UHL); Wapsipinicon River (INHS); Mahaska Co., South Skunk River (INHS); Polk Co., Des Moines River (ISU, UHL); Story Co., possibly South Skunk River (ISU); Tama Co., Iowa River (UHL); Van Buren Co., Des Moines River (UHL).

Isoperla dicala Frison

This species was collected from Iowan Surface and Paleozoic Plateau/Coulee Section streams (Fig. 11). *Isoperla dicala* was confined to medium-sized streams in Wisconsin and usually smaller streams than that inhabited by *I. bilineata* (Hilsenhoff and Billmyer 1973). *Isoperla dicala* is a new state record and has been reported from 22 states/provinces (Stark 2001) including adjacent Minnesota (Harden and Mickel 1952) and Missouri (Poulton and Stewart 1991).

Records.—Allamakee Co., Upper Iowa River (INHS); Waterloo Creek (UHL); Yellow River (INHS, UHL); Clayton Co., Volga River (UHL); Delaware Co., Maquoketa River (INHS); Fayette Co., Turkey River (UHL).

Isoperla longiseta Banks

Stark et al. (1986) previously reported this species from Iowa and historical re-

records from the INHS bear collection sites within the Des Moines Lobe (Table 1). There are no contemporary records for this species. *Isoperla longiseta* is considered a typical prairie stonefly of larger rivers (Ricker 1946, Harden and Mickel 1952, Kondratieff and Baumann 1999) and has been reported from 17 other states/provinces (Stark 2001) including adjacent Illinois (Frison 1935), Minnesota (Harden and Mickel 1952), Missouri (Stark 2001), and South Dakota (Huntsman et al. 2001).

Isoperla marlynia (Needham and Claassen)

Isoperla marlynia was collected from medium-sized rivers in three ecoregions (Fig. 11). Specimens were found in leaf packs and on woody debris in slow current. This is a new state record and has been previously reported from 22 states/provinces (Stark 2001), including adjacent Illinois (Frison 1942), Minnesota (Harden and Mickel 1952), Nebraska (Rhodes and Kondratieff 1996), and Wisconsin (Hilsenhoff and Billmyer 1973), although it has possibly been extirpated from Illinois (Webb and Harris 1993).

Records.—Allamakee Co., Upper Iowa River (UHL); Chickasaw Co., Little Cedar River (UHL); Wapsipinicon River (INHS); Clayton Co., Volga River (UHL); Jackson Co., North Fork Maquoketa River (INHS).

Isoperla richardsoni Frison

Isoperla richardsoni was collected from small creeks to medium-sized rivers within the Iowan Surface, Paleozoic Plateau/Coulee Section, and Rolling Loess Prairies (Fig. 12). Harden and Mickel (1952) and Hilsenhoff and Billmyer (1973) found that this species was most common in medium and larger rivers of Minnesota and Wisconsin, respectively. This species is a new state record and has been reported from eight states (Stark 2001), including adjacent Illinois (Frison 1935) and Missouri (Stark 2001).

Records.—Allamakee Co., Upper Iowa River (INHS); Benton Co., Spring Creek

(UHL); Chickasaw Co., Little Cedar River (UHL); Fayette Co., Turkey River (UHL); Volga River (INHS); Linn Co., Big Creek (INHS).

Isoperla signata (Banks)

Isoperla signata was collected from the Iowan Surface and Paleozoic Plateau/Coulee Section (Fig. 12). This species occurred in small, cold-water streams and medium-sized rivers that were strongly influenced by ground water. Hilsenhoff and Billmyer (1973) found that *I. signata* was the least habitat specific of the Wisconsin perlotids, occurring in small and large streams. However, Poulton and Stewart (1991) reported that this species inhabited permanent, spring-fed streams, an assessment supported by Harden and Mickel's (1952) work in Minnesota. *Isoperla signata* is a new state record and has been reported from 17 states/provinces (Stark 2001).

Records.—Allamakee Co., French Creek (UHL); Hickory Creek (UHL); Upper Iowa River (UHL); Waterloo Creek (UHL); Williams Creek (UHL); Yellow River (INHS, UHL); Clayton Co., Bloody Run Creek (INHS); North Cedar Creek (UHL); Sny Magill Creek (UHL); Unnamed trib. to Sny Magill Creek (UHL); Volga River (UHL); West Fork Sny Magill Creek (INHS); Delaware Co., Elk Creek (UHL); Dubuque Co., White Pine Hollow Creek (UHL); Fayette Co., Otter Creek (UHL); Volga River (INHS).

Isoperla slossonae (Banks)

Isoperla slossonae is a new state record and was collected in Iowan Surface streams only (Fig. 12). This species occurred in small-to-medium-sized streams, as was found by Hilsenhoff and Billmyer (1973) in Wisconsin. *Isoperla slossonae* has been found in 14 states/provinces (Stark 2001) including adjacent Minnesota (Harden and Mickel 1952).

Records.—Delaware Co., possibly Maquoketa River (BYU); South Fork Maquoketa River (BYU, UHL).

Isoperla transmarina (Newman)

This species was collected from medium-sized rivers of the Iowan Surface and Paleozoic Plateau/Coulee Section (Fig. 11). *Isoperla transmarina*, *I. dicala*, and *I. richardsoni* were often found in the same stream. Harden and Mickel (1952) often found *P. media* with this species in Minnesota. *Isoperla transmarina* is a new state record and has been reported from 26 states/provinces (Stark 2001), including adjacent South Dakota (Huntsman et al. 2001) and Wisconsin (Hilsenhoff and Billmyer 1973).

Records.—Fayette Co., Turkey River (INHS); Volga River (INHS); Linn Co., Buffalo Creek (INHS); Winneshiek Co., Upper Iowa River (INHS).

Isogenoides doratus (Frison)

This species was collected from the Rock River, Sioux County, in the Northwest Iowa Loess Prairies and is known from several historical records in the Des Moines Lobe (Ricker 1952). *Isogenoides doratus* has been collected from three other states/provinces (Stark 2001) with Michigan as the only other upper midwestern state (Ricker 1952).

Isogenoides krumholzi (Ricker)

Isogenoides krumholzi was only collected in the Rolling Loess Prairies (Fig. 11). In Michigan this species was collected from the northernmost cold streams and Lake Superior (Ricker 1952). This species is a new state record and has been collected from three states/provinces including adjacent Minnesota (Stark 2001). The genus is currently under revision by John Sandberg at the University of North Texas. Consequently some nomenclature or status may change, especially as it refers to this species.

Records.—Linn Co., Cedar River (INHS).

Isogenoides varians (Walsh)

This species is a new state record and was collected from the same site as *I. krumholzi* (Fig. 12). Walsh (1863) described this species from neighboring Illinois at the mouth of the Rock River. *Isogenoides varians* is a large river species (Ricker 1952) and has been reported from eight states (Stark 2001) including adjacent Minnesota (Harden and Mickel 1952).

Records.—Linn Co., Cedar River (INHS).

Family Pteronarcyidae

Pteronarcys pictetii Hagen

Pteronarcys pictetii was collected in five ecoregions in the northern two-thirds of the state (Fig. 13). *Pteronarcys* nymphs were collected from three additional ecoregions (Table 1), but identification to species is not possible at this time. Some of these nymphs may represent *P. dorsata* since Harden and Mickel (1952) found it in Minnesota. However, there are no confirmed records of *P. dorsata* from neighboring states to the immediate east (Frison 1935, 1942; Harris and Webb 1995), the south (Poulton and Stewart 1991), or to the west (Rhodes and Kondratieff 1996, Kondratieff and Baumann 1991, Huntsman et al. 2001). With more adult records a pattern of *P. dorsata* being eastern and northern transcontinental and *P. pictetii* being eastern, midwestern, and central Great Plains states may be confirmed. This is a new state record and has been reported from 15 states/provinces (Stark 2001).

Records.—Allamakee Co., Yellow River (INHS); Clay Co., Ocheyedon River (BYU); Clayton Co., Volga River (UHL); Delaware Co., Maquoketa River (UHL); South Fork Maquoketa River (ISU); Emmet Co., West Fork Des Moines River (CSU); Fayette Co., Turkey River (UHL); Volga River (INHS); Iowa Co., possibly Iowa River (INHS); Linn Co., Big Creek (INHS); Story Co., possibly South Skunk River (INHS, ISU).

DISCUSSION

Streams of the Iowan Surface and the Paleozoic Plateau/Coulee Section support the greatest stonefly diversity in Iowa (Table 1). These are the only areas of the state where large, cool, rocky rivers and abundant springs and springbrooks can be found. Three stoneflies, *A. pygmaea*, *A. linda*, and *N. trispinosa*, require these conditions and are considered northern species (Ross and Ricker 1971, Huntsman et al. 2001). The collection of *A. pygmaea* in Iowa has filled a considerable disjunction between Missouri and Minnesota populations. Ross and Ricker (1971) hypothesized that this species reached the upper Midwest during the post-Pleistocene period. After glacial advances and retreats two populations occurred, one in the Missouri Ozarks and the other in the Cumberland Gap region of Tennessee and Kentucky. *Allocapnia pygmaea* then dispersed north from the Cumberland Gap into southern Canada, Michigan, Wisconsin, and Minnesota. The population in Iowa most likely came from nearby Minnesota and Wisconsin. The Loess Flats and Till Plains, which lack large, cool-water rivers, separate the Missouri and Iowa populations.

Streams of the Rolling Loess Prairies and the Des Moines Lobe harbored the second greatest number of stonefly species (Table 1). Both ecoregions cover a large area of the state, with most of Iowa's streams and rivers flowing through them. A combined three unique species were present in these regions, *Isoperla longiseta*, *Isogenoides krumholzi*, and *Isogenoides varians*. All were found in the sandy rivers common to the regions. There appears to be a mixing zone here with *I. longiseta* being from western states and *I. krumholzi* and *I. varians* being of a more northern and eastern origin.

The six remaining ecoregions contained no unique species and supported considerably fewer species than that of previously mentioned ecoregions (Table 1). Although these western ecoregions have not been

sampled as extensively as in the east, we believe that numerous stream alterations have reduced species richness from pre-settlement times. All species present, *Allocapnia vivipara*, *Taeniopteryx burksi*, *Acroneuria abnormis*, and *Isoperla bilineata* are considered widespread and tolerant of moderate organic enrichment (Hilsenhoff 1987).

Pteronarcys pictetii and nymphs of *Pteronarcys* were found in much of Iowa, but were missing from the Loess Flats and Till Plains (Table 1). This species should occur in the largest rivers, but frequent summer droughts probably preclude it from maturing in smaller streams due to a documented two-year nymphal life cycle (Hilsenhoff and Narf 1972).

Seventeen of the 33 new stonefly species reported for Iowa were found in the last three years; therefore, it is conceivable that several more new state records will be discovered. Thirteen additional species are known from adjacent states (Stark 2001). These include *Paracapnia angulata* Hanson, *Leuctra ferruginea* (Walker), *Prostoia similis* (Hagen), *Taeniopteryx parvula* Banks, *Haploperla brevis* (Banks), *Acroneuria internata* (Walker), *Perlesta dakota* Kondratieff and Baumann, *Neoperla stewarti* Stark and Baumann, *Agnentina flavescens* (Walsh), *Isoperla frisoni* Illies, *Hydroperla crosbyi* (Needham and Claassen), *H. fugitans* (Needham and Claassen), and *Pteronarcys dorsata* (Say).

Our work has greatly increased the distributional knowledge of stoneflies in Iowa. Much of eastern Iowa has been collected with regularity, but western and southern Iowa remain poorly surveyed. Nonetheless, enough distribution information exists in eastern Iowa for use by state resource organizations to protect sensitive stream habitats, and to set imperilment status for some of the stoneflies whose existence is tenuous. We suggest that the state consider purchasing easements and buffers along streams to protect the following species: *Allocapnia pygmaea*, *Leuctra tenuis*, *Amphinemura linda*, *Nemoura trispinosa*, and *Soyedina val-*

licularia. Much of these efforts should be focused on Paleozoic Plateau/Coulee Section and Iowan Surface ecoregions. Other species and regions may be considered when additional distribution information on Iowa stoneflies is available.

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