

Updated Checklist of the Minnesota Caddisflies (Trichoptera) with Geographic Affinities

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ABSTRACT

In this paper 284 caddisfly (Trichoptera) species representing 20 families and 74 genera are reported from Minnesota based on examination of over 100,000 larval and adult specimens. Of these, 28 are new state species records and 87 are new additions to the fauna since Etnier's (1965) state checklist. The known distributions of all species from five geographic regions of Minnesota are reported. Also, the caddisfly faunas of these five regions are compared, the abundance of each species based on material examined stated, and protective status of rare species noted. An additional 21 species recorded in the literature from Minnesota are listed as doubtful.

INTRODUCTION

Aside from Ross' (1944) landmark study of the Illinois fauna, the caddisflies of the northcentral United States and southcentral Canada are not well known. Preliminary checklists are available only for Indiana (Waltz and McCafferty 1983), Minnesota (Etnier 1965), North Dakota (Harris et al. 1980), and Wisconsin (Longridge and Hilsenhoff 1973). Such distributional data are important for documenting regional biodiversity, recording the occurrences of rare and endangered species, and for proposing hypotheses on speciation and patterns of distribution (Resh and Grodhaus 1983, Rosenberg and Resh 1993, Monson 1997). Moreover, due to the ecological diversity of caddisflies, their abundance in virtually all freshwater environments, and their varying susceptibilities to pollution and other disturbances, caddisfly distributional data are particularly valuable for formulating water quality biomonitoring indices (Mackay and Wiggins 1979, Rosenberg and Resh 1993).

The state of Minnesota is situated at the intersection of the three largest biotic provinces of North America: Prairie, Eastern Deciduous Forest, and Northern Coniferous Forest (Fig. 1) (e.g., Coffin and Pfanmuller 1988). Caddisflies collected from the state, therefore, may reflect the diversity found in all of these regions. This makes assessment of the statewide fauna particularly important.

Figure 2 shows the yearly progression of Minnesota caddisfly faunal discovery. Elkins (1936) published the first study of Minnesota caddisflies, documenting 31 species and hypothesizing that the fauna may include "at least 100 species". Papers primarily by Ross (1938a, b, 1941a, b, 1944, 1946, 1947, 1950, 1956) and Denning (1937, 1941, 1942, 1943, 1947a, b, c) in the mid-1900s reported 118 additional species. Etnier (1965) published the first preliminary checklist of the fauna, documenting 208 species. Since then, regional taxonomic studies (Etnier 1968, Lager et al. 1979, Phillippi and Schuster 1987, MacLean 1995, Monson 1997), taxonomic revisions of families and genera (Nimmo 1971, Morse 1972, Denning and Blickle 1972, Schuster and Etnier 1978, Blickle 1979, Nimmo 1986), and new species descriptions (Wiggins 1975, Monson and Holzenthal 1993, Sykora and Harris 1994) have added an additional 48 species to the reported fauna (Fig. 2). The purpose of this study was to compile a checklist of the Minnesota species, confirm the validity of historical records, and add additional species to the fauna based on recently collected material.

MATERIALS AND METHODS

The authors have been investigating the state fauna for over 15 years and have collected larval and adult caddisflies from a variety of aquatic environments throughout the state. The most common collecting method used for adults was light trapping. The device typically employed was an 8-watt portable ultraviolet light set on top of a white plastic pan filled with 80% EtOH. Lights placed near aquatic habitats for about two hours after dusk attract most caddisfly species. Other adult collecting methods included malaise trapping, sweep netting, aspiration from riparian rocks and vegetation, and suspending several 8-watt ultraviolet lights in front of a white bed sheet for about two hours after dusk, with subsequent hand capture in a cyanide kill jar. Larvae and pupae were collected mainly by hand picking from aquatic substrates, with subsequent rearing to adult in a 3.0 m x 0.6 m x 0.6 m refrigerated tank equipped with two Penguin 1140 power heads (Marineland Aquarium Products, Moorpark, CA) to provide current, or in 20 L aerated aquaria.

Caddisflies were collected by the authors from several hundred localities distributed approximately evenly throughout the state. Additional material came from the University of Minnesota Insect Collection (UMSP), including many of the specimens collected by D. G. Denning and D. A. Etnier during the mid-1900s. Additionally, caddisfly collections of the Illinois Natural History Survey (INHS), National Museum of Natural History, Smithsonian Institution (NMNH), and the University of Tennessee Insect Collection (UT) were surveyed for Minnesota records. All

identified caddisfly specimens were entered into the UMSP BIOTA database (Colwell 1996), which uses barcode labels affixed to specimens to permanently associate collection, locality, and ecological data with specimens. Collection localities which have produced examined specimens are shown in Fig. 3. Newly examined material is deposited in the UMSP and in the personal collection of DBM.

The distributions of caddisfly species within five Minnesota regions are reported (Fig. 4). These regions were constructed by grouping state watersheds (USGS 2001) together geographically. Interregional boundaries were established by applying ecological information potentially important for influencing distributions of Minnesota caddisflies, such as biotic province, topography, and relative abundance of lakes. Specifically, the Central region (CN) contains a large abundance of lakes relative to other water body types; the Northwest region (NW) includes the northern watersheds of the Red River Valley and those east to the edge of the Prairie biotic province; the Northeast region (NE) comprises the forested areas of Minnesota north and east of the Central Lakes region; the Southeast region (SE) includes the watersheds of the topographically diverse Minnesota River Valley; and the Southwest region (SW) is made up of watersheds of the southern Red River Valley south of the Central Lakes region, east to the border of the Southeast Region. Although they incorporate potentially important ecological data, these regions are fundamentally geographic in nature and should not necessarily be treated as biologically meaningful units.

RESULTS AND DISCUSSION

Based on an a synthesis of the literature and an additional 28 state records, 284 species within 74 genera and 20 families are now known from Minnesota (Table 1). These species are based on 118,604 specimens from 477 Minnesota localities (Fig. 3), and include 1,415 separate collections dating back to the late 1800s. A list of specific localities and collection dates are available from the senior author and will eventually be accessible online. A list of 21 unconfirmed records (Table 2) is also provided; these are either doubtful literature records, misidentifications, or represent species names that are no longer valid. Due to these doubtful records, the number of species known for Minnesota barely increases in this paper from Monson's (1997) estimation of 283 species. That paper included all past literature records in its species count.

The greatest species richness is represented by the families Hydroptilidae (60), Limnephilidae (51), Leptoceridae (50), Hydropsychidae (34), and Polycentropodidae (25); the highest diversity within genera by *Hydroptila* (27), *Limnephilus* (20), *Hydropsyche* (20), *Ceraclea* (19), and *Polycentropus* (17). The most abundant species were *Oecetis inconspicua* (11,714 specimens), *Psychomyia flavida* (8,433), *O. avara* (7,151), *Triaenodes marginata* (5,839), and *Ceraclea tarsipunctata* (5,305). We did not, however, identify females of *Cheumatopsyche*, *Hydropsyche*, or Hydroptilidae due to their lack of readily identifiable characters; therefore some abundant species, such as *Cheumatopsyche campyla*, *C. pettiti*,

Hydropsyche morosa, and several hydroptilids, may actually be more abundant in collections than the preceding species. Monson (1997) used subsampling and extrapolation to compensate for this difficulty and found that *Hydropsyche morosa* and *Cheumatopsyche pettiti* were among the five most common caddisflies of the Lake Itasca region of northcentral Minnesota.

Table 1 also shows the known distribution of species based on geographic region and provides caddisfly biodiversity totals for each region. The Northeast region had the highest total caddisfly biodiversity (232 species), followed by the Central (187), Southeast (95), Southwest (86), and Northwest (80). The Southeast region had the highest diversity relative to its size (10.5 species/1,000 km²) followed by the Northeast (5.9), Central (3.9), Northwest (3.8), and Southwest (3.2). The Northeast had by far the greatest abundance—both total and relative to its size—of species not found in other regions of the state (70 total species, 1.8 species/1,000 km²), followed by the Central (21, 0.4), Southwest (5, 0.2), Southeast (2, 0.2), and Northwest (2, 0.1) (Table 1).

Factors affecting caddisfly biodiversity in Minnesota are probably both historic and contemporary. The Southeast region, the smallest of the five, supports the most diverse caddisfly fauna relative to its size (Table 1). The region contains a diversity of aquatic ecosystems due to its varied topography, relatively undisturbed trout streams, and the presence of the Mississippi River with its accompanying backwater marshes and oxbow lakes. Furthermore, the southeastern tip of Minnesota was not covered by the Wisconsin glaciation; this provided potential refuge for aquatic organisms (e.g., Ojakangas and Matsch 1982). These attributes likely promote a diverse aquatic insect fauna (e.g., Cummins and Merritt 1996). The Northeast region contains both the highest total caddisfly biodiversity and the highest diversity of Minnesota species unique to it. It has the second highest biodiversity relative to its size. The region is impacted by few industrial or agricultural factors relative to other regions of the state and contains a wide variety of lotic ecosystems—small high-gradient streams to large marshy rivers—and includes also lakes, ponds, bogs, and temporary wetlands. All of these factors are conducive to both a diverse and unique caddisfly fauna (e.g., Cummins and Merritt 1996). Indeed, on several occasions the senior author has collected 50–55 caddisfly species from a single ultraviolet light trap on a northeastern Minnesota river. One such collection in summer 2000 from the Little Cloquet River in northeastern Minnesota yielded 64 species; this is 80% of the entire fauna known from all the historical collecting in the Northwest region of the state.

The Central region, the largest of the five, contains the second highest total biodiversity, yet has only the median diversity relative to its size (Table 1). Ecosystems in this region tend to be fairly homogenous—meandering rivers connecting small lakes—and may not provide a high diversity of habitats relative to the region's large size. The Central region does, however, harbor the second highest number of Minnesota species unique to it (Table 1). The Northwest and Southwest regions are characterized by the lowest total and relative biodiversity, as well as the lowest

diversity of unique species (Table 1). These regions contain fairly homogeneous prairie ecosystems and have a 50-year history of intensive agricultural use (e.g., Tester 1993).

Considering that 42 species, almost 15% of the known Minnesota fauna, have been reported during the last six years (MacLean 1995, Monson 1997, and the current paper), despite a 70-year state collecting history (Fig. 2), it is likely that additional species remain to be found. Sixty-two species, over 20% of the reported fauna, are known from less than 10 examined specimens and 24 are known from only a single specimen. Species like these, that are low in abundance or difficult to collect, likely remain undiscovered in Minnesota. Efforts are underway to find adults of *Oligotomis*, which is known in the state only from larval records.

Future research in Minnesota caddisfly biodiversity will include collecting in areas and habitats under-represented by past collecting and the completion of a watershed-level sampling regime. Ultimately, we hope to determine biologically-meaningful patterns of caddisfly biodiversity in Minnesota and to correlate species distributions with both large- and small-scale environmental variables. This should increase the utility of caddisflies in regional water quality assessments and also contribute to a greater understanding of their ecology and conservation needs.

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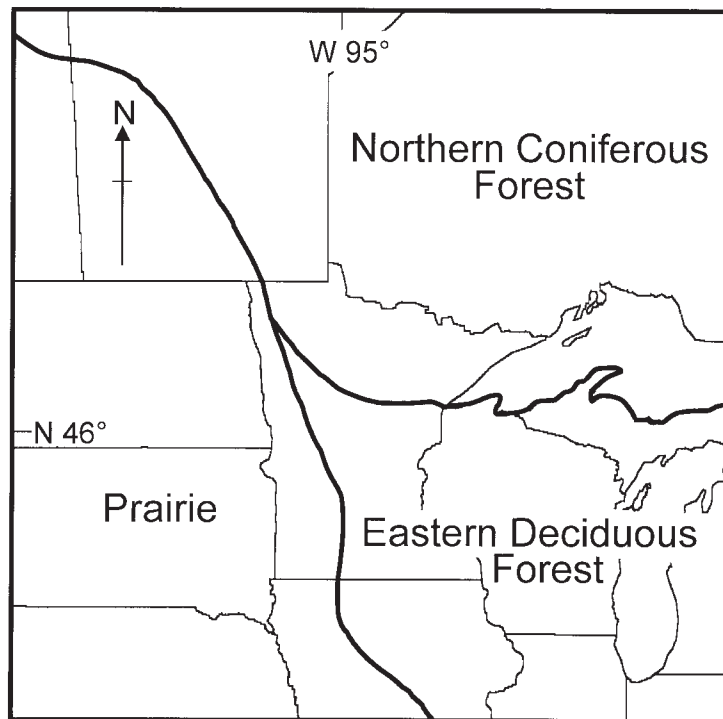


Figure 1. Northcentral United States and southcentral Canada showing the convergence of the Northern Coniferous Forest, Eastern Deciduous Forest, and Prairie biotic provinces.

Table 1. The list of 284 Minnesota caddisfly species distributed within five geographic regions indicated by Fig. 4. Areas for each region are NW = 20,817 km², NE = 39,267 km², CN = 47,577 km², SW = 27,257 km², SE = 9,175 km². #: number of specimens examined, X: confirmed adult specimen, L: confirmed larval specimen, U: unconfirmed but plausible literature record. The totals at the bottom were tabulated using confirmed specimens only. All taxa are arranged alphabetically. New state species records are in boldface type. Species listed as Special Concern or Endangered by the MNDNR (1996) are denoted by asterisk or double-asterisk, respectively. Number of species within each family follows family names.

Taxon	#	Geographic Region				
		NW	NE	CN	SW	SE
APATANIIDAE (1)						
<i>Apatania zonella</i> (Zetterstedt) 1840	86		X			
ARCTOPSYCHIDAE (1)						
<i>Parapsyche apicalis</i> (Banks) 1908	11			X		
BRACHYCENTRIDAE (6)						
<i>Brachycentrus americanus</i> (Banks) 1899	43		X	X		X
<i>B. fuliginosus</i> Walker 1852	-			U		
<i>B. numerosus</i> (Say) 1823	65			X		
<i>B. occidentalis</i> Banks 1911	234			X		X
<i>Micrasema gelidum</i> MacLachlan 1876	76					X
<i>M. rusticum</i> (Hagen) 1868	36			X		
<i>M. wataga</i> Ross 1938	34		X	X		
DIPSEUDOPSIDAE (1)						
<i>Phylocentropus placidus</i> (Banks) 1905	63		X			X
GLOSSOSOMATIDAE (8)						
<i>Agapetus rossi</i> Denning 1941	34	X	X	X	X	X
<i>A. tomus</i> Ross 1941*	5		X			X
<i>Glossosoma intermedium</i> (Klap.) 1892	171	X	X	X		X
<i>G. nigrrior</i> Banks 1911	94		X			X
<i>Protoptila erotica</i> Ross 1938	105			X		X
<i>P. maculata</i> (Hagen) 1961	34		X	X		
<i>P. talola</i> Denning 1947*	1			X		
<i>P. tenebrosa</i> (Walker) 1862	16		X	X		
GOERIDAE (1)						
<i>Goera stylata</i> Ross 1938	7			X		
HELICOPSYCHIDAE (1)						
<i>Helicopsyche borealis</i> (Hagen) 1861	3440	X	X	X	X	X
HYDROPSYCHIDAE (34)						
<i>Cheumatopsyche aphantia</i> Ross 1938	544	X	X	X	X	X
<i>C. campyla</i> Ross 1938	1316	X	X	X	X	X
<i>C. gracilis</i> (Banks) 1907	147	X	X	X	X	X
<i>C. lasia</i> Ross 1938	96	X			X	
<i>C. minuscula</i> (Banks) 1907	4		X			
<i>C. oxa</i> Ross 1938	233	X	X	X	X	X
<i>C. pasella</i> Ross 1941	12					X
<i>C. pettiti</i> (Banks) 1908	1942	X	X	X	X	X
<i>C. sordida</i> (Hagen) 1861	177		X	X		
<i>C. speciosa</i> (Banks) 1904	68		X	X		
<i>C. wabasha</i> Denning 1947	1					X

Taxon	#	NW	NE	CN	SW	SE
<i>Diplectrona modesta</i> Banks 1908	10				X	X
<i>Hydropsyche alhedra</i> (Ross) 1939	69	X	X	X	X	X
<i>H. alternans</i> (Walker) 1852	365		X	X	X	X
<i>H. betteni</i> Ross 1938	740	X	X	X	X	X
<i>H. bidens</i> Ross 1938	1854			X	X	X
<i>H. bronta</i> (Ross) 1938	309	X	X	X	X	X
<i>H. californica</i> Banks	3		X			
<i>H. confusa</i> (Walker) 1852	9			X		
<i>H. dicantha</i> Ross 1938	43		X			
<i>H. frisoni</i> Ross 1938	1			X		
<i>H. morosa</i> (Hagen) 1861	4351	X	X	X	X	X
<i>H. orris</i> Ross 1938	46		X	X		X
<i>H. phalerata</i> (Hagen) 1862	27			X		
<i>H. placoda</i> Ross 1941	453	X	X	X	X	X
<i>H. scalaris</i> Hagen 1861	24		X	X		X
<i>H. slossonae</i> (Banks) 1905	757	X	X	X	X	X
<i>H. sparna</i> (Ross) 1938	47		X	X		
<i>H. simulans</i> Ross 1938	81			X	X	X
<i>H. valanis</i> Ross 1938	1				X	
<i>H. vexe</i> (Ross) 1938	97		X	X		
<i>H. walkeri</i> (Betten and Mosely) 1940	22		X			
<i>Macrostemum zebratum</i> (Hagen) 1861	523		X	X		X
<i>Potamyia flava</i> (Hagen) 1861	4734	X	X	X	X	X
HYDROPTILIDAE (60)						
<i>Agraylea multipunctata</i> Curtis 1834	863	X	X	X	X	X
<i>Hydroptila ajax</i> Ross 1938	357			X	X	
<i>H. albicornis</i> Hagen 1861	31		X			
<i>H. amoena</i> Ross 1938	2		X			
<i>H. ampoda</i> Ross 1941	1		X			
<i>H. angusta</i> Ross 1938	86			X	X	X
<i>H. antennopedia</i> Sykora & Harris 1994	3		X			
<i>H. armata</i> Ross 1938	834		X	X		
<i>H. callia</i> Denning 1948	-		U			
<i>H. consimilis</i> Morton 1905	352	X	X	X	X	X
<i>H. delineata</i> Morton 1905	2		X			
<i>H. grandiosa</i> Ross 1938	140	X	X	X	X	X
<i>H. hamata</i> Morton 1905	7		X			
<i>H. jackmanni</i> Blickle 1963	469		X			
<i>H. metoeca</i> Blickle and Morse 1954	1			X		
<i>H. novicola</i> Blickle and Morse 1954	23		X			
<i>H. perdita</i> Morton 1905	28	X	X	X	X	X
<i>H. quinola</i> Ross 1947	21	X	X	X	X	X
<i>H. rono</i> Ross 1941	2				X	
<i>H. salmo</i> Ross 1941	7		X			
<i>H. scolops</i> Ross 1938	84				X	
<i>H. spatulata</i> Morton 1905	30		X	X		
<i>H. tortosa</i> Ross 1938*	1		X			
<i>H. valhalla</i> Denning 1947	19		X	X		
<i>H. waskesia</i> Ross 1944	2			X		
<i>H. waubesiana</i> Betten 1934	154	X	X	X	X	X
<i>H. wyomia</i> Denning 1947	228		X	X		
<i>H. xera</i> Ross 1938	253		X	X		
<i>Ithytrichia clavata</i> Morton 1905	34		X			

Taxon	#	NW	NE	CN	SW	SE
<i>Leucotrichia pictipes</i> (Banks) 1911	120		X	X		
<i>Mayatrichia ayama</i> Mosely 1937	130	X	X	X	X	
<i>Neotrichia falca</i> Ross 1941	2		X			
<i>N. halia</i> Denning 1948	3		X			
<i>N. minutisimella</i> (Chambers) 1873	1		X			
<i>N. okopa</i> Ross 1939	123	X	X	X	X	X
<i>N. vibrans</i> Ross 1939	234		X			
<i>Ochrotrichia spinosa</i> (Ross) 1938	4		X		X	
<i>O. balduffi</i> Kingsolver & Ross 1961	26		X			
<i>O. curta</i> Kingsolver & Ross 1961	4		X			
<i>O. tarsalis</i> (Hagen) 1861	700	X	X	X	X	X
<i>Orthotrichia aegerfasciella</i> (Cham.) 1873	264	X	X	X	X	X
<i>O. balduffi</i> Kingsolver & Ross 1961	26		X			
<i>O. cristata</i> Morton 1905	289	X	X	X	X	X
<i>O. curta</i> Kingsolver & Ross 1961	4		X			
<i>Oxeythira aeola</i> Ross 1938	9		X			
<i>O. anabola</i> Blickle 1966	1		X			
<i>O. arraya</i> Ross 1941	12		X	X		
<i>O. coerrens</i> Morton 1905	172		X	X		
<i>O. ecornuta</i> Morton 1893*	1			X		
<i>O. forcipata</i> Mosely 1934	386	X	X	X	X	X
<i>O. itascae</i> Monson and Holzenthal 1993*	75		X	X		
<i>O. michiganensis</i> Mosely 1934	95		X	X		
<i>O. obtatus</i> Denning 1947	11		X	X		
<i>O. pallida</i> (Banks) 1904	18		X	X		
<i>O. rivicola</i> Blickle & Morse 1954	187	X	X	X	X	X
<i>O. rossi</i> Blickle & Morse 1954	5		X			
<i>O. serrata</i> Ross 1938	35		X	X		
<i>O. sida</i> Blickle & Morse 1954	71		X	X		
<i>O. verna</i> Ross 1938	86		X	X		
<i>O. zeronia</i> Ross 1941	19		X	X		
<i>Stactobiella delira</i> (Ross) 1938	17		X			
<i>S. palmata</i> (Ross) 1938	46		X			
LEPIDOSTOMATIDAE (8)						
<i>Lepidostoma americanum</i> (Banks) 1897	1		X			
<i>L. bryanti</i> (Banks) 1908	493		X	X		
<i>L. cinereum</i> (Banks) 1899	2		X			
<i>L. costale</i> (Banks) 1914	122		X	X		
<i>L. libum</i> Ross 1941	3				X	
<i>L. prominens</i> (Banks) 1930	2		X			
<i>L. sackeni</i> (Banks) 1936	1		X			
<i>L. togatum</i> (Hagen) 1861	117		X	X		X
<i>L. unicolor</i> (Banks) 1911	9		X			
LEPTOCERIDAE (51)						
<i>Ceraclea alagma</i> (Ross) 1938	1865	X	X	X	X	X
<i>C. albsticta</i> (Hagen) 1861	1		X			
<i>C. alces</i> (Ross) 1941	5		X			
<i>C. ancylus</i> (Vorhies) 1909	130	X	X	X	X	X
<i>C. annulicornis</i> (Stephens) 1836	20		X			
<i>C. arielles</i> (Denning) 1942	125		X	X		
<i>C. brevis</i> (Etnier) 1968*	-		U			
<i>C. cancellata</i> (Betten) 1934	1127	X	X	X	X	X

Taxon	#	NW	NE	CN	SW	SE
<i>C. diluta</i> (Hagen) 1861	1093		X	X		
<i>C. excisa</i> (Morton) 1941	862		X	X		
<i>C. flava</i> (Banks) 1904	154		X			
<i>C. maculata</i> (Banks) 1899	520	X	X	X	X	X
<i>C. mentiea</i> (Walker) 1852	6		X			
<i>C. nepha</i> (Ross) 1944	-		U			
<i>C. resurgens</i> (Walker) 1852	261		X	X		
<i>C. tarsipunctata</i> (Vorhies) 1909	5305	X	X	X	X	X
<i>C. transversa</i> (Hagen) 1861	2790	X	X	X	X	X
<i>C. vertreesi</i> (Denning) 1966*	39			X		
<i>C. wetzeli</i> (Ross) 1941	241		X			
<i>Leptocerus americanus</i> (Banks) 1899	4714	X	X	X	X	X
<i>Mystacides interjecta</i> (Banks) 1914	2071	X	X	X	X	X
<i>M. sepulchralis</i> (Walker) 1852	517	X	X	X	X	X
<i>Nectopsyche albida</i> (Walker) 1852	1247	X	X	X	X	X
<i>N. candida</i> (Hagen) 1861	41		X	X		
<i>N. diarina</i> (Ross) 1944	316	X	X	X	X	X
<i>N. exquisita</i> (Walker) 1852	265		X	X		
<i>N. pavidata</i> (Hagen) 1861	1108		X			
<i>Oecetis avara</i> (Banks) 1895	7151	X	X	X	X	X
<i>O. cinerascens</i> (Hagen) 1861	1986	X	X	X	X	X
O. disjuncta (Banks) 1920	1		X			
O. ditissa Ross 1966	1				X	
<i>O. immobilis</i> (Hagen) 1861	151	X	X	X	X	
<i>O. inconspicua</i> (Walker) 1852	11714					
<i>O. nocturna</i> Ross 1966	127		X	X	X	
<i>O. ochracea</i> Curtis 1825	354	X	X	X	X	
<i>O. osteni</i> Milne 1934	933		X	X		
<i>O. persimilis</i> (Banks) 1907	506		X	X		
<i>Setodes incertus</i> (Walker) 1852	15		X			
S. oligius (Ross) 1938	181			X		
<i>Triaenodes abus</i> Milne 1935	101		X	X		
<i>T. baris</i> Ross 1938	36		X	X		
<i>T. dipsius</i> Ross 1938	295	X	X	X	X	X
<i>T. flavescens</i> Banks 1900	14		X	X		
<i>T. ignitus</i> (Walker) 1852	2		X	X		
<i>T. injustus</i> (Hagen) 1861	751	X	X	X		X
<i>T. marginatus</i> Sibley 1926	5839	X	X	X		
<i>T. nox</i> Ross 1941	146		X	X		
<i>T. tardus</i> Milne 1934	921	X	X	X	X	X
Ylodes frontalis Banks 1934	3	X			X	
<i>Y. reuteri</i> (McLachlan) 1880	166	X	X	X	X	
LIMNAPHILIDAE (51)						
<i>Anabolia bimaculata</i> (Walker) 1852	271	X	X	X	X	X
<i>A. consocia</i> (Walker) 1852	113	X	X	X	X	X
<i>A. ozburni</i> (Milne) 1935	18	X		X		
<i>A. sordida</i> Hagen 1861	33	X				
<i>Arctopora pulchella</i> (Banks) 1908	4		X			
<i>Asynarchus montanus</i> (Banks) 1907	9		X			
<i>A. mutatus</i> (Hagen) 1861	2		X			
<i>A. rossi</i> (Leonard and Leonard) 1949*	85		X	X		
<i>Chilostigma itasca</i> Wiggins 1975**	6			X		

Taxon	#	NW	NE	CN	SW	SE
<i>Frenesia missa</i> (Milne) 1935	34			X		X
<i>Glyphopsyche irrorata</i> (F.) 1781	4		X			
<i>Grammotaulius interogationis</i> (Zet.) 1840	1		X			
<i>Hesperophylax designatus</i> (Walk.) 1852	154		X	X	X	X
<i>Hydatophylax argus</i> (Harris) 1869	37		X	X		
<i>Ironoquia lyrata</i> (Ross) 1938	8		X	X	X	X
<i>I. punctatissima</i> (Walker) 1852	14			X	X	
<i>Lenarchus crassus</i> Banks 1920	2		X			
<i>L. keratus</i> (Ross) 1938	1		X			
<i>Leptophylax gracilis</i> Banks 1900	5	X		X		
<i>Limnephilus argenteus</i> Banks 1914	2		X			
<i>L. canadensis</i> Banks 1908	138	X	X	X		
<i>L. dispar</i> MacLachlan 1875	1			X		
<i>L. hyalinus</i> Hagen 1861	78	X	X	X		
<i>L. indivisus</i> Walker 1852	415		X	X	X	X
<i>L. infernalis</i> (Banks) 1914	50		X	X		
<i>L. janus</i> Ross 1938	2		X			
<i>L. moestus</i> Banks 1908	49		X	X		
<i>L. ornatus</i> Banks 1897	45	X	X	X		
<i>L. partitus</i> Walker 1852	1		X			
<i>L. parvulus</i> (Banks) 1905	14			X		
<i>L. perpusillus</i> Walker 1852	16	X	X	X	X	X
<i>L. rhombicus</i> (L.) 1758	19		X	X	X	X
<i>L. sackeni</i> Banks 1930	1		X			
<i>L. secludens</i> Banks 1914	19	X	X	X	X	X
<i>L. sericeus</i> (Say) 1824	33	X	X	X	X	X
<i>L. sublunatus</i> Provancher 1877	1		X			
<i>L. submonifer</i> Walker 1852	160	X	X	X	X	X
<i>L. tarsalis</i> (Banks) 1920	2		X			
<i>L. thorus</i> Ross 1938	14		X			
<i>Nemotaulius hostilis</i> (Hagen) 1873	49		X	X		X
<i>Onocosmoecus unicolor</i> (Banks) 1897	10		X			
<i>Philarctus quaeris</i> (Milne) 1935	2	X				
<i>Platycentropus amicus</i> (Hagen) 1861	213		X	X		
<i>P. radiatus</i> (Say) 1824	25		X	X		
<i>Pseudostenophylax sparsus</i> (Banks) 19081			X			
<i>P. uniformis</i> (Betten) 1934	129		X	X	X	X
<i>Pycnopsyche aglona</i> Ross 1941	2		X	X		
<i>P. guttifer</i> Ross 1941	1733	X	X	X		X
<i>P. lepida</i> (Hagen) 1861	267	X	X	X		X
<i>P. limbata</i> (MacLachlan) 1871	13		X	X		
<i>P. subfasciata</i> (Say) 1828	433	X	X	X		X
MOLANNIDAE (4)						
<i>Molanna blenda</i> Sibley 1926	41		X			
<i>M. flavicornis</i> Banks 1914	809	X	X	X	X	X
<i>M. tryphena</i> Betten 1934	62		X	X		
<i>M. uniophila</i> Vorhies 1909	809	X	X	X	X	X
PHILOPOTAMIDAE (6)						
<i>Chimarra aterrima</i> Hagen 1861	1					X
<i>C. feria</i> Ross 1941	130		X	X		
<i>C. obscura</i> (Walker) 1852	292		X	X		
<i>C. socia</i> Hagen 1861	712		X	X		

Taxon	#	NW	NE	CN	SW	SE
<i>Dolophilodes distinctus</i> (Walker) 1852	23		X	X		X
<i>Wormaldia moesta</i> (Banks) 1914	29		X			
PHRYGANEIDAE (17)						
<i>Agrypnia deflata</i> Milne 1873	2		X			
<i>A. glacialis</i> (Hagen) 1873	13		X			
<i>A. improba</i> (Hagen) 1873	223		X	X		
<i>A. macdunnoughi</i> (Milne) 1931	10		X			
<i>A. straminea</i> Hagen 1873	98	X	X	X	X	X
<i>A. vestita</i> (Walker) 1852	166		X	X	X	X
<i>Banksiola crotchi</i> Banks 1943	811	X	X	X		X
<i>B. dossuaria</i> (Say) 1828	5		X			
<i>B. smithi</i> (Banks) 1914	1		X			
<i>Beothukus complicatus</i> Banks 1924	1		X			
<i>Fabria inornata</i> (Banks) 1907	26			X		
<i>Hagenella canadensis</i> (Banks) 1907	20		X	X		
<i>Oligostomis</i> sp.	2			L		
<i>Phryganea cinerea</i> Walker 1852	347	X	X	X	X	X
<i>Ptilostomis ocellifera</i> (Walker) 1852	99	X	X	X	X	X
<i>P. semifasciata</i> (Say) 1828	279	X	X	X	X	X
POLYCENTROPODIDAE (25)						
<i>Cyrnellus fraternus</i> (Banks) 1913	28				X	X
<i>Neureclipsis bimaculata</i> (L.) 1758	89	X	X	X	X	X
<i>N. crepuscularis</i> (Walker) 1852	188		X	X		X
<i>N. valida</i> (Walker) 1852	28		X			
<i>Nyctiophylax affinis</i> (Banks) 1897	1324	X	X	X	X	X
<i>N. banksi</i> Morse 1972	1		X			
<i>N. celta</i> Denning 1948	23		X			
<i>N. moestus</i> Banks 1911	227		X	X		X
<i>Polycentropus albipunctatus</i> (Banks) 1930	7		X	X		
<i>P. aureolus</i> (Banks) 1930	47	X	X	X	X	X
<i>P. centralis</i> Banks 1914	6		X			
<i>P. cinereus</i> (Hagen) 1861	1651	X	X	X	X	X
<i>P. clinei</i> (Milne) 1936	2			X		
<i>P. confusus</i> Hagen 1961	14		X	X		
<i>P. crassicornis</i> (Walker) 1852	8	X	X			
<i>P. flavus</i> (Banks) 1908	35	X	X	X		
<i>P. glacialis</i> (Ross) 1944	2		X	X		
<i>P. iculus</i> Ross 1941	2			X		
<i>P. interruptus</i> (Banks) 1914	1330	X	X	X		X
<i>P. melanae</i> (Ross) 1938	18		X	X		
<i>P. milaca</i> Etnier 1968*	1			X		
<i>P. pentus</i> Ross 1841	56	X	X	X	X	X
<i>P. picicornis</i> Stephens 1836	2	X	X			
<i>P. remotus</i> Banks 1911	60		X	X	X	
<i>P. weedi</i> Blicke and Morse 1955	22		X	X		
PSYCHOMYIIDAE (2)						
<i>Lype diversa</i> (Banks) 1914	22		X	X		
<i>Psychomyia flavida</i> Hagen 1861	8433	X	X	X	X	X
RHYACOPHILIDAE (3)						
<i>Rhyacophila angelita</i> Banks 1911	4		X			
<i>R. fuscula</i> (Walker) 1852	86		X			
<i>R. vibox</i> Milne 1936	1		X			

Taxon	#	NW	NE	CN	SW	SE
SERICOSTOMATIDAE (1)						
<i>Agarodes distinctus</i> (Ulmer) 1905	30		X			
UENOIDAE (3)						
<i>Neophylax concinnus</i> MacLachlan 1871	144		X	X		X
<i>N. fuscus</i> Banks 1903	11			X		
<i>N. oligius</i> Ross 1938	43		X	X		
Total Species		80	232	187	86	95
Species/1000 km ²		3.8	5.9	3.9	3.2	10.5
Total Unique Species		2	70	21	5	2
Unique Species/1000 km ²		0.1	1.8	0.4	0.2	0.2

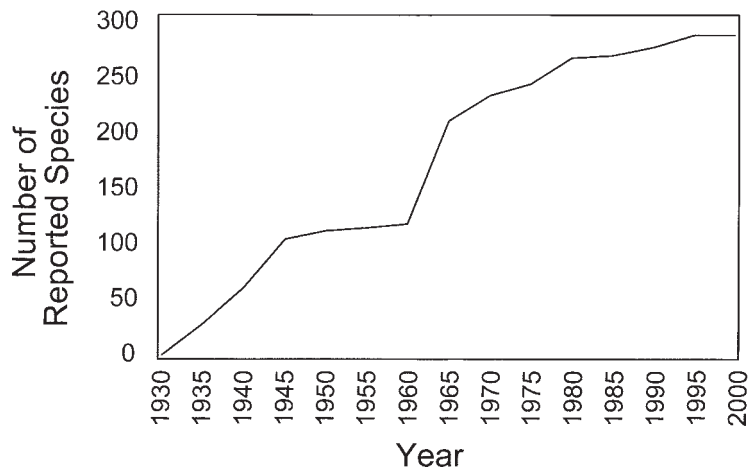


Figure 2. The progression of caddisfly species discovery in Minnesota from the years 1930 to 2000.

Table 2. The 21 caddisfly species reported from Minnesota in the literature that we do not consider valid records listed by species and initial citation. Subsequent citations are not listed.

Species	Initial Citation	Notes
<i>Agapetus illini</i> Ross	MacLean 1995	Misidentified, is actually <i>A. rossi</i> .
<i>Agrypnia colorata</i> Hagen	MacLean 1995	Misidentified, is actually <i>A. straminea</i> .
<i>Agrypnia obsoleta</i> McLachlan	MacLean 1995	Adult record; specimen whereabouts unknown; is likely <i>A. deflata</i> .
<i>Apatania incerta</i> (Banks)	Etnier 1965	Female record; specimen whereabouts unknown; is likely <i>A. zonella</i> .
<i>Ceraclea neffi</i> (Resh)	Lager et al. 1979	Larval record.
<i>Goera calcarata</i> Banks	Etnier 1965	Larval record; specimen whereabouts unknown; may be <i>G. stylata</i> .
<i>H. cuanis</i> Ross	Lager et al. 1979	Larval record; specimen whereabouts unknown.
<i>H. hageni</i> Banks	Denning 1943	Female record; specimen whereabouts unknown.
<i>H. ventura</i> Ross	Phillippi and Schuster 1987	Adult record; specimen whereabouts unknown.
<i>Hydroptila strepha</i> Ross	Etnier 1965	All known Minnesota specimens have been reidentified as <i>H. antennopedia</i> .
<i>H. virgata</i> Ross	Etnier 1965	Female record.
<i>Limnephilus acrocurvus</i> Denning	Denning 1942	Designated a junior synonym of <i>L. dispar</i> (Ruitter 1997).
<i>L. externus</i> Hagen	Etnier 1965	Pupal record; specimens whereabouts unknown; may be <i>L. thorus</i> .
<i>Molanna ulmerina</i> Navás	Harris et al. 1991	Unknown record; specimen whereabouts unknown.
<i>Neophylax nacatus</i> Denning	Lager et al. 1979	Larval record; specimen whereabouts unknown.
<i>Ochrotrichia stylata</i> (Ross)	Denning & Blickle 1972	Adult record; specimen whereabouts unknown.
<i>O. wojcicky</i> Blickle	Denning & Blickle 1972	Adult record; specimen whereabouts unknown.
<i>Psilotreta</i> sp.	MacLean 1995	Misidentified, is actually <i>Phylocentropus placidus</i> .
<i>Pycnopsyche scabripennis</i> (Rambur)	Lager et al. 1979	Larval record
<i>Setodes guttatus</i> (Banks)	Etnier 1965	Misidentified, is actually <i>S. oligius</i> .
<i>Triaenodes borealis</i> Banks	Banks 1900	Species described from female without illustrations; likely <i>nomen dubium</i> .

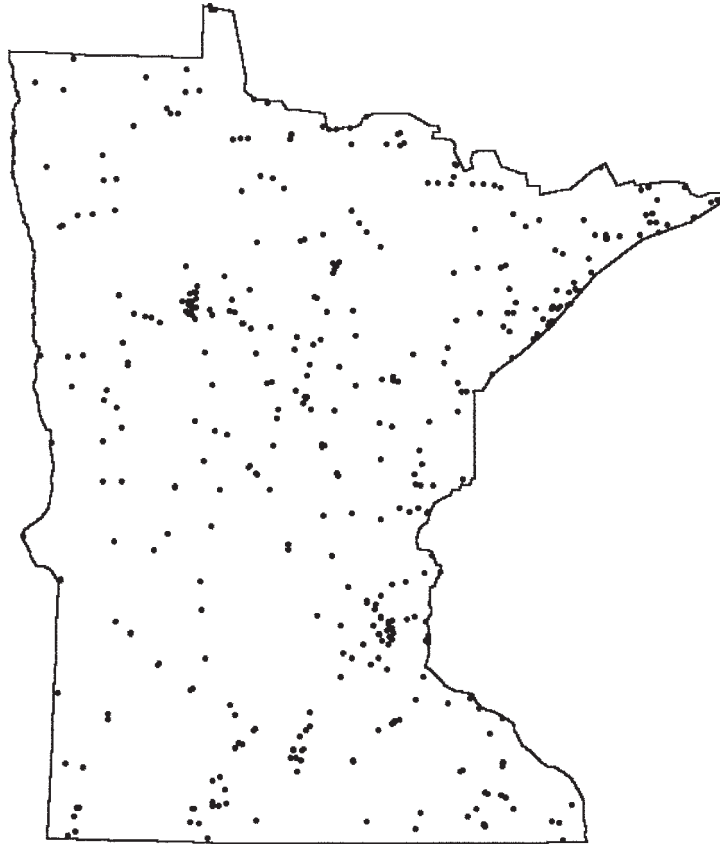


Figure 3. Minnesota collecting localities corresponding to specimens examined during this study.

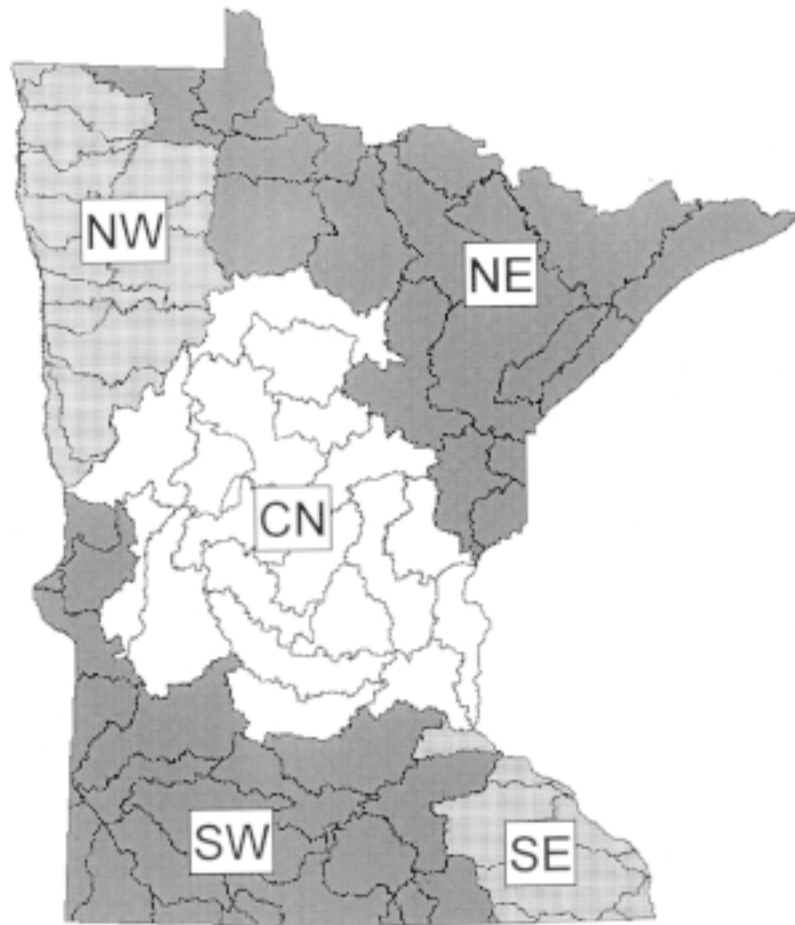


Figure 4. The five geographic regions of Minnesota designed and used during this study, NW: Northwest, NE: Northeast, CN: Central, SW: Southwest, SE: Southeast. Smaller subdivisions represent watersheds established by the U.S. Geological Survey (USGS 2001).