

NEW RECORDS OF MAYFLIES (EPHEMEROPTERA) FROM NOVA SCOTIA AND NEW BRUNSWICK, CANADA¹

Eric R. Whiting²

ABSTRACT: Collections of mayflies (Ephemeroptera) from Nova Scotia and New Brunswick, Canada in 1988 and 1989 yielded 38 species, all but four of which were identified from adult males. Twelve of these species are reported from the area for the first time; nine additional species were previously reported only in technical reports by the Canadian Department of Fisheries and Oceans. The majority of these mayfly species are widely distributed in eastern North America. Only three appear to be restricted to the northeast, and six are transcontinental in distribution.

The mayfly fauna of the provinces of Nova Scotia and New Brunswick, Canada is poorly known. The majority of species recorded from this area are from taxa which can be identified as larvae, particularly the family Ephemerellidae and the genus *Stenonema* (Allen and Edmunds 1961, 1962a, 1962b, 1963a, 1963b, 1965, Lewis 1974, Bednarik and McCafferty 1979, Peterson *et al.* 1985). The most thorough study of mayflies in these provinces was restricted to four drainage basins in southern Nova Scotia and two in southwestern New Brunswick (Peterson and Martin-Robichaud 1986, Peterson 1989).

I collected mayfly adults and larvae from Nova Scotia and southern New Brunswick in 1988 and 1989 (Fig. 1). Collections were made from July 15 to August 31, 1988, and from May 12 to July 24, 1989.

Adult mayflies were obtained by netting specimens from swarms, by examining streamside vegetation and spider webs, and by rearing field-collected larvae in the laboratory. Larvae were reared individually in cylindrical mesh cages (25 cm long by 5 cm diameter) made of nylon window screening. Cages were placed partially submersed in 25 l aquaria containing dechlorinated tap water. Aquaria were aerated continuously, and exposed to a photoperiod of 16 hours light and 8 hours darkness. Each cage had a removable top for extracting the reared adult.

Adult mayflies were identified using the keys and descriptions in Traver (1935), Burks (1953), Allen and Edmunds (1961, 1962b, 1963a, 1963b, 1965; Ephemerellidae), McCafferty (1975; Ephemeridae), Bednarik and McCafferty (1979; *Stenonema*) and Kondratieff and Voshell (1981; *Siphonurus barbaroides* McDunnough). Generic and species con-

¹ Received January 10, 1992. Accepted April 21, 1992.

² Department of Biology, University of Saskatchewan, Saskatoon, Saskatchewan, Canada S7N 0W0

cepts within the Baetidae follow McCafferty and Waltz (1990).

It was not always possible to distinguish adults of *Ephemerella rotunda* Morgan and *E. subvaria* McDunnough. Of the thirty adult *Ephemerella* collected, some clearly fit the descriptions of either of these two species. However, the majority of specimens were intermediate in form. Larval exuviae associated with adult males all appeared to be *E. subvaria*. This suggests that the adults collected represent previously undescribed variations in *E. subvaria*, and that adults of this species and *E. rotunda* cannot be separated using existing keys and diagnoses. However, it is also possible that the intermediate specimens are hybrids between *E. subvaria* and *E. rotunda*. The resolution of this problem requires more specimens (adults with associated larval exuviae) from a broader geographic area.

A few species were identified from larvae alone. Larvae of *Anthopotamus* and *Baetisca* were identified using Bae and McCafferty (1991) and Pescador and Berner (1981), respectively. Larvae of *Heptagenia* were identified by comparison with specimens in the author's collection. As

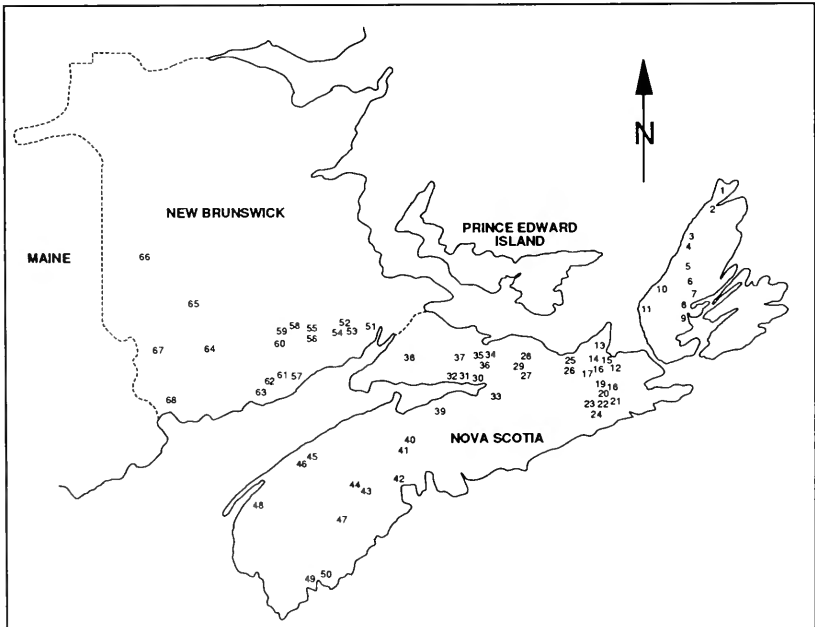


Figure 1. Sites in Nova Scotia and New Brunswick from which mayfly adults were collected or reared. Site locations are described in the Appendix.

only one species of *Arthroplea* is known from North America, the larvae collected are assumed to be *A. bipunctata* McDunnough.

A total of 330 adult males were identified to species (Table 1). These adult males represented thirty-four species in seven families. Four additional species, representing two additional families, were identified from larvae alone.

Twelve species are recorded from the Maritime Provinces for the first time. Nine additional species have been previously reported only in technical reports by the Canadian Department of Fisheries and Oceans (Peterson and Martin-Robichaud 1986, Peterson 1989). Two of these species (*Paraleptophlebia adoptiva* (McDunnough) and *P. volitans* (McDunnough) were previously identified only from larvae. Four species previously known from only one of the Maritime Provinces are now recorded from both Nova Scotia and New Brunswick. *Procloeon rufostrigatum* (McDunnough) and *Eurylophella temporalis* (McDunnough) are recorded from Nova Scotia for the first time. *Leptophlebia cupida* (Say) and *Siphonurus alternatus* (Say) are reported from New Brunswick for the first time.

Four species collected in this study are very widely distributed in North America (Table 1). Two additional species appear to have disjunct distributions, with separate populations in the east and west. *Procloeon venosum* has been reported from the southwestern United States (McCafferty and Waltz 1990), northern Quebec (Harper 1989) and now Nova Scotia. *Cinygmula subaequalis* is widely distributed in eastern North America and has also been reported from Alaska (McCafferty 1985).

Eighteen or nineteen species collected in this study occur throughout eastern Canada and the eastern United States (regions defined as in Edmunds *et al.* 1976), at least as far south as North Carolina. The ranges of eleven of these species extend westward into central regions of Canada and/or the U.S. Nine additional species also occur in eastern and central regions of Canada and the U.S., but are absent from the southeastern U.S. Seven of the preceding twenty species reported to occur in central North America have ranges that extend northwest into the MacKenzie River drainage in the Northwest Territories (Cobb and Flannagan 1980); two of these have also been reported from the Yukon (McCafferty 1985). Only three of the species collected in this study appear to be restricted to the northeast (northeastern U.S. and eastern Canada). The mayfly fauna of Nova Scotia and New Brunswick thus appears to be dominated by species which are generally and widely distributed in eastern and central North America. Only one species of mayfly, *Siphonurus demarayi* Kondratieff and Voshell, is known only from the study area. No adults of *S. demarayi* were collected during this study.

The collection sites presented in Table 1 do not represent the entire range within the study area for most species. Because adult mayflies have short lifespans and many species are difficult to rear from larvae, adults were not obtained from all sites at which a species occurred.

This study brings the total number of mayfly species reported from Nova Scotia and New Brunswick to about 80. There are probably additional species present, especially among the Baetidae. *Siphonisca aerodromia* Needham is also likely to occur in the area, as it has been reported from Maine, New York and Labrador (Burian and Gibbs 1988).

Table 1. Mayflies collected in Nova Scotia and southern New Brunswick. Collection sites are shown in Figure 1.

	Sites [†]	N.A. Distribution
Siphonuridae		
<i>Siphonurus alternatus</i> (Say)	44	northeastern & central
** <i>Siphonurus barbaroides</i> McDunnough	6,17,23,27,55,59	northeastern
Metretopodidae		
** <i>Siphloplecton basale</i> (Walker)	64,66	eastern & central
Baetidae		
* <i>Acerpenna pygmaea</i> (Hagen)	16	eastern & central
* <i>Baetis flavistriga</i> McDunnough	14,15	eastern & central
<i>Baetis tricaudatus</i> Dodds	8,12	widespread
** <i>Callibaetis ferrugineus</i> (Walsh)	28	northeastern & central
** <i>Procloeon venosum</i> (Traver)	12,14,31	eastern & southwestern
** <i>Procloeon rubropictum</i> (McDunnough)	18	northeastern
<i>Procloeon rufostrigatum</i> (McDunnough)	22	northeastern & central
Heptageniidae		
* ^N <i>Arthroplea bipunctata</i> McDunnough	21,56,64	northeastern & central
* <i>Cinygmula subaequalis</i> (Banks)	2,27,36,51,55,58	eastern & Alaska
** <i>Epeorus pleuralis</i> (Banks)	6,10,12,19,27,29, 31,32,34,37,38,39,54,55,58	eastern
** ^N <i>Heptagenia pulla</i> (Clemens)	37	northeastern & central
* <i>Leucrocota hebe</i> (McDunnough)	4,31,47	northeastern & central
** <i>Nixe inconspicua</i> (McDunnough)	13	northeastern & central
** <i>Rhiithrogena impersonata</i> (McDunnough)	1,6,19,27,55	northeastern & central
** <i>Rhiithrogena jejuna</i> Eaton	23,27,35,38,64	northeastern & central
* <i>Stenacron interpunctatum</i> (Walker)	13,20,24,49	eastern & central
<i>Stenonema femoratum</i> (Say)	20,63	eastern & central
<i>Stenonema modestum</i> (Banks)	21,40,42,48,50	eastern
<i>Stenonema vicarium</i> (Walker)	23,33,57,60,65,68	eastern & central
Leptophlebiidae		
<i>Leptophlebia cupida</i> (Say)	28,52,56,57	widespread
* <i>Paraleptophlebia adoptiva</i> (McDunnough)	19,25,29,52,54,57, 59,61	eastern & central
* <i>Paraleptophlebia mollis</i> (Eaton)	14,15,16,22,30,33, 45,51	eastern
* <i>Paraleptophlebia strigula</i> (McDunnough)	13	northeastern
* <i>Paraleptophlebia volitans</i> (McDunnough)	22	eastern

EphemereIIDae

<i>Attenella margarita</i> (Needham)	14	widespread
<i>Drunella cornuta</i> (Morgan)	3,7,26	eastern
<i>EphemereIIa dorothea</i> Needham	46	eastern & central
<i>EphemereIIa rotunda</i> Morgan/ <i>subvaria</i> McDunnough	5,9,11,12,23,25, 35,38,53,59,61,66	eastern/ northeastern
<i>Eurylophella bicolor</i> (Clemens)	20,59	eastern & central
<i>Eurylophella temporalis</i> (McDunnough)	21,43	eastern & central
<i>Serratella deficiens</i> (Morgan)	4,14	eastern

Baetiscidae

^N <i>Baetisca laurentia</i> McDunnough	41,67	eastern & central
---	-------	-------------------

Potamanthidae

** ^N <i>Anthopotamus distinctus</i> (Traver)	62	eastern
---	----	---------

EphemereIIDae

** <i>Ephemera simulans</i> Walker	20	widespread
------------------------------------	----	------------

^t — sites 1-50 are in Nova Scotia; sites 51-68 are in New Brunswick

** — new record for the area Nova Scotia and New Brunswick

* — previously reported from Nova Scotia and New Brunswick only in reports by Peterson and Martin-Robicaud (1986) and Peterson (1989).

^N — identified from larvae only

Appendix. Collection sites in Nova Scotia and southern New Brunswick. Sites are numbered from northeast to southwest.

NOVA SCOTIA**Victoria County**

- 1 Salmon River, 2 km E of Capstick
- 2 North Apsy River, 8 km SW of Cape North

Inverness County

- 3 Farm Brook at Cabot Trail, 6 km S of Cheticamp
- 4 stream at Cap Lemoine, at Cabot Trail
- 5 Margaree River Southwest at Hwy. 395, 5 km N of Scottsville
- 6 Mathieson Glen Brook at Hwy. 395, 3 km N of Scottsville
- 7 Mackay Brook at Hwy. 395, at south end of Lake Ainslie
- 8 River Denys at Hwy. 105, at Blues Mills
- 9 River Denys at River Denys
- 10 Broad Cove River at Hwy. 19, 8 km NE of Mabou
- 11 Southwest Mabou River at Hwy. 19, 8 km SW of Mabou

Antigonish County

- 12 South River, 2 km W of St. Andrews
- 13 Wright's River at Hwy. 245, 12 km NW of Antigonish
- 14 Wright's River at Antigonish
- 15 West River at Antigonish
- 16 West River at West River Road, 5 km W of Antigonish
- 17 James River, at West River Road, 13 km SW of Antigonish
- 18 Copper Lake
- 19 McNab Brook at West Lochabor Lake Road
- 20 Lochabor Lake at West Lochabor

Guysborough County

- 21 Goshen Lake

- 22 North River, St. Mary's, 2 km S of Lochabor Lake
- 23 East River, St. Mary's at Hwy. 347, 1 km. S of New Town
- 24 West Branch, St. Mary's, 2 km W of Glenelg

Pictou County

- 25 Barney's River at Avondale
- 26 Fall Brook, 2 km S of McPherson's Mills

Colchester County

- 27 Salmon River at Kempton
- 28 Earltown Lake, 2 km SE of Earltown
- 29 Waughs River at Hwy. 311, 1 km S of Earltown
- 30 Debert River at Hwy. 104, 1 km E of Glenholme
- 31 Great Village River at Hwy. 2, at Great Village
- 32 Bass River, 5 km N of Bass River
- 33 Stewiacke River at Middle Stewiacke

Cumberland County

- 34 Wallace River, East Branch, at Hwy. 246, 3 km E of Wentworth
- 35 Wallace River at Hwy. 104, at Wentworth Provincial Park
- 36 Smith's Brook at Hwy. 104, 7 km S of Wentworth
- 37 Portapique River, 9 km NW of Sutherland Lake
- 38 Maccan River at Mapleton

Hants County

- 39 Little Nine Mile River at Hwy. 14, at Roulston Corner

Lunenburg County

- 40 stream, flowing into South Canoe Lake, 9 km SW of Vaughn
- 41 Gold River at New Ross
- 42 Middle River, 10 km NNW of Chester
- 43 New Germany Lake at New Germany

Annapolis County

- 44 pond, 1 km N of Springfield
- 45 Leonard Brook at Hwy. 1, 1 km NE of Paradise
- 46 Round Hill River at Hwy. 201, at Round Hill

Queen's County

- 47 Medway River at Hwy. 208, at South Brookfield

Digby County

- 48 stream flowing into Partridge Island Lake, at Hwy. 340

Shelbourne County

- 49 Ogden's Creek at Hwy. 103, 4 km E of Jordan Falls
- 50 Jordan River at Hwy. 103, at Jordan Falls

NEW BRUNSWICK**Westmoreland County**

- 52 Pollett River at Hwy. 905, at Pollett River

Albert County

- 51 Turtle Creek at Rosevale, 18 km SW of Hillsborough
- 53 Little River at Hwy. 895, at Parkindale
- 54 Pollett River at Hwy. 895, 2 km N of Elgin

King's County

- 55 Kennebecasis River, South Branch, at Hwy. 114
- 56 pond at Hwy. 114, 2 km E of Hwy. 2 junction
- 57 Anderson Brook, 3 km S of Walton's Lake
- 58 Windgap Brook, 5 km NW of Newtown
- 59 Millstream River, 7 km N of Berwick

- 60 Trout Creek at Hwy. 111, at Sussex Corner
 61 Hammond River at Hwy. 111, 1 km E of Hillsdale
 62 Hammond River at Hwy. 120, 6 km SE of Upham
St. John's
 63 Loch Lomond at Loch Lomond
Sunbury County
 64 Oromocto River at Hwy. 101, 10 km SSE of Fredricton Junction
York County
 65 Nashwaak River at Hwy. 620
 67 Magaguadavic River at Brockway
Carleton County
 66 Clearwater Stream at Hwy. 107, 5 km SW of Juniper
Charlotte County
 68 Digdeguash River at Hwy. 770, at Rolling Dam

ACKNOWLEDGMENTS

I am grateful to M. Blouw and G.E. Newsome, St. Francis Xavier University, Antigonish, Nova Scotia, for comments and assistance during this study. I am also indebted to P.G. Mason, Canada Agriculture Research Station, Saskatoon, Saskatchewan and to two anonymous reviewers for comments on the manuscript. Dennis Dyck prepared the map of the study area. All specimens are in the collection of the author.

LITERATURE CITED

- Allen, R.K. and G.F. Edmunds, Jr. 1961. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) III. The subgenus *Attenuatella*. J. Kansas Entomol. Soc. 34: 161-173.
- _____. 1962a. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) IV. The subgenus *Dannella*. J. Kansas Entomol. Soc. 35: 333-338.
- _____. 1962b. A revision of the genus *Ephemerella* (Ephemeroptera, Ephemerellidae) V. The subgenus *Drunella* in North America. Misc. Publ. Entomol. Soc. Am. 3: 147-179.
- _____. 1963a. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) VI. The subgenus *Serratella* in North America. Ann. Entomol. Soc. Am. 56: 583-600.
- _____. 1963b. A revision of the genus *Ephemerella* (Ephemeroptera: Ephemerellidae) VII. The subgenus *Eurylophella* in North America. Can. Entomol. 95: 597-623.
- _____. 1965. A revision of the genus *Ephemerella* (Ephemeroptera, Ephemerellidae) VIII. The subgenus *Ephemerella* in North America. Misc. Publ. Entomol. Soc. Am. 4: 243-282.
- Bednarik, A.F. and W.P. McCafferty, 1979. Biosystematic revision of the genus *Stenonema* (Ephemeroptera: Heptageniidae). Can. Bull. Fish. Aquat. Sci. 201: 1-73.
- Bae, Y.J. and W.P. McCafferty, 1991. Phylogenetic systematics of the Potamanthidae (Ephemeroptera). Trans. Am. Entomol. Soc. 117: 1-143.
- Burian, S.K. and K.E. Gibbs, 1988. A redescription of *Siphonisca aerodromia* (Ephemeroptera: Siphonuridae). Aquatic Insects 10: 237-248.
- Burks, B.D. 1953. The mayflies, or Ephemeroptera, of Illinois. Bull. Ill. Nat. Hist. Surv. 26: 1-216.
- Cobb, D.G. and J.F. Flannagan, 1980. The distribution of Ephemeroptera in northern Canada. pp. 155-166. in Flannagan, J.F. and K.E. Marshall (eds.), Advances in Ephemeroptera biology. Plenum, New York. 552 pp.
- Edmunds, G.F., Jr., S.L. Jensen and L. Berner, 1976. The mayflies of North and Central America. Univ. of Minnesota Press, Minneapolis. 330 pp.

- Harper, P.P. 1989. Zoogeographical relationships of aquatic insects (Ephemeroptera, Plecoptera, and Trichoptera) from the eastern James Bay drainage. *Can. Field-Nat.* 103: 535-546.
- Kondratieff, B.C. and J.R. Voshell, Jr. 1981. A new species of *Siphonurus* from Nova Scotia, Canada. *Ann. Entomol. Soc. Am.* 74: 545-547.
- Lewis, P.A. 1974. Taxonomy and Ecology of *Stenonema* mayflies (Heptageniidae: Ephemeroptera). USEPA Monitoring Series, Report No. EPA-670/4-74-006, 81 pp.
- McCafferty, W.P. 1975. The burrowing mayflies (Ephemeroptera: Ephemeroidea) of the United States. *Trans. Am. Entomol. Soc.* 101: 447-504.
- _____. 1985. The Ephemeroptera of Alaska. *Proc. Entomol. Soc. Wash.* 87: 381-386.
- McCafferty, W.P. and R.D. Waltz. 1990. Revisionary synopsis of the Baetidae (Ephemeroptera) of North and Middle America. *Trans. Am. Entomol. Soc.* 116: 769-799.
- Pescador, M.L. and L. Berner. 1981. The mayfly family Baetiscidae (Ephemeroptera) Part II Biosystematics of the genus *Baetisca*. *Trans. Am. Entomol. Soc.* 107: 163-228.
- Peterson, R.H. 1989. Species distributions of mayfly (Ephemeroptera) nymphs in three stream systems in New Brunswick and Nova Scotia with notes on identification. *Can. Tech. Rep. Fish. Aquat. Sci.* 1685. 14 pp.
- Peterson, R.H., D.J. Gordon and D.J. Johnston. 1985. Distribution of mayfly nymphs (Insecta: Ephemeroptera) in some streams of eastern Canada as related to stream pH. *Can. Field Nat.* 99: 490-493.
- Peterson, R.H. and D.J. Martin-Robichaud. 1986. Aquatic insect histories and Atlantic salmon fry diets in the St. Croix river, New Brunswick, Canada. *Can. Tech. Rep. Fish. Aquat. Sci.* 156:12 pp.
- Traver, J.R. 1935. Part II. Systematic. pp 237-739 in Needham, J.G., J.R. Traver and H.-C. Hsu (eds.), *The Biology of Mayflies*. Comstock Publishing Co., Ithaca, NY. 759 pp.