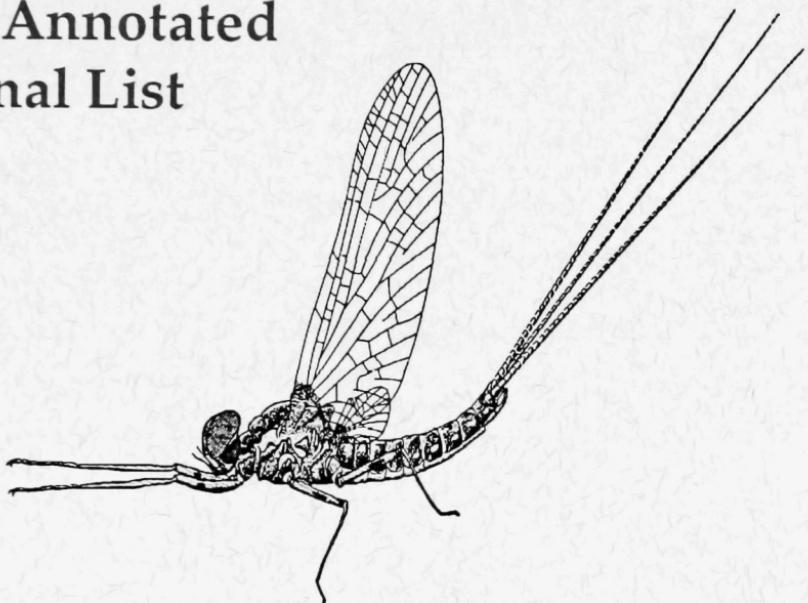


# Mayflies of Maine: An Annotated Faunal List



Steven K. Burian  
and  
K. Elizabeth Gibbs



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Steven K. Burian  
*Assistant Professor*  
*Department of Biology,*  
*Southern Connecticut State University*  
*New Haven, CT 06515*

and

K. Elizabeth Gibbs  
*Associate Professor*  
*Department of Entomology*  
*University of Maine*  
*Orono, Maine 04469*

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Cover illustration is a male imago of *Choroterpes (C.) fusca* Spieth drawn by S.K. Burian.

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## INTRODUCTION

Mayflies, insects of the order Ephemeroptera, are descendants of an ancient lineage of insects that originated in the Permian era, about 225–290 million years ago. Adults (both subimagoes and imagoes) are terrestrial, but immature forms (nymphs) are entirely aquatic. Availability of suitable aquatic habitats for nymphs is an important factor that limits their distribution. Mayflies are generally restricted to unpolluted freshwater habitats, but some species exhibit a wide range of ecological tolerances (Roback 1974) including adaptation to brackish waters (Berner and Sloan 1954; Forbes and Allanson 1970). Reproduction and dispersal are the primary functions of the adult. Dispersal by nymphs frequently occurs within a drainage basin, but is unlikely to occur across basin boundaries.

Mayflies are an important part of many aquatic food webs as processors of organic detritus and as food for predators. They are often one of the most abundant and diverse groups of benthic macroinvertebrates in rivers and lakes because they are microhabitat specialists. Groups of mayflies with similar ecological requirements can be classified according to habitat and functional role (Cummins 1973; Cummins and Klug 1979). Mayflies differ in sensitivity to changes in the overall structure of their habitats, making them potentially important tools for monitoring water quality. In spite of their importance, there is a lack of understanding of the taxonomy, biology, and ecology of the order for many geographic areas.

This is a study of the mayflies of Maine. Although this study is limited to Maine, it is expected that the fauna is similar in comparable habitats of adjacent areas and that the findings will be of value beyond Maine. The purpose of the study is to determine the composition and distribution of the mayfly fauna and to reference all pertinent taxonomic, ecologic, and biologic data.

### Historical Review

About 114 species of mayflies had been reported as occurring in Maine previous to this study. If recent nomenclatural changes in major taxa, such as *Baetis*, *Isonychia*, and *Stenonema*, are considered along with misidentifications, the number would be about 100.

The first scientific account of a mayfly from Maine was published by Eaton (1883) when he renamed *Ephemerella decora* to *Ephemerella varia* from specimens in the collection of the Museum of Comparative Zoology at Harvard University. Morgan (1911) described *Drunella lata* from the Sandy River. McDunnough (1924a) described *Arthroplea bipunctata* from Wales township, but did not list a precise site locality.

Needham et al. (1935) published Maine location records for *Caenis amica* (Bar Harbor), *Callibaetis ferrugineus* (Bar Harbor), *Cloeon ingens* (Eustis), *Drunella lata* (Sandy River), *Litobrancha recurvata* (as *H. recur-*

*vata*) (Passadumkeag Bog), and *Leptophlebia nebulosa* (Bar Harbor). Spieth (1941b) recorded specimens of *Hexagenia limbata affiliata* and *Litobrancha recurvata* (as *H. recurvata*) from Jefferson and Passadumkeag in a revisionary study of the hexageniids of North America.

Burks (1946) described *Epeorus frisoni* based on a single specimen collected by T.H. Frison in 1939 from Roaring Brook on Mt. Katahdin. Despite numerous later collections made in the vicinity of the type location, no specimens have been obtained that match Burks's description. In addition, such a high degree of variability has been noted in the structure of male genitalia of the closely related species *Epeorus pleuralis* by McDunnough (1938) and Spieth (1938) that the validity of *Epeorus frisoni* is suspect.

Procter (1938, 1946) published a survey of the insects of Mount Desert Island. His later list included 44 species of mayflies; 29 were new state records. Although he collected adult mayflies intensively from about 11 sites around the island, he did not collect nymphs or conduct rearings. Unfortunately, few of the mayflies recorded in his survey survive in the collection in the Entomology Department Museum, University of Massachusetts, Amherst, Massachusetts. This makes it impossible to assess the validity of some records like *Callibaetis fluctuans*, which has not been reported in Maine since Procter's study.

Burks's (1953) study of the Illinois mayfly fauna reported several species with Maine distribution records, but did not give specific site records for most. Allen and Edmunds (1962b, 1963b) studied specimens of *Eurylophella prudentalis* (Oquossoc, Seebon Sook [Seboomook?], Kellyland, Norway, and Augusta), *Eurylophella coxalis* (Oquossoc), and *Drunella lata* (Phillips and the Sandy River) as part of a series of revisionary studies of the genera of North American Ephemerellidae.

Koss (1970) published a list of the holdings of Ephemeroptera in the Michigan State University Entomology Museum; this list contained records for 23 species collected from Maine. Eight of these species (*Siphlonurus mirus*, *Cinygmulia subaequalis*, *Heptagenia diabasia*, *Leucrocuta hebe*, *Rhithrogena impersonata*, *Stenonema vicarium*, *Ephemera guttulata*, *Hexagenia rigida*) were noted as new state records. However, Koss's new state record notation is incorrect for two of these taxa because Procter (1946) first reported *Siphlonurus mirus* and *Stenonema vicarium* (as *S. fuscum*). In addition, some of Koss's specimens have been reexamined, and specimens he determined to be *Heptagenia diabasia* are actually *H. pulla*. Moreover, Koss (1970), like Burks (1953), did not provide site-specific locations, but listed the taxa simply as occurring in Maine.

McCafferty (1975) studied the nymphs of the North American members of the Ephemeroidea and listed *Ephemera varia*, *E. guttulata*, *E. simulans*, *Hexagenia limbata*, *H. rigida*, and *Litobrancha recurvata* as occurring in Maine, but gave the records only as Maine. McCafferty only provided

specific site records for previously unpublished range extensions. This is particularly troublesome in the case of *Hexagenia rigida*, which is uncommon in Maine and has only been reported by Koss (1970). This record is presumed to be the one McCafferty shows on his distribution map.

Berner (1978), in a revision of the Metretopodidae, reported examining specimens of *Siphloplecton basale* and *Metretopus borealis* from the Narraguagus River and Schoodic Brook in Hancock County. Mingo (1978b) discussed the distribution of both of these species and the habitats where they were collected as part of a larger study of the aquatic insects of the Narraguagus River.

Lewis (1974), in a reprinted edition of his study of the genus *Stenonema*, listed three species then known as *S. smithae*, *S. rubromaculatum*, and *S. integrum*, as occurring in Crooked River and Carsley Brook, Harrison, Maine. He also listed records for *Stenacron interpunctatum*, *S. canadense*, and *S. frontale* from Crooked River and Carsley Brook. However, Bednarik and McCafferty (1979), in a later revision of the *Stenonema*, placed *S. rubromaculatum* as a junior synonym of *S. modestum* and restricted the range of *S. smithae* to the deep South, relegating all northern populations to *S. modestum*. They also reported specimens of *Stenonema vicarium* and *S. modestum* from Maine.

Mingo (1978a) studied parthenogenesis in *Stenacron interpunctatum* collected from Aroostook County. Specimens reared in the laboratory were shown to produce eggs that would develop without fertilization. He concluded that this species was facultatively parthenogenetic and suggested that further field studies would be necessary to determine the extent to which parthenogenesis occurs in natural populations.

Gibbs (1980) reported *Siphlonisca aerodromia* in eastern Maine, marking the rediscovery of a species that was last collected in New York over 40 years ago by C.P. Alexander (Edmunds et al. 1976). Mingo et al. (1979) reported on the aquatic insects of the St. John River drainage. Their study contained a list of 22 genera and 29 species of mayflies, two of which were listed as new state records.

Mingo and Gibbs (1980), in a detailed assessment of the aquatic insects of the Narraguagus River, provided a list of 28 genera and 74 species of mayflies, 14 of which were listed as new state records and 2 as new national records. However, reexamination of as many of these specimens as possible indicates that some were misidentified: *Baetis bicaudatus* should be *B. tricaudatus*; *Baetis insignicans* should be *B. propinquus*; *Baetisca bajkoui* should be *B. lacustris*; and *Baetisca obesa* should be *B. laurentina*. Although the record for *Attenella margarita* (as *E. margarita*) is probably correct, the specimen cannot be located for study. The same is true for *Leucrocuta minerva* (as *H. minerva*). The record of *Rhithrogena amica* is likely incorrect because it is based on nymphs only and determinations to species can only be

made when reared specimens are available. The same is true for the record of *Tricorythodes atratus*. Although specimens labeled *Isonychia notata* could not be located, the determination is undoubtedly incorrect in terms of the analysis of this species given by Kondratieff and Voshell (1984). A complete discussion of the physical nature of the habitats sampled is provided by Mingo (1978b) as well as a discussion of the effects of long-term pesticide use in the vicinity of the Narraguagus River.

Pescador and Berner (1981), in a revision of the genus *Baetisca*, listed Maine records for *B. laurentina* and *B. rubescens*. Kondratieff and Voshell (1984) similarly list Maine records for *Isonychia bicolor* and *I. obscura* as part of a study of North American *Isonychia*.

Little is known about the distribution and ecology of the mayflies of Maine's larger rivers and lakes. No research has been conducted to specifically study the mayflies of these habitats, but some data can be obtained from the few general studies of macroinvertebrates. Rabeni (1977) and Davies (1987) studied the changes in structure of the benthic macroinvertebrate community at 11 sites along the Penobscot River from East Millinocket to Bangor. Rabeni (1977) identified current velocity, siltation and detritus as major factors affecting benthic community structure. Rabeni used an ordination technique to show that *Ephemerella invaria*, *Attenella attenuata*, *Drunella walkeri*, *Serratella deficiens*, *Eurylophella bicolor*, and *Eurylophella temporalis* formed clusters that corresponded to the non-silted, fast-current habitats. The distribution of three species of *Stenonema* were less unified, with *S. vicarium* and *S. modestum* preferring fast-current areas and *S. ithaca* preferring slower flow and some silt. One species of *Stenacron* (*S. interpunktatum*) was included in the group with *Stenonema* and was determined to prefer even slower flow and more silt.

Davies (1987) reexamined the study sites of Rabeni (1977), using similar ordination methods to study community relationships, but concentrated on analyzing changes in the functional components of the benthic community. Although she detected changes in species diversity among the 11 sites, observations of mayfly habitat preference followed that of Rabeni's earlier study.

Trotzky and Gregory (1974) and Eiler (1986) studied the benthic macroinvertebrate community of the Wyman Lake area of the Kennebec River. Trotzky and Gregory (1974) examined the effects of regulated discharge from Wyman Dam on the benthic macroinvertebrate community of the tail-water zone below the reservoir and compared it to areas above the impoundment and to an unaffected tributary (Carrabassett River) of the Kennebec River. Six genera of mayfly nymphs were collected below the dam, and their occurrence and distribution was described in relation to flow regulated by the dam. Intensity, timing, and duration of high- or low-flow periods were shown to be the major factors affecting the structure of the tail-water community.

Eiler (1986) studied the benthic macroinvertebrate community associated with sunken logs that litter the bottom of Wyman Lake. Except for Diptera, Ephemeroptera had the greatest diversity in the sunken log areas and in the open sediment areas. Mayfly biomass was highest in the open sediment areas. Heptageniidae, Ephemerellidae, and Leptophlebiidae occurred only in log areas, whereas *Baetis* and *Caenis* were found in both sampling areas (logs and open sediments). Eiler also measured a wide range of water-quality parameters; these are the only data available on the physical nature of deep-lake habitats where mayflies have been collected.

The rediscovery of a sizeable population of *Siphlonisca aerodromia* in eastern Maine has presented the first opportunity to study this species since it was last observed in New York in the early 1900s. Gibbs and Mingo (1986) described the life history and post-embryonic growth of the nymphs. Burian and Gibbs (1988) presented a redescription of all life stages, including electron micrographs of some structures.

Recently the mayfly fauna of Mount Desert Island was intensively collected and studied by Mack (1988). The current species list developed by Mack (1988) contains records for 23 genera and 47 species. Many of the species originally recorded by Procter (1946) were recollected, and several species not reported by Procter were collected. However, a few species collected by Procter, e.g., *Callibaetis fluctuans* and *Choroterpes basalis*, were not collected during this new study.

### Specimens Examined

Specimens examined for this study were obtained from the Aquatic Insect Collection of the University of Maine Department of Entomology, Maine Pest Management Service light traps for summer 1985, Maine Forest Service light traps for summer 1985, the Procter Collection at the University of Massachusetts, the Aquatic Insect Collection of Florida A&M University, Cornell University Insect Collection, the Arthropod Collection of the Museum of Comparative Zoology at Harvard University, the Arthropod Collection of the American Museum of Natural History, and from personal collections of the authors and their friends and colleagues during the summers of 1985, 1986, and 1987.

All specimens examined were identified to species where possible. Verified specimens were used for comparison and some specimens were sent to specialists for verification. All determinations were made using a combination of the most recent taxonomic keys (from revisional studies), pertinent regional keys for other areas, and original descriptions and redescriptions. Particular attention was paid to correcting all names in accordance with changes in nomenclature (e.g., synonymy or homonymy). All species determinations and biogeographic data from collection labels were recorded and entered into a computer using PC-File III database software.

### Rearing and Collecting

Whenever possible nymphs were reared for identification with adult forms. Rearing was conducted both in the laboratory and in the field. In the laboratory, specimens were reared individually and in mass (Burian 1990). Nymphs requiring cool ambient water temperatures were reared in a walk-in environmental chamber set at 15° C (58° F). The chamber's daylight fluorescent lights were set to approximate the seasonal photoperiod. Nymphs collected from lentic and depositional lotic habitats were reared outside of the environmental chamber at room temperature under natural daylight conditions.

Measurements of water temperature (°C), specific conductance (mhos·cm<sup>-1</sup> corrected to 25°C), pH (standard units), average depth (m), and average current velocity (m·sec<sup>-1</sup>) were made where nymphs were collected. Notes on substrate composition, degree of particle embeddedness (Platts et al. 1983), and aquatic vegetation were kept to characterize the physical nature of the habitats examined. A standard notation was used to characterize the substrate composition of each habitat (Burian 1990). Particle size was estimated in the field using the size classification of Platt et al. (1983). The degree of embeddedness was also recorded as a descriptor of how much of the larger substrate particles were covered or surrounded by fine sediment (Platt et al. 1983). This descriptor is of little use in lakes or pool habitats where the substrate is composed almost entirely of fine sediment.

General weather conditions, observations of swarming behavior, notes on occurrence in and among various habitats, and records of photographs were kept in a general field notebook. Specific environmental measurements were recorded on field data cards.

To fill gaps in the geographic coverage of the state as represented by existing collections and to collect series of mature nymphs and adults that could be used for taxonomic study, an intensive collecting program was conducted during the summer of 1986. The collecting program was based on an assessment of the existing specimens in the reference collection of the Department of Entomology at the University of Maine, the Procter Collection at the University of Massachusetts, a survey of the literature on Maine collection records, a tentative list of species thought to occur in Maine derived from Edmunds et al. (1976), and examination of about 5000 specimens obtained from the Maine Pest Management Service and Forest Service light traps for 1985. Six regions were selected for intensive collecting:

Northern Region (East Moosehead Lake area)

Western Region (North Brn. Dead River/Carrabassett River)

Southern Region (E. & W. Brn. Sheepscot River)

Central Region (Penobscot & Stillwater Rivers area)

Eastern Region (Tomah Stream area)

Coastal Region (Mount Desert Island/Acadia National Park)

Within each region a variety of brooks, streams, rivers, forest pools, spring seeps, marshes, ponds, and lakes are present. Based on a preliminary survey conducted in 1985 and early 1986, specific aquatic habitat types were selected and sampled intensively. Extensive sampling of other habitats was conducted as time and weather conditions permitted.

### Aquatic Habitats

In Maine, mayflies are found in a wide range of lotic and lentic habitats, including several types of fluctuating habitats. Major habitat types and ecological divisions in which mayflies occur are given by Burian (1990). Ecological divisions correspond to macroecological requirements of species groups. Within each division individual species are partitioned by specific microhabitat parameters. Detailed habitat descriptions for a particular taxon or site can be obtained from Burian (1990).

## ANNOTATED FAUNAL LIST

Families are listed according to the classification of McCafferty and Edmunds (1979). Families and genera can be identified using the keys and descriptions in Edmunds et al. (1976) and Merritt and Cummins (1984). Recent taxonomic and nomenclatural changes not contained in either of these references are noted.

New state records are indicated by (\*); new national records by (++) ; species that were previously reported, but not collected or reexamined by (+); and tentative species determinations by (?). Habitat designations for nymphs (N) are taken from (Burian 1990) and are followed by additional references on ecology and habitat. In descriptions of nymphal habitats, major categories of particulate organic matter (i.e., coarse and fine) are indicated as CPOM and FPOM respectively. Collection records are listed for nymphs (N) and adults (A) and, where possible, males (M) and females (F). Species distributions are listed by site codes as defined in Table 1. Burian (1990) gives species distributions plotted on spot maps. Special site codes for *Ameletus* records furnished by Dr. David Funk of the Philadelphia Academy of Science are defined in Table 2. The Nearctic ranges of species are given by codes that represent broad geographic areas (Table 3). In a few instances, specific states or type locations are given for endemic species or those with highly restricted distributions.

### Siphlonuridae

In Maine the Siphlonuridae are represented by three genera and 16 species. McCafferty and Edmunds (1979) depicted the Siphlonuridae as the stem family from which all the rest of the modern Ephemeroptera evolved. General information on siphlonurid life cycles, voltinism, biology, and ecology is found in Edmunds et al. (1976) and Clifford (1982).

#### \* *Ameletus browni* McDunnough, 1933

Taxonomy (N) & (A): Needham et al. (1935).

Ecology & Habitat (N): Stream order 1, erosional areas.

Seasonal Occurrence (N): April-June; (A): June.

Biology (N): Unknown.

Distribution (N): Ps16, WAD5; (A): ABO2 (M,F), Ps14 (M), WAD2 (M).

Nearctic Range: NE, EC.

#### \* *Ameletus lineatus* Traver, 1932

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953).

This species is difficult to separate as nymphs from *A. ludens* because characters pertaining to the ventral longitudinal stripes of the abdomen are highly variable. Recent electrophoretic work indi-

cates that *A. lineatus* may be a clonal variant of *A. ludens* (D. Funk pers. comm.). Reared specimens are required for positive identification.

**Ecology & Habitat (N):** Spring brooks, erosional. Nymphs occurred in shallow pools and gentle riffles of shaded intermittent small brooks where they clung to vegetation and stones in areas of highest flow.

**Seasonal Occurrence (N):** May-June; (A): May.

**Biology (N) & (A):** Unknown, but the species is thought to be parthenogenetic (Carle 1978).

**Distribution (N):** F4; (A): F4 (F).

Mack (1988) has recently reported the species on Mount Desert Island.

**Nearctic Range:** SE, NE, CC.

#### ***Ameletus ludens* Needham, 1905**

**Taxonomy (N) & (A):** Needham et al. (1935); Burks (1953).

Nymphs are difficult to separate from *A. lineatus* (see note under *A. lineatus*). Reared specimens are required for positive identification.

**Ecology & Habitat (N):** Stream orders 2-3, erosional with secondary depositional areas; Hubbard and Peters (1978).

**Seasonal Occurrence (N):** May-June.

**Biology (N) & (A):** Clemens (1922); Sweeney and Vannote (1978).

Although Clemens (1922) indicated that one male specimen was collected, it is now believed to be a misidentification (D. Funk, pers. comm.), and the species is thought to be parthenogenetic.

**Distribution (N):** P20, WAD5.

**Nearctic Range:** NE, CC.

#### **\* *Ameletus tertius* McDunnough, 1938**

**Taxonomy (N) & (A):** McDunnough (1938).

**Ecology & Habitat (N):** Stream orders 1-4, erosional with secondary depositional areas. In larger rivers and streams this species occurred on clumps of submerged grass and detritus along the margins of riffles and transitional areas.

**Biology (N) & (A):** Unknown.

**Seasonal Occurrence (N):** May-June; (A): June.

**Distribution (N):** CRY3, F3, F6, F9, F18, F20, S5, WAD5; (A): F3 (M,F).

**Nearctic Range:** SE, NE, EC.

#### ***Siphlonisca aerodromia* Needham, 1908a**

**Taxonomy (N) & (A):** Needham et al. (1935); Burks (1953); Edmunds et al. (1976); Burian and Gibbs (1988).

**Ecology & Habitat (N):** Stream backwaters; temporary floodplain pools;

Edmunds et al. (1976), New York; Gibbs and Mingo (1986), Maine.

Nymphs were collected from an inundated sedge and cattail area along the North Branch of the Dead River along with *Siphlonurus*, *Leptophlebia*, and *Eurylophella*.

Seasonal Occurrence (N): January-early June; (A): May-early June.

Biology: Edmunds et al. (1976); Gibbs and Mingo (1986).

Nymphs reared in the field at Tomah Stream (Site Wn6) molted to the subimago about 8:00 p.m.; whereas, those in the laboratory emerged from 3:10-5:00 p.m. Molting from the nymph to the subimago took about 12 min. at room temperature.

Distribution (N): Ak33, F1, P28, Wn6; (A): Wn6 (M,F).

Nearctic Range: NE, EC.

#### *Siphlonurus alternatus* (Say), 1824

Taxonomy (N) & (A): Clemens (1915a); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Malzacher (1981); Berner (1983).

Ecology & Habitat (N): Stream orders 2-3, depositional; ponds/lakes, littoral zones; Hubbard and Peters (1978).

Nymphs occurred among littoral zone vegetation and detritus in a wide range of depositional habitats. A few specimens were collected from one site (P9) that had a pH of 5.7.

Seasonal Occurrence (N): June-August; (A): June-August.

Biology (N) & (A): Leonard and Leonard (1962), Hubbard and Peters (1978).

Distribution (N): F1, F10, H9, P9, P35, Ps2, S6, S8, W1, W5; (A): F2 (M), F10 (M), F12 (M), P2 (M), P3 (M,F), P8 (M,F), P9 (M), P28 (M), Ps2 (F), Ps7 (M,F), Ps\*\* (F), Ps 25 (M), Ps26 (M), W1 (M), W5 (M,F), Wn3 (M), Wn4 (F), Wn5 (F), Y3 (F).

Nearctic Range: NE, C, EC, CC, WC.

#### \* *Siphlonurus barbaroides* McDunnough, 1929

Taxonomy (A): McDunnough (1929); Needham et al. (1935); Kondratieff and Voshell (1981b).

Ecology & Habitat (N): Lake, littoral zone near inlet of stream.

At the inlet of Lilly Bay Brook (site Ps8) the nymphs occurred among vegetation in quiet pools with deposits of well-sorted small fines and CPOM. The pools were sheltered from strong wave action by gravel bars.

Seasonal Occurrence (N): June; (A): June-July.

Biology (N) & (A): Unknown.

Distribution (N): Ps8; (A): Ps8 (M,F).

Nearctic Range: NE, EC.

**++ *Siphlonurus demarayi* Kondratieff & Voshell, 1981b**

Taxonomy (N) & (A): Kondratieff and Voshell (1981b).

Ecology & Habitat (N): Lake, littoral zones near inlet of stream.

This species occurred in the same areas as *S. barbaroides* and along margins of larger streams among vegetation.

Seasonal Occurrence (N): May-July; (A): July.

Biology (N) & (A): Kondratieff and Voshell (1981b).

Distribution (N): F6, Ps8, S8; (A): Ps8 (M,F).

Nearctic Range: Maine, EC (endemic).

***Siphlonurus marginatus* Traver, 1932**

Taxonomy (N) & (A): Needham et al. (1935).

Ecology & Habitat (N): Stream orders 2-3, depositional areas; pond/lake, littoral zones.

Seasonal Occurrence (N): May-July; (A): July.

Biology (N) & (A): Unknown.

Distribution (N): F1, F22, Ps1, Ps8, Ps23, Wn6; (A): Wn5 (F).

Nearctic Range: SE, NE.

***Siphlonurus marshalli* Traver, 1934**

Taxonomy (N) & (A): Burks (1953); (A): Needham et al. (1935).

Ecology & Habitat (N): Roback (1974); pond/lake, littoral zones.

Seasonal Occurrence (N): May-June.

Biology (N) & (A): Unknown.

Distribution (N): H9, H10, H13, P29, P40.

Nearctic Range: SE, NE.

***Siphlonurus mirus* Eaton, 1885**

Taxonomy (N) & (A): Needham et al. (1935).

Ecology & Habitat (N): Stream orders 2-3, depositional areas; pond/lake, littoral zones; Hubbard and Peters (1978); Voshell (1982), Virginia.

Nymphs occurred among vegetation of inundated floodplains and stream backwater areas.

Seasonal Occurrence (N): April-May; (A): May-June.

Biology (N) & (A): Voshell (1982).

Female oviposition behavior was observed at Tomah Stream on June 4, 1986, from the Rt. 6 bridge (site Wn5). Females were observed at about 5:30 p.m. flying upstream from south of the bridge to the pool on the north side of the bridge. Females immediately descended from this position coming to rest on the water's surface. After resting for about 15 sec, they took off and came to rest in a new spot a short distance away. Individual males were collected from the pool area.

Distribution (N): F1, Ps8, Wn5; (A): F1 (M,F), Wn5 (M,F).  
Nearctic Range: SE, NE.

***Siphlonurus quebecensis* (Provancher), 1876**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953), Leonard and Leonard (1962).

Adult ventral abdominal maculations are figured and compared to *S. barbaroides*, *S. rapidus*, and *S. berenice* (now *S. typicus*) by McDunnough (1929).

Ecology & Habitat (N): Stream orders 2-3, depositional areas; pond/lake, littoral zones; Leonard and Leonard (1962), Michigan; Hubbard and Peters (1978).

Seasonal Occurrence (N): May-June; (A): May-July.

Biology (N) & (A): Ide (1935b); Needham et al. (1935); Leonard and Leonard (1962).

Mating swarms were observed over riffles and transitional runs on June 4, 19, 30, and July 1, 1986. Swarms were usually small, consisting of 4-12 individuals and formed 5-7 m above the water. Males comprised most of the swarm and flew in a rising and falling pattern that spanned about 30 cm. In most instances the swarm did not remain stationary. No swarm markers were obvious, and swarming occasionally occurred sympatrically with *S. rapidus*. The largest of these sympatric swarms was observed at the Rt. 6 bridge on Tomah Stream. Females of *S. quebecensis* were observed to hold the tip of their abdomens bent downward as they flew. Males clasped the bent-down portion of the abdomen and the mating pair flew away from the swarm. This behavior was not observed among individuals of smaller swarms or when *S. rapidus* was absent.

Distribution (N): P9, Ps1, S5, S8; (A): F22 (M), P3 (F), P8 (M,F), P9 (M,F), P10 (F), P15 (F), P23 (M), P37 (M), Ps2 (M), W2 (M), Wn4 (M,F), Wn5 (F), Wn6 (M,F).

Nearctic Range: SE, NE, C, EC.

\* ***Siphlonurus* n. sp. A. (*quebecensis* variant)**

Taxonomy (A): This species is similar to *S. quebecensis*, but differs from it by having lighter lateral triangular marks on the sternites that usually do not meet anteriorly, by the shape of the genitalia, and presence of many short spines on the upper surface of the inner projections of the penes. The species has not been reared and only when an associated series has been studied will a formal description be possible.

Ecology & Habitat (N): Stream orders 2-3, depositional areas.

Seasonal Occurrence (A): June.

Biology (A): Swarming was observed at dusk on June 7 and 30, 1986, and

continued until dark. Swarms were composed of groups of 15–20 individuals (mostly males) that formed about 6–10 m above quiet pools. Males were easily distinguished from females by their rhythmic flight pattern. Usually males flew in a vertical rising and falling pattern that spanned about 1 m. Females entered the swarm from the side and flew diagonally up through it until seized by a male. Mating pairs immediately left the swarms and dropped towards the water. After about a minute the pair separated, and the females either began ovipositing in the pool or flew out of sight upstream. Males returned to the swarm. Occasionally, at Birch Stream, Alton (site P8), a mating pair was observed to momentarily land on the bridge over the pool.

Distribution (A): P8 (M,F), P9 (M,F), P13 (M,F), Wn4 (M,F).

Nearctic Range: NE.

***Siphlonurus rapidus* McDunnough, 1924a**

Taxonomy (A): Needham et al. (1935), Burks (1953), Leonard and Leonard (1962).

Ecology & Habitat (N): Stream orders 2–3, depositional; pond/lake, littoral zones; Lyman (1955), Michigan; Hubbard and Peters (1978).

Seasonal Occurrence (N): May-June; (A): May-July.

Biology (N) & (A): Lyman (1955); Leonard and Leonard (1962).

Nymphs occurred sympatrically with those of *S. quebecensis*. Occasionally adults also swarmed sympatrically with *S. quebecensis*. This was observed on June 4, 1986, at the Rt. 6 bridge on Tomah Stream. Females of *S. rapidus* did not exhibit the posturing described for *S. quebecensis* females.

Distribution (A): P7 (M), P10 (M,F), P37 (M,F), W2 (M), W13 (M), Wn5 (M,F).

Nearctic Range: NE, C, EC.

\* ***Siphlonurus securifer* McDunnough, 1926b**

Taxonomy (A): Needham et al. (1935).

Ecology & Habitat (N): Pond/lake, littoral zones.

Along the North Branch of the Dead River (site F1) nymphs occurred in the wave-wash zone over well-sorted small fines covered with a mixture of CPOM and FPOM and among emergent aquatic vegetation.

Seasonal Occurrence (N): June; (A): June.

Biology (N) & (A): Unknown.

Distribution (N): F1; (A): F1 (M)

Nearctic Range: NE, EC.

***Siphlonurus typicus* Eaton, 1885**

Taxonomy (N) & (A): Needham et al. (1935); Spieth (1941a); Burks (1953); (N): Provonsha and McCafferty (1982).

Ecology & Habitat (N): Temporary lentic, forest pools and flood plain puddles; Provonsha and McCafferty (1982), Indiana.

On the Moosehead Plateau this species occurred in small spring-fed pools filled with decaying leaves. On Mount Desert Island it occurred in shallow ditches among aquatic macrophytes (Mack 1988).

Seasonal Occurrence (N): May-June; (A): May-July.

Biology (N) & (A): Unknown.

Distribution (A): F4 (M,F).

In addition to new collections, Procter (1946) and Mack (1988) reported it from Mount Desert Island.

Nearctic Range: NE, C, EC.

### Baetidae

The family Baetidae is one of the largest families of mayflies occurring in Maine with 9 genera and 37 species represented. McCafferty and Edmunds (1979) indicated that the Baetidae is a paraphyletic lineage within the Siphlonuridae originating from the *Metamonioides*-group of the Siphlonurinae. The taxonomic status of many genera is uncertain. In North America, revisional work on *Baetis* has shown the genus to be a complex of at least three genera (Waltz and McCafferty 1987a). Similar studies of *Pseudocloeon* have indicated that it is composed of several genera and that the name *Pseudocloeon* can only be reliably applied to the type material on which the genus was established (Waltz and McCafferty 1987b). Edmunds et al. (1976) discussed the problems in distinguishing between *Centroptilum* and *Cloeon*, indicating that primary diagnostic character states are not consistent on a world basis. Lowen and Flannagan (1990) recently placed *Centroptilum infrequens* as a junior synonym of the European taxon *Pseudocentroptilum pennulatum*, which has now been placed in the genus *Procloeon* by McCafferty and Waltz (1990). New genera are continually being established as new species are discovered further contributing to this confusion. Among these, except for the new genera in *Baetis*, only the new genus *Barbaetis* (Waltz et al. 1985) may occur in Maine. Currently it has not been reported north of Virginia. McCafferty and Waltz (1990) provide a complete list and discussion of the taxonomic status of North and Middle American genera and species.

Ranges of water quality parameters for *Baetis* sp., *Callibaetis* sp., *Cloeon* sp., *Pseudocloeon* sp., and *Heterocloeon* sp. are provided by Roback (1974). Clifford (1982) characterizes baetid life cycles and comments on voltinism.

#### *Acentrella ampla* Traver, 1932

Taxonomy (N) & (A): Needham et al. (1935); (N): Morihara and McCafferty (1979a); Waltz and McCafferty (1987b) Waltz and McCafferty (1987a).

Ecology & Habitat (N): Stream orders 1–2, erosional areas; Hubbard and Peters (1978).

Nymphs occurred in greatest abundance in coarse erosional areas of swift streams. On Mount Desert Island specimens were collected from *Fontinalis* matts growing on bedrock ledges in a swift stream; the species was most abundant in Duck Brook (site H2).

Seasonal Occurrence (N): April-June; (A): June.

Biology (N) & (A): Hubbard and Peters (1978).

Distribution (N): H2, P37, Wn2.

Nearctic Range: SE, NE.

***Acentrella carolina* (Banks), 1924**

Taxonomy (N) & (A): Needham et al. (1935), as *Pseudocloeon carolina*; (N): Ide (1930), figure of nymph; Waltz and McCafferty (1987a), revised genus *Acentrella*.

Ecology & Habitat (N): Stream order 2, erosional with secondary depositional areas; Ide (1935b), Ontario; Hubbard and Peters (1978).

Nymphs occurred among gravel and large fines of coolwater streams in areas of moderate flow.

Seasonal Occurrence (N): June-September; (A): July.

Biology (N): Unknown.

Distribution (N): Ak17, Ak23, F8, F12, Ps7, S5; (A): H9 (M).

Nearctic Range: SE, NE, EC.

**\* *Acerpenna macdunnoughi* (Ide), 1937**

Taxonomy (N) & (A): McCafferty and Morihara (1979); (N): Ide (1937); Morihara and McCafferty (1979a); Waltz and McCafferty (1987a), established new genus *Acerpenna*.

Ecology & Habitat (N): Stream orders 1-3, erosional areas.

Nymphs primarily occurred among coarse gravel and poorly sorted large fines in moderately to swiftly flowing streams. Occasionally, a few specimens were collected from transitional runs where the substrate was composed mostly of small gravel and well-sorted large fines.

Seasonal Occurrence (N): March-August; (A): May-August.

Biology (N) & (A): McCafferty and Morihara (1979).

Distribution (N): F9, F13, H4, H6, P3, P9, P7, Ps1, Ps7, Ps10, W11, Wn1, Wn2, Wn5; (A): F18 (M), P3 (F), Ps1 (F), Ps5 (M,F), Ps8 (F).

Nearctic Range: NE, EC.

***Acerpenna pygmaea* (Hagen), 1861**

Taxonomy (N) & (A): Ide (1937); Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Morihara and McCafferty (1979a); Waltz and McCafferty (1987a) established new genus *Acerpenna*.

Ecology & Habitat (N): Stream orders 1-3, erosional and transitional runs; pond/lake, wave-wash zones; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs were common among coarse substrate types in swift streams and in erosional areas of primarily depositional zones.

Seasonal Occurrence (N): April-August; (A): July-August.

Biology (N) & (A): Morgan 1911; Harper et al. (1983); Berner and Pescador (1988).

Adult males were observed swarming early in the afternoon on July 3, 1986 and swarming continued into early evening. Swarms formed in bright sunny areas along stream banks often near small trees or shrubs. Most swarms were small, composed of less than 20

individuals. Males executed a rising and falling flight pattern in small (15-20 cm), U-shaped circuits.

Distribution (N): F12, H2, K1, L2, P7, P8, P37, S2, Wn5; (A): H2 (M), K1 (F), L1 (F), L2 (F), P3 (M), Wn5 (M), Wn6 (M).

Nearctic Range: SE, NE, C, EC.

#### *Baetis armillatus* McCafferty and Waltz, 1990

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Berner and Pescador (1988); McCafferty and Waltz (1990); (N): Ide (1937), figure of nymph.

Ecology & Habitat (N): Stream order 2-3, erosional and transitional areas.

Seasonal Occurrence (N): June and September.

Biology (N) & (A): Harper and Harper (1984); Berner and Pescador (1988).

Distribution (N): Ak13, Wn4.

Nearctic Range: SE, NE, C, EC, WC.

The species has been reported most frequently in the southeastern United States despite the fact that it originally was described from eastern Canada.

#### *Baetis brunneicolor* McDunnough, 1925a

Taxonomy (N) & (A): Burks (1953); Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Ide (1937), figures of nymph; Morihara and McCafferty (1979a).

Variation in color patterns of nymphs makes this species difficult to identify.

Ecology & Habitat (N): Stream orders 1-3, erosional with secondary depositional zones; Leonard (1965), Michigan; Hubbard and Peters (1978); Bergman and Hilsenhoff (1978), Wisconsin.

One of the most frequently collected baetids in Maine, this species occurred in wide range of lotic habitats, especially where there were large clumps of CPOM trapped among the larger substrate particles.

Seasonal Occurrence (N): May-September; (A): June-August.

Biology (N) & (A): Harper and Harper (1984).

Distribution (N): Ak9, Ak23, F5, F9, F12, F18, F20, F21, H2, H4, H9, K1, L1, P3, P7, P8, P10, Ps2, Ps5, Ps7, S5, W2, W3, W4, Wn1, Wn4; (A): H2 (F), L1 (F), P7 (M,F), P10 (M,F), Ps2 (F), Ps5 (F), Ps6 (F), Ps7 (M), Wn4 (M).

Nearctic Range: NE, C, EC.

#### *Baetis cinctetus* McCafferty and Waltz, 1990

Taxonomy (N) & (A): Needham et al. (1935); McCafferty and Waltz (1990); (N): Ide (1937), figure of nymph.

**Ecology & Habitat (N):** Stream order 1-3, erosional areas.  
**Seasonal Occurrence (N):** June-July and September; (A): July-August.  
**Biology (N) & (A):** Unknown.  
**Distribution (N):** Ak7, Ak13, Ak20, Ak22, Ak23, F8, F12, H8, H9, Wn4;  
(A): Ps7 (M,F).  
**Nearctic Range:** NE, EC.

***Baetis dubius* (Walsh), 1862**

**Taxonomy (N) & (A):** Needham et al. (1935); Burks (1953); McCafferty and Waltz (1990); (N): Ide (1937), figure of nymph.  
**Ecology & Habitat (N):** Stream order 2-3, erosional and transitional areas.  
**Seasonal Occurrence (N):** June-September; (A): May-August.  
**Biology (N) & (A):** Lyman (1955); Harper and Harper (1984).  
**Distribution (N):** Ak7, F8, F12, F13, P3, P7; (A): F12 (M), H9, P13 (M), P16 (M), L1 (M).  
**Nearctic Range:** SE, NE, EC, CC.

***Baetis flavistriga* McDunnough, 1921**

**Taxonomy (N) & (A):** Burks (1953); Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Ide (1937); Morihara and McCafferty (1979a).  
**Ecology & Habitat (N):** Stream orders 1-2, erosional areas; Ide (1935b), Ontario; Bergman and Hilsenhoff (1978), Wisconsin; Hubbard and Peters (1978); Kohler (1983), Michigan.  
Similar to *B. brunneicolor* in occurrence, nymphs were common among poorly sorted erosional substrates with trapped clumps of CPOM.

**Seasonal Occurrence (N):** May-September; (A): June-August.  
**Biology (N) & (A):** Needham et al. (1935); Lyman (1955); Hubbard and Peters (1978); Harper and Harper (1984).

Although no swarms were observed, individual adult males were collected in August flying upstream over the Carrabassett River between 8:00-9:00 p.m. Males flew at about 3 m above the water.  
**Distribution (N):** Ak15, F3, F5, F6, F8, F12, F20, K1, L2, P3, P7, P8, P10, Ps2, Ps7, S1, W2, W7, Wn1, Wn4, Wn11; (A): F8 (M), F12 (M), F20 (F), K1 (F), L2 (M), Ps2 (M), Ps7 (F), S8 (M), W7 (F).  
**Nearctic Range:** SE, NE, C, EC.

***Baetis frondalis* McDunnough, 1925a**

**Taxonomy (N) & (A):** Burks (1953); Bergman and Hilsenhoff (1978); (N): Ide (1937), figure of nymph; Morihara and McCafferty (1979a, 1979b).  
**Ecology & Habitat (N):** Stream orders 1-2, depositional areas; stream backwaters among plants; Ide (1935b), Ontario; Hubbard and Peters (1978); Bergman and Hilsenhoff (1978), Wisconsin; Berner and

Pescador (1988), Florida.

Nymphs occurred among submerged linear-leaved aquatic plants (e.g., *Sparganium*) and among the stems and leaves of rushes and sedges. Nymphs were often pale green and when resting on a green background were almost invisible. Nymphs were common in both lentic and lotic depositional areas. This species was frequently sympatric with *B. propinquus*.

Seasonal Occurrence (N): June-September; (A): August.

Biology (N) & (A): Morihara and McCafferty (1979a); Berner and Pescador (1988).

Distribution (N): Ak7, Ak9, Ak16, Ak17, Ak19, Ak23, P3, P7, P9, Ps1, W9, Wn6, Wn12; (A): P9 (M).

Nearctic Range: SE, NE, C, EC.

#### *Baetis intercalaris* McDunnough, 1921

Taxonomy (N) & (A): Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Ide (1937), figure of nymph; Morihara and McCafferty (1979a).

Ecology & Habitat (N): Stream orders 1-3, erosional with secondary depositional areas; Ide (1935b), Ontario; Leonard (1965), Michigan; Bergman and Hilsenhoff (1978), Wisconsin; Hubbard and Peters (1978); Kohler (1983), Michigan.

Nymphs occurred among poorly sorted gravel and large fine sediment in erosional riffles and transitional runs. In the Carrabassett River drainage nymphs were found both in the river and in small 1st order tributaries.

Seasonal Occurrence (N): June-August; (A): June-August

Biology (N) & (A): Harper and Harper (1984); Berner and Pescador (1988).

It was most frequently collected as adults near shallow riffles of large rivers.

Distribution (N): F8, F12, P7, Wn5; (A): P16 (M,F), P30 (M,F)

Nearctic Range: SE, NE, C, EC.

#### *Baetis pluto* McDunnough, 1925b

Taxonomy (N) & (A): Burks (1953); (N): Ide (1937), figure of nymph; Morihara and McCafferty (1979a).

Ecology & Habitat (N): Stream orders 1-2, erosional with secondary depositional areas.

Nymphs occurred in riffles and transitional runs that had substrates composed of gravel and large fines.

Seasonal Occurrence (N): June-July.

Biology (N) & (A): Unknown.

Distribution (N): Ps2, Wn11.

Nearctic Range: NE, C, EC.

**\* *Baetis propinquus* (Walsh), 1863**

Taxonomy (N) & (A): Burks (1953); Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Morihara and McCafferty (1979a, 1979b).

Ecology & Habitat (N): Stream orders 2-3, depositional areas; stream backwaters among plants; Hubbard and Peters (1978); Bergman and Hilsenhoff (1978), Wisconsin.

Similar in appearance to *B. frondalis*, individuals were often pale green to greenish-brown and occurred among the stems and leaves of aquatic plants. Nymphs were especially abundant in the flooded sedge meadows along Tomah Stream, south of Rt. 6. This species was common and sympatric with *B. frondalis*, but *B. propinquus* was not as abundant as *B. frondalis*.

Seasonal Occurrence (N): June-August; (A): August.

Biology (N) & (A): Morihara and McCafferty (1979a); Berner and Pescador (1988).

Distribution (N): H8, K1, P3, P8, Ps7, S2, Wn4, Wn5; (A): Wn5 (M,F). Nearctic Range: SE, NE, C, SW, NW, EC, CC.

***Baetis punctiventralis* (McDunnough), 1923**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Berner and Pescador (1988); McCafferty and Waltz (1990); (N): Ide (1937), figure of nymph.

Ecology & Habitat (N): Stream order 2-3, erosional and transitional areas.

Seasonal Occurrence (N): June-September; (A): June.

Biology (N) & (A): Harper and Harper (1984); Berner and Pescador (1988).

Distribution (N): Ak7, Ak17, K1, L1, L2, P3, P8, Ps2, Ps7, S8, W2; (A): Ps2 (M).

Nearctic Range: SE, NE, EC, CC.

***Baetis tricaudatus* Dodds, 1923**

Taxonomy (N) & (A): Burks (1953); Leonard and Leonard (1962); Bergman and Hilsenhoff (1978); (N): Ide (1937), figure of nymph as *B. vagans*; Morihara and McCafferty (1979a).

Ecology & Habitat (N): Stream order 1-3, erosional areas; Ide (1935b), Ontario; Leonard (1965), Michigan; Coleman and Hynes (1970), as *B. vagans* in Ontario; Bergman and Hilsenhoff (1978), Wisconsin; Hubbard and Peters (1978); Ciborowski (1983a; 1983b), Alberta; Kohler (1983), Michigan; Ciborowski and Clifford (1983), Alberta.

Nymphs occurred among poorly sorted gravel in erosional areas of riffles and transitional runs. In the Carrabassett Valley it occurred more frequently in small 1st order tributaries to the Carrabassett

River than in the river itself. It was especially abundant where there were clumps of trapped CPOM.

**Seasonal Occurrence (N):** April-September; **(A):** June-August.  
**Biology (N) & (A):** Ide (1935b); Clifford (1969); Coleman and Hynes (1970), as *B. vagans*; Boerger and Clifford (1975); Corkum and Pointing (1979), as *B. vagans*; Corkum and Clifford (1981), as *B. vagans*; Harper and Harper (1984).

**Distribution (N):** Ak15, Ak16, Ak19, Ak20, F5, F6, F8, F9, F10, F12, L2, Ps15, S1, Wn1, Wn2; **(A):** F6 (M,F), F10 (M), F12 (M), F21 (M,F), Ps7 (M), Wn17 (M).

**Nearctic Range:** NE, E, SW, NW, EC, CC.

\* ***Baetis veteris* (McDunnough), 1924b**

**Taxonomy (N):** Burks (1953); **(A):** Needham et al. (1935); McCafferty and Waltz (1990).

**Ecology & Habitat (N):** Stream order 2, transitional and depositional (?).

**Seasonal Occurrence (A):** June.

**Biology (N) & (A):** Unknown.

**Distribution (A):** S4 (M).

**Nearctic Range:** NE, C.

\* ***Baetis virile* (McDunnough), 1923**

**Taxonomy (N) & (A):** Needham et al. (1935); Ide (1937), figure of nymph; McCafferty and Waltz (1990).

**Ecology & Habitat (N):** Stream orders 2-3, erosional and transitional areas.

**Seasonal Occurrence (N):** June-August; **(A):** May.

**Biology (N) & (A):** Unknown.

**Distribution (N):** F12, P3, P8, Ps2, W2, Wn4; **(A):** P16 (M).

**Nearctic Range:** NE, EC.

***Callibaetis ferrugineus* (Walsh), 1862**

**Taxonomy (N) & (A):** Needham et al. (1935); Check (1982).

**Ecology & Habitat (N):** Stream orders 2-3, depositional areas; pond/lake outlets; pond/lake, littoral zone among plants; Hubbard and Peters (1978); Check (1982).

**Seasonal Occurrence (N):** April-July; **(A):** May-September.

**Biology (N) & (A):** Lyman (1955); Gibbs (1979); Check (1982); Gibbs et al. (1984)

At Pleasant Lake in Stetson a swarm was observed on May 11, 1986, that formed about 12:00 noon and lasted until about 1:00 p.m. The swarm was composed mostly of males that hovered facing into the wind about 4-5 m above a small clearing near the shore of the lake. The nucleus of the swarm changed position several times, but stayed within the largest sunlit spot. Males flew in rising and falling

patterns that spanned about 50 cm. Mating pairs flew up through the swarm and out over the lake. When the swarm was momentarily dispersed by a strong gust of wind, individuals came to rest on dark objects near the ground (at one point I had 6 or 7 on my camouflage jacket).

A much smaller swarm was observed on May 21, 1986, at a small bridge on the North Branch of the Dead River in Eustis. This swarm formed about 3:00 p.m. and lasted until about 6:30 p.m. (when it began to rain). Males exhibited behavior similar to those observed at Pleasant Lake, but no females were observed. Swarming location at this site was similar to that described by Check (1982) (i.e., exclusively over open water). However, the location of the swarm observed at Pleasant Lake was different, occurring about 20 m from the lake over dry land. Check (1982) had indicated that swarming location was consistent for this species, especially when it was sympatric with *C. pallidus*.

Adult females were collected up to a 3.5 km from the nearest permanent stream or pond, indicating that they were capable of dispersal between drainage areas.

Distribution (N): F1, H13, K1, P6, P29, Ps8, Ps\*\*, Ps22, W6; (A): Ak30 (F), F1 (M,F), P2 (M), P3 (M), P4 (M), P31 (F), P38 (F), S11 (M), Wn5 (M).

Nearctic Range: NE, C, SW, NW, EC, WC.

+ *Callibaetis fluctuans* (Walsh), 1862

Taxonomy (N) & (A): Needham et al. (1935); Check (1982).

Ecology & Habitat (N): Pond/lake, littoral zones; marshes; stream backwaters; Hubbard and Peters (1978); Gibbs (1979), Quebec; Check (1982).

Seasonal Occurrence (A): August.

Biology (N) & (A): Gibbs (1979), Check (1982).

Distribution (A): Bar Harbor (Procter 1946).

Nearctic Range: SE, NE, C, EC.

\* *Callibaetis pallidus* Banks, 1900

Taxonomy (N) & (A): Check (1982).

Ecology & Habitat (N): Pond/lake, littoral zones; marshes; stream backwaters; Check (1982).

Seasonal Occurrence (A): August.

Biology (N) & (A): Check (1982).

Distribution (A): Y1 (F).

Nearctic Range: NE, C, SW, EC, CC.

A species of the Mississippi drainage system, *C. pallidus* has previously only been reported as far east as western New York near the outlet of Lake Ontario.

**\* *Callibaetis pretiosus* Banks, 1914**

Taxonomy (N) & (A): Needham et al. (1935); Check (1982).

Ecology & Habitat (N): Pond/lake, littoral zone among plants; Hubbard and Peters (1978); Check (1982).

Nymphs occurred along pond margins among decaying organic matter and stems of living aquatic macrophytes.

Seasonal Occurrence (N): August; (A): August

Biology (N) & (A): Check (1982); Berner and Pescador (1988).

Distribution (N): W6, (A): K5 (F).

Nearctic Range: SE, NE, C, EC.

**\* *Centroptilum semirufum* McDunnough, 1926a**

Taxonomy (A): Needham et al. (1935); McCafferty and Waltz (1990).

Ecology & Habitat (N): Unknown.

A single adult male specimen was collected from the underside of an oak leaf from a tree along the lower Carrabassett River.

Seasonal Occurrence (A): July.

Biology (N) & (A): Unknown.

Distribution (A): S8 (M).

Nearctic Range: NE, EC.

**\* *Centroptilum triangulifer* (McDunnough), 1931b**

Taxonomy (N): Ide (1937), figure of nymph; (A): Needham et al. (1935); McCafferty and Waltz (1990).

Ecology & Habitat (N): Stream orders 2-4, depositional among plants; pond/lake, littoral zone among plants; Gibbs (1973), Quebec; Sweeney and Vannote (1984), Pennsylvania.

Seasonal Occurrence (N): July-August; (A): August.

Biology (N) & (A): Gibbs (1973; 1977); Harper and Harper (1984); Sweeney and Vannote (1984); Tabak (1986).

Distribution (N): F1; (A): F1 (F).

Nearctic Range: NE, EC.

**\* *Cloeon cognatum* Stephens, 1835**

Taxonomy (A): Burks (1953), as *C. dipterum*; Flowers (1978); McCafferty and Waltz (1990).

Ecology & Habitat (N): Unknown.

In Europe the nymphs occur in a wide range of lentic habitats (Traver 1962).

Seasonal Occurrence (A): Late August-September.

Biology (N) & (A): Burks (1953), as *C. dipterum*, Traver (1962); Newkirk (1981).

Imagos and subimagoes were collected in late afternoon and evening from the side of a small white house next to the Penobscot River in Winterport. One adult male was collected from vegetation along

Great Moose Lake. One female specimen from Winterport lived for 27 days.

Distribution (A): S17 (M), W10 (M,F).

Nearctic Range: NE, C.

#### ***Diphetor hageni* (Eaton), 1885**

Taxonomy (N) & (A): Bergman and Hilsenhoff (1978); Morihara and McCafferty (1979a); Waltz and McCafferty (1987a), establish new genus *Diphetor*.

Ecology & Habitat (N): Stream orders 1-2, erosional with secondary depositional areas; Hubbard and Peters (1978).

Nymphs were most abundant in small rocky streams with relatively large amounts of CPOM in the form of leaf litter and woody debris.

Seasonal Occurrence (N): May-June and August.

Biology (N) & (A): Harper and Harper (1984).

Distribution (N): F8, F10, H8, K2, P3.

Nearctic Range: SE, NE, EC, CC.

#### ***Heterocloeon curiosum* (McDunnough), 1923**

Taxonomy (N) & (A): Needham et al. (1935); (N): Ide (1937), figure of nymph; (A): Burks (1953).

Ecology & Habitat (N): Stream orders 2-3, erosional areas; Hubbard and Peters (1978).

Nymphs occurred among gravel and poorly sorted large fines in areas of moderate to high flow. Within the matrix of substrate particles, nymphs were collected from the lower layer of particles, but never from the uppermost particles.

Seasonal Occurrence (N): June-September; (A): August.

Biology (N) & (A): Kondratieff and Voshell (1981a).

Distribution (N): K1, L1, L2, P3, P23, S5, Wn11; (A): L2 (M).

Nearctic Range: SE, NE, EC, CC.

#### ***Procloeon album* (McDunnough), 1926a**

Taxonomy (N) & (A): Needham et al. (1935); Leonard and Leonard (1962); McCafferty and Waltz (1990); (N): McDunnough (1930), figure of nymph.

Ecology & Habitat (N): Stream orders 1-3, depositional and transitional zones; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan.

Seasonal Occurrence (N): June-August; (A): June-July.

Biology (N) & (A): Unknown.

Distribution (N): Ps2, Ps8, S8; (A): Ps7 (M), Ps8 (F), Wn13 (M).

Nearctic Range: NE, C, EC.

**\* *Procloeon bellum* (McDunnough), 1924c**

Taxonomy (N) & (A): Needham et al. (1935); McCafferty and Waltz (1990); (N): Ide (1930).

Ecology & Habitat (N): Stream orders 1-3, erosional with secondary depositional areas; Ide (1935b), Ontario.

Nymphs were common in cool rocky streams among gravel embedded in poorly sorted large fines and where there were submerged aquatic plants.

Seasonal Occurrence (N): June-August; (A): July.

Considered to be mostly a southeastern species, *C. pretiosus* had previously been reported as far north as southern Connecticut.

Biology (N) & (A): Ide (1930); Harper and Harper (1984).

Distribution (N): F10, F12, H1, P3, P7, P9, S8, Wn5; (A): F10 (M,F), Wn5 (M).

Nearctic Range: NE, C, EC.

***Procloeon convexum* (Ide), 1930**

Taxonomy (N) & (A): Needham et al. (1935); Leonard and Leonard (1962); McCafferty and Waltz (1990); (N): Ide (1930), figure of nymph.

Ecology & Habitat (N): Stream orders 1-3, erosional and depositional areas; Ide (1930; 1935b), Ontario.

It was abundant in most rocky streams and rivers and in many places was sympatric with *C. album*.

Seasonal Occurrence (N): June-September; (A): August.

Biology (N) & (A): Ide (1930); Harper and Harper (1984).

Distribution (N): Ak15, Ak22, F12, H9, K1, L2, P3, Ps7, Ps8, S8, Wn4, Wn5, Wn13; (A): Ps8 (M).

Nearctic Range: NE, C, SW, EC.

***Procloeon ingens* (McDunnough), 1923**

Taxonomy (N) & (A): Needham et al. (1935); McCafferty and Waltz (1990); (A): Burks (1953).

The nymphs of this species are difficult to identify unless reared to adults.

Ecology & Habitat (N): Stream orders 2-3, depositional among plants; pond/lake, littoral zones; wetlands; stream backwaters.

Seasonal Occurrence (N): June-August.

Biology (N) & (A): Unknown.

Distribution (N): L2, Ps1, Ps8, S6, W5, Wn5, Wn6.

Nearctic Range: NE, SW, EC, WC.

**\* *Procloeon intermediale* (McDunnough), 1931b**

Taxonomy (A): Needham et al. (1935); McCafferty and Waltz (1990).

Ecology & Habitat (N): Unknown.

Seasonal Occurrence (A): July.  
Biology (N) & (A): Unknown.  
Distribution (A): F16 (M).  
Nearctic Range: SE, NE, EC.

\* ***Procloeon mendax* (Walsh), 1862**

Taxonomy (N): Ide (1930), figure of nymph; (A): Needham et al. (1935); Burks (1953); McCafferty and Waltz (1990).  
Ecology & Habitat (N): Stream orders 1-3, depositional; Hubbard and Peters (1978).  
Seasonal Occurrence (A): September.  
Biology (N) & (A): Unknown.  
Distribution (A): P39 (F).  
Nearctic Range: NE, C, EC.

\* ***Procloeon ozburni* (McDunnough), 1924c**

Taxonomy (N) & (A): Needham et al. (1935); McCafferty and Waltz (1990).  
Ecology & Habitat (N): Stream orders 1-3, depositional among plants.  
Seasonal Occurrence (N): June and August; (A): July.  
Biology (N) & (A): Unknown.  
Distribution (N): Ps8, S3; (A): P17 (M).  
Nearctic Range: NE, EC.

***Procloeon rivulare* (Traver), 1935**

Taxonomy (N) & (A): Needham et al. (1935); McCafferty and Waltz (1990).  
Ecology & Habitat (N): Stream orders 1-3, depositional among plants and in transitional areas.  
Seasonal Occurrence (N): August; (A): July-August.  
Biology (N) & (A): Unknown.  
Distribution (N): L2; (A): Wn5 (M), Wn13.  
Nearctic Range: NE, C.

***Procloeon rubropictum* (McDunnough), 1923**

Taxonomy (N) & (A): Needham et al. (1935); Berner and Pescador (1988); McCafferty and Waltz (1990); (N): Burks (1953).  
Ecology & Habitat (N): Stream orders 1-3, depositional and transitional areas; Hubbard and Peters (1978).  
Seasonal Occurrence (N): August; (A): June-September.  
Biology (N) & (A): Ide (1935b), Lyman (1955); Berner and Pescador (1988).  
Swarming was observed August 12, 1986, at the washed-out fire road bridge south of Rt. 6 on Tomah Stream. The swarm was first noticed at 2:45 p.m. The nucleus of the swarm was relatively station-

ary about 25 cm above some small alders along the stream bank. When the swarm was momentarily dispersed by a strong gust of wind, it reformed over the same spot. The weather was warm, mostly cloudy, and there were no bright sunlit patches. Females were so small that they were not noticeable until they entered the swarm and attracted the attention of several males. Mating pairs left the swarm and flew towards the open stream channel where they separated, and the female oviposited in the center of the open channel.

Distribution (N): L1, Ps5; (A): An4 (M), H9, L1 (M), L2 (M,F), P8 (F), P13 (F), P16 (M), P35 (M,F), Ps4 (F), Wn5 (M), Wn6 (M), S8 (F).

Nearctic Range: SE, NE, EC, CC.

\* *Procloeon rufostrigatum* (McDunnough), 1924c

Taxonomy (A): Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); McCafferty and Waltz (1990).

Because of the distinctive abdominal coloration they are the most easily recognized member of this genus occurring in Maine.

Ecology & Habitat (N): Stream orders 2-3, depositional and transitional areas; Hubbard and Peters (1978).

Seasonal Occurrence (A): July-August.

Biology (N) & (A): Hubbard and Peters (1978).

Swarming behavior was observed on July 1, 1986, along Tomah Stream, north of the Rt. 6 bridge. The swarm formed about 15-20 m above the ground near the tops of some fir trees next to the stream just before sunset (about 7:58 p.m.). The nucleus of the swarm was composed of males which flew in elongated u-shaped patterns by flying upward about 1 m then drifting back and downward with the wind to about the level of the starting position. Occasionally individuals left the swarm, flying east away from the stream. After copulation females oviposited in the pool below the swarm or flew upstream.

Distribution (A): P16 (F), P17 (F), Wn5 (M,F).

Nearctic Range: NE, C, EC, CC.

*Procloeon simplex* (McDunnough), 1925a

Taxonomy (N): Ide (1937) figure of nymph; (A): Needham et al. (1935); McCafferty and Waltz (1990); Burks (1953).

Ecology & Habitat (N): Stream orders 1-2, depositional among plants; Ide (1935b), Ontario.

Seasonal Occurrence (N): July-September; (A): July-September.

Biology (N) & (A): Unknown.

Distribution (N): Wn6; (A): P9 (M), Ps2 (M,F), W9 (M).

Nearctic Range: NE, EC, WC.

### Metretopodidae

The family is represented in Maine by two genera and two species. McCafferty and Edmunds (1979) indicated that the Metretopodidae were derived from within the Siphlonurinae and are closely related to the *Siphlonurus-Parameletus* cluster. Landa and Soldan (1985) proposed that Metretopodidae should be considered a subfamily of the Siphlonuridae (based on the study of internal organs). This proposed change in the higher classification of the Ephemeroptera has not been widely accepted in North America.

#### *Metretopus borealis* Eaton, 1901

Taxonomy (N) & (A): Berner (1978).

Ecology & Habitat (N): Stream orders 2–3, depositional among plants; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Berner (1978).

Seasonal Occurrence (N): June–July, and September.

Biology (N) & (A): Unknown.

Distribution (N): Ak7, Ak9, Ak11, Ak16, Ak21, H9, S9, Wn14.

Nearctic Range: Maine, Michigan, EC, CC, WC.

#### *Siphloplecton basale* (Walker), 1853

Taxonomy (N) & (A): Leonard and Leonard (1962); Berner (1978).

Ecology & Habitat (N): Stream orders 2–3, depositional areas; pond/lake, littoral; stream backwaters; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs were abundant among aquatic vegetation in quiet areas of streams and lakes. They also occurred along the rocky wave-wash zones of some ponds on the Moosehead Plateau, but seemed less abundant in these habitats.

Seasonal Occurrence (N): April and September; (A): May.

Biology (N) & (A): Lyman (1955); Boerger and Clifford (1975); Clifford (1976); Berner and Pescador (1988).

Subimagoes were collected in the morning rafting on the surface of slow flowing streams and along the shorelines of ponds. Imagoes were collected over lakes and streams in the afternoon and early evening. Males did not form stationary swarms, but flew back and forth along lake shores or over streams searching for females.

Distribution (N): H9, P3, P9, Wn5, Wn9; (A): P7 (M), Ps3 (F), Ps8 (M.F), Ps27 (M,F), Wn5 (M,F).

Nearctic Range: SE, NE, C, EC, CC, WC.

#### \* *Siphloplecton* n. sp. A.

Taxonomy (N): Nymphs of this species are of the *basale* type, but differ from *S. basale* in the shape of the fore tarsal claw which is slender with few lateral setae. The length of each division of the fore tarsal

claw is about twice the width of the base of the claw. Ventral abdominal stripes are absent except for a faint midventral dark line on sternites 8-10. A formal description will not be possible until associated adults of this species have been examined.

**Ecology & Habitat (N):** Stream orders 2-3, depositional among plants; pond/lake, littoral zones.

**Seasonal Occurrence (N):** April and July-August.

**Biology (N) & (A):** Unknown.

**Distribution (N):** F1, P3, P8, Wn5, Wn6.

**Nearctic Range:** NE.

### Oligoneuriidae

The family is represented in Maine by a single genus and two species. Until the higher classification of the Ephemeroptera was revised by McCafferty and Edmunds (1979), the *Isonychia* had been listed as a subfamily of the Siphlonuridae. McCafferty and Edmunds (1979) indicated that the group undoubtedly arose from a siphlonurid-like ancestor, but at a very early time and that no modern siphlonurid possessed morphological structures observed in modern oligonurids. They placed the subfamily Isonychiinae within the paraphyletic lineage of the Oligoneuriidae.

Environmental tolerances for a wide range of water quality parameters are presented for *Isonychia* sp. by Roback (1974). General life cycle patterns and comments on voltinsim for the genus are presented by Clifford (1982).

#### *Isonychia (I.) bicolor* (Walker), 1853

Taxonomy (N) & (A): Kondratieff and Voshell (1984).

Ecology & Habitat (N): Stream order 2–5, erosional; pond/lake outlets.

Nymphs were common in most swiftly flowing streams especially in riffles at pool or pond outlets. Nymphs were strong swimmers and were one of the few mayflies that occurred where vast populations of Simuliidae carpeted the substrate, literally cementing the substrate particles together.

Seasonal Occurrence (N): May-June and August-October;

(A): July-August.

Biology (N) & (A): Harper and Harper (1984); Kondratieff and Voshell (1984).

Mature nymphs collected in the spring and early summer from waters ranging in temperature from 12–14°C usually did not survive transportation or rearing in the laboratory. However, those collected later in the summer from water about 20°C usually survived transportation, and many completed their development to the subimago. Subimagos emerged in field-rearing containers at about 1:15 p.m. and usually completed the final molt to the imago within 24 h. Imagines were most active after dark. From mid-July through August mercury vapor lights at the University of Maine campus at Orono attracted large numbers of males and females from the nearby Stillwater and Penobscot Rivers late into the evening.

Distribution (N): Ak10, Ak16, Ak17, Ak25, Ak32, F8, F12, F20, K1, L1, P8, Ps25, S5, Wn3, Wn7; (A): F12 (M), O3 (M), P16 (M,F), P30 (M,F), P31 (M,F), P35 (M,F), S5 (M).

Nearctic Range: SE, NE, EC, CC.

***Isonychia (P.) obscura* Traver, 1932**

Taxonomy (N) & (A): Kondratieff and Voshell (1984).

Ecology & Habitat (N): Stream orders 1–5, erosional areas.

Not as frequently collected as *I. bicolor*, this species was limited to lotic habitats and was especially abundant in the lower areas of large rivers like the Penobscot. Unlike *I. bicolor*, this species was not collected in areas of high Simuliidae populations.

Seasonal Occurrence (N): July-August; (A): July-August.

Biology (N) & (A): Kondratieff and Voshell (1984).

Distribution (N): F20, P7, Wn4; (A): P13 (F), P15 (F), P16 (M,F).

Nearctic Range: SE, NE.

### Heptageniidae

The family is represented in Maine by nine genera and 34 species. McCafferty and Edmunds (1979) depicted the family as arising from the same hypothetical ancestor as the oligoneuriids. As with the Oligonueriidae, the Heptageniidae are thought to have originated very early from a siphlonurid-like ancestor.

Environmental tolerances for a wide range of water quality parameters are provided by Roback (1974) for *Heptagenia* spp. (including *Leucrocuta* and *Nixe*), *Stenacron* spp., and the major *Stenonema* spp. groups according to Lewis (1974). Data on life cycles and voltinism is summarized by Clifford (1982).

#### *Arthroplea bipunctata* McDunnough, 1924a

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Flowers and Hilsenhoff (1975); Edmunds et al. (1976).

Ecology & Habitat (N): Stream orders 1–2, depositional among plants; stream backwaters; wetlands, marshes and swamps; pond/lake, littoral zones among plants; Ide (1935b), Ontario; Edmunds et al. (1976); Hubbard and Peters (1978).

Nymphs were abundant in most lentic habitats, especially those connected to streams that flood seasonally. This species was one of the few mayflies that occurred in bogs.

Seasonal Occurrence (N): May–June; (A): May–June.

Biology (N) & (A): Edmunds et al. (1976); Flowers and Hilsenhoff (1978).

Distribution (N): F1, H15, K1, P3, P6, P28, P34, Ps1, Ps2, Ps5, Ps8, Ps23, S5, S8, S12, Wn13; (A): P10 (F), Ps8 (M).

Nearctic Range: NE, C, EC, CC, WC.

The species is Holarctic in distribution and in North America it has not been reported to occur further south than 40° N latitude.

#### *Cinygmulia subaequalis* (Banks), 1914

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953).

Ecology & Habitat (N): Stream orders 1–2, erosional areas.

Nymphs occurred among loose gravel and rubble in the swiftest parts of cool streams. Nymphs clung tightly to substrate particles and were difficult to dislodge. They were also quick to avoid direct light, moving immediately for cover if exposed.

Seasonal Occurrence (N): March–June; (A): June.

Biology (N) & (A): Unknown.

Individual males were collected over the Carrabassett River in the evening (8:00–9:00 p.m.) on June 20, 1986, as they flew upstream about 2–3 m above the water.

Distribution (N): F6, F8, F9, F18, F20, F21, Ps7, Ps14, Ps16, Ps17, Ps18; (A): F5 (M), F8 (F), F19 (M,F), F20 (F), F21 (M), Ps18 (M).

Nearctic Range: SE, NE, EC.

***Epeorus (I.) fragilis* (Morgan), 1911**

Taxonomy (N) & (A): Morgan (1911); Needham et al. (1935).

Ecology & Habitat (N): Stream orders 1–2, erosional areas; Hubbard and Peters (1978).

Similar to *E. pleuralis* in general habitat requirements, *E. fragilis* was not collected either as nymphs or adults at the same time as *E. pleuralis*.

Seasonal Occurrence (N): May–August; (A): July.

Biology (N) & (A): Maxwell and Benson (1963).

Emergence occurred later in the spring than *E. pleuralis* and nymphs were usually much smaller at time of emergence than those of *E. pleuralis*. Adult males were collected in July from the undersides of leaves along stream banks just after sunrise (about 5:45 a.m.).

Distribution (N): F6, F8, F19, F21, Ps5, Ps7, W11; (A): F19 (M), Ps7 (M,F).

Nearctic Range: SE, NE, C, EC.

**+ *Epeorus (I.) frisoni* (Burks), 1946**

Taxonomy (N) & (A): Burks (1946).

Ecology & Habitat (N): Stream order 2, erosional areas.

Seasonal Occurrence (A): late August.

Biology (N) & (A): Unknown.

Distribution (A): Ps 19 (Type location only, Roaring Brook, Mt. Katahdin [Burks 1946]).

Nearctic Range: Maine (endemic).

***Epeorus (I.) pleuralis* (Banks), 1910**

Taxonomy (N) & (A): Needham (1935); Bartlett (1941).

Ecology & Habitat (N): Stream order 1–3, erosional areas; Ide (1935b), Ontario; Minshall (1967), Kentucky; Hubbard and Peters (1978).

Nymphs occurred commonly among the loose upper layers of gravel and rubble of cool swiftly flowing streams.

Seasonal Occurrence (N): April–June; (A): April–June.

Biology (N) & (A): Ide (1935c); Maxwell and Benson (1963); Minshall (1967).

In May mating swarms were observed in the mid-morning (about 9:30 a.m.), in the late afternoon, and early evening. Swarms occurring early in the day were usually composed of 8–10 individuals; those occurring in the later half of the day were much larger. One swarm observed at the Palermo Fish Culture Station (on the East Branch of the Sheepscot River) on May 14, 1986, was composed of thousands of individuals covering about half of the hatchery grounds. On this occasion, the swarm formed rapidly about 45 min before

sunset and was probably the result of a mass emergence that occurred the day before when large numbers of nymphal skins were observed in the nearby river. Males exhibited the rhythmic flight pattern observed for individuals of smaller swarms. Males faced into the wind and flew upwards about 1 m, then drifted downward on the wind to about the level of their starting point where vertical flight resumed. The pattern was repeated 3–4 times after which the individual would have traveled, horizontally, about 2 m. At this point rhythmic flight stopped and the individual repositioned itself in the swarm and began again. After sunset the swarm dissipated as quickly as it had formed.

Distribution (N): F3, F4, F8, F19, F21, H1, P10, Ps6, W2, W8, Wn1, Wn2, Wn4; (A): F17 (M,F), F19 (M,F), F20 (M,F), W8 (M), W11 (F), W14 (M).

Nearctic Range: SE, NE, EC.

#### *Epeorus (I.) rubidus* (Traver), 1933

Taxonomy (N) & (A): Needham et al. (1935).

Ecology & Habitat (N): Stream order 3, erosional and transitional runs.

Nymphs are of the *E. vitreus* type and possibly have similar ecological tolerances.

Seasonal Occurrence (N): July.

Biology (N) & (A): Unknown.

Distribution (N): F6, Wn11.

Nearctic Range: SE, NE.

#### *Epeorus (I.) vitreus* (Walker), 1853

Taxonomy (N) & (A): Needham et al. (1935), as *I. humeralis*; Leonard and Leonard (1962); Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 1–5, erosional areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Nymphs were abundant among loose gravel and poorly sorted large fine sediment and were more tolerant of warmer temperatures and slower current velocities than *E. pleuralis*. Nymphs were especially abundant where algae and a thick periphyton film covered the larger particles.

Seasonal Occurrence (N): May–September; (A): June–August.

Biology (N) & (A): Ide (1935c); Needham et al. (1935); Flowers and Hilsenhoff (1978).

Specimens were reared in static dishes as opposed to the flow-tank that had to be used for other species of *Epeorus* because of the nymphs' tolerance of reduced flow. Although subimagoes were not

observed emerging, all nymphal skins were found submerged in the rearing dishes (some still clinging to stones) and emergence is presumed to occur underwater similar to that observed by Minshall (1967) for *E. pleuralis*.

Distribution (N): Ak1, F8, F9, F10, F12, F20, K1, L1, L2, P3, P5, P7, F8, S5, W2, W7, Wn1, Wn4, Wn5, Wn16; (A): F6 (M,F), F22 (M), K1 (M,F), L1 (M), P10 (F), P16 (M,F), W2 (M,F), Wn16.

Nearctic Range: SE, NE, C, EC, CC.

\* *Heptagenia flavaescens* (Walsh), 1862

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Flowers and Hilsenhoff (1975); Berner and Pescador (1988); (N): Daggy (1945), figure of nymph.

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Seasonal Occurrence (N): September.

Biology (N) & (A): Flowers and Hilsenhoff (1978); Berner and Pescador (1988).

Distribution (N): Ak14, Ak15, Ak16.

Nearctic Range: SE, NE, C, EC, CC.

*Heptagenia pulla* (Clemens), 1913

Taxonomy (N) & (A): Clemens (1913), figure of nymph; Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 2–4, erosional areas; Clemens (1913); Ide (1935b), Ontario; Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Nymphs occurred under loose large gravel and boulders in swiftly flowing streams. It was most abundant in the wide shallow transitional areas of larger streams and rivers. At the east outlet of Moosehead Lake it was the most abundant heptageniid occurring in collections.

Seasonal Occurrence (N): May and July–August; (A): June–August.

Biology (N) & (A): Ide (1935c); Flowers and Hilsenhoff (1978).

Specimens were collected from lights at the University of Maine campus in Orono between 10:30 and 11:30 p.m. from June–August 1986.

Distribution (N): Ps2, Ps5, S1; (A): F12 (M,F), P16 (M,F), Ps26 (M), S1 (M,F), Wn4 (M,F).

Nearctic Range: SE, NE, C, EC, CC.

**\* *Leucrocuta aphrodite* (McDunnough), 1926a**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Flowers (1980), established new genus *Leucrocuta*.

Nymphs cannot be positively identified without associated adults. The male imago is similar to that of *L. hebe*, but is distinguished from it by the length of the inner pair of long spines on the male genitalia. In *L. aphrodite* the spines are short, not extending to the tips of the penes; in *L. hebe* the spines are longer almost reaching the tips of the penes. In addition, *L. aphrodite* is smaller; dorsal abdominal maculations are distinct and do not tend to bleed into dark blotches; and the thorax is lighter colored so that a dark stripe across the pleural area is distinctive.

**Ecology & Habitat (N):** Stream orders 2–5, erosional areas.

Nymphs occurred under and among gravel and poorly sorted large fine sediment in lotic habitats. They were especially abundant in the lower parts of large rivers (e.g., Penobscot River in the vicinity of Old Town).

**Seasonal Occurrence (N):** May–August; (A): June–August.

**Biology (N) & (A):** Unknown.

Adults were active most of the night and were readily attracted to lights.

**Distribution (N):** L2; (A): P3 (M), P13 (M,F), P14 (M,F), P15 (M,F), P16 (M,F).

**Nearctic Range:** SE, NE, EC.

***Leucrocuta hebe* (McDunnough), 1924c**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Flowers (1980).

**Ecology & Habitat (N):** Stream orders 2–5, erosional; pond/lake, wave-wash zones; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Nymphs occurred among and under gravel and small boulders in a variety of erosional habitats, and were abundant in the warmer riffles and transitional areas of large rivers. Nymphs were sympatric with *L. aphrodite*. In the Carrabassett River above North Anson, *L. hebe* occurred on clumps of sod that had broken off from the bank and became embedded in the river bottom. Nymphs swiftly retreated from direct light to the nearest dark crevice. Later instar nymphs had distinctive iridescent green blotches on their heads and legs, breaking up the outline of their bodies on dark surfaces.

**Seasonal Occurrence (N):** May–September; (A): May–September.

**Biology (N) & (A):** Ide (1935c); Needham et al. (1935); Flowers and

Hilsenhoff (1978); Harper et al. (1983); Harper and Harper (1984).

This was the most abundant and frequently occurring species of *Leucrocuta*. Adults were active at dusk and swarmed around lights several kilometers from the nearest permanent water body. Here they remained throughout the next day and completed their imaginal molt.

Distribution (N): Ak1, Ak19, F8, F12, F20, K1, L1, P7, P8, Ps2, S5, S8, Wn1, Wn2, Wn3, Wn4, Wn5, Wn16, Wn17; (A): Ak1 (M,F), F12 (M,F), F16 (M,F), F20 (M,F), H9, L1 (M,F), L2 (F), P3 (M,F), P7 (F), P8 (M), P14 (M), P15 (M), P16 (M,F), P24, P30 (M,F), P31 (M,F), P35 (M), S8 (F), Wn3 (M), Wn4 (M,F), Wn5 (F), Wn11, Wn16.

Nearctic Range: SE, NE, C, EC.

\* *Leucrocuta maculipennis* (Walsh), 1863

Taxonomy (N) & (A): Clemens (1913), figure of nymph; Needham et al. (1935); Burks (1953); Flowers (1980).

Ecology & Habitat (N): Stream orders 1–2, erosional areas.

Nymphs occurred among small gravel and large fines in slower flowing areas of riffles and in transitional runs between pools.

Seasonal Occurrence (N): July+August; (A): August.

Biology (N) & (A): Unknown.

Distribution (N): P7, S8; (A): F20 (M).

Nearctic Range: SE, NE, EC, CC.

\* *Leucrocuta minerva* (McDunnough), 1924c

Taxonomy (N) & (A): Needham et al. (1935); Flowers (1980). (N): McCafferty (1977a); (A): Burks (1953).

Ecology & Habitat (N): Unknown.

Seasonal Occurrence (A): July.

Biology (N) & (A): Unknown.

Distribution (A): Wn10 (M).

Nearctic Range: SE, NE, EC.

\* *Leucrocuta walshi* (McDunnough), 1926a

Taxonomy (A): Needham et al. (1935); Burks (1953); Flowers (1980).

Nymphs cannot be identified without associated adult male specimens.

Ecology & Habitat (N): Stream orders 2–4, erosional areas.

Nymphs occurred among and under well-sorted gravel and rubble in riffles and transitional runs.

Seasonal Occurrence (N): May; (A): May–August.

Biology (A): Harper and Harper (1984).

Nymphs with dark wing pads were most abundant in late June and July. Nymphal exuviae were always found submerged in the rearing dishes suggesting that emergence took place underwater.

Distribution (A): Ak1 (M), F12 (M,F).

Nearctic Range: NE, C, EC.

***Nixe (N.) horrida* (McDunnough), 1926b**

Taxonomy (A): Needham et al. (1935); Flowers (1980), established new genus *Nixe*.

Nymphs cannot be identified without associated adult males.

Ecology & Habitat (N): Stream orders 2–3, erosional areas.

Nymphs occurred among and under large gravel and poorly sorted large fines in riffles and transitional runs.

Seasonal Occurrence (A): June-July.

Biology (N) & (A): Unknown.

Distribution (A): Ak1 (M), H8 (M), Wn16 (M).

\* ***Nixe (N.) lucidipennis* (Clemens), 1913**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Flowers and Hilsenhoff (1975); Flowers (1980). (N): Clemens (1913), figure of nymph.

Ecology & Habitat (N): Stream orders 2–5, erosional areas; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Seasonal Occurrence (N): September; (A): July.

Biology (N) & (A): Lyman (1955); Flowers and Hilsenhoff (1978).

Distribution (N): Ak19; (A): P16 (M).

Nearctic Range: SE, NE, C, EC.

\* ***Nixe (N.) perfida* (McDunnough), 1926b**

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Flowers (1980).

Ecology & Habitat (N): Stream order 3, erosional areas.

Nymphs occurred among gravel and poorly sorted large fine sediments in the swiftly flowing cool streams.

Seasonal Occurrence (A): July.

Biology (N) & (A): Unknown.

Distribution (A): F6 (M).

Until now the northeastern-most record of this species had been from Erie County Pennsylvania (Grant and Masteller 1984).

Nearctic Range: SE, NE, C, EC.

***Rhithrogena amica* Traver, 1935?**

Taxonomy (N) & (A): Needham et al. (1935).

Reared material is required for positive determination.

Ecology & Habitat (N): Stream orders 2–3, erosional areas.

Seasonal Occurrence (N): June and September.

Biology (N) & (A): Unknown.

Distribution (N): Ak15, Ak16, Ak17, Ak19, Wn10, Wn11.

Nearctic Range: SE, NE.

\* ***Rhithrogena brunneotincta* McDunnough, 1933**

Taxonomy (N) & (A): Needham et al. (1935).

The nymphs of this species are large and can easily be mistaken for *R. amica*; however, genitalia of the adult males is very different from that of all other species, except *R. robusta*.

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow).

Nymphs occurred in swift shallow cool streams among the loose upper layers of large gravel where they clung tightly to the edges of rocks that were directly exposed to the current.

Seasonal Occurrence (N): March–June and September–November;

(A): June–July.

Biology (N) & (A): Unknown.

Distribution (N): Ak15, Ak16, Ak17, Ak19, F18, H10, Ps15, Ps16, Ps18, Ps19, Wn11, Wn16; (A): F18 (M), F21 (M), Ps17 (M).

Nearctic Range: Maine, EC (endemic).

***Rhithrogena impersonata* (McDunnough), 1925a**

Taxonomy (N) & (A): Needham et al. (1935); Leonard and Leonard (1962); Ide (1954), discussion of *sanguinea* form; Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow); Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Nymphs occurred among loose upper layers of large gravel in shallow cool swift streams where they clung tightly to the edges and undersides of larger stones.

Seasonal Occurrence (N): May–June; (A): June–July.

Biology (N) & (A): Ide (1954); Flowers and Hilsenhoff (1978).

Individual males were collected above the Carrabassett River in June (from 8:00–9:00 p.m.) as they flew upstream.

Distribution (N): F6, F8, F9, F20, F21; (A): F7 (M), F17 (M), F21 (M), Ps17 (M).

Nearctic Range: NE, C, EC.

\* ***Rhithrogena jejuna* Eaton, 1885**

Taxonomy (N) & (A): Needham et al. (1935); Leonard and Leonard (1962); Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 2–4, erosional and transitional (shallow); Leonard (1965); Michigan: Flowers and Hilsenhoff (1975; 1978); Wisconsin: Hubbard and Peters (1978).

Nymphs occurred among loose large gravel and poorly sorted

large fine sediment in swift shallow riffles where they clung tightly to the edges and undersides of large substrate particles.

Seasonal Occurrence (N): August; (A): May–July.

Biology (N) & (A): Flowers and Hilsenhoff (1978).

Distribution (N): S5; (A): F16 (M), F20 (M), S8 (M).

Nearctic Range: NE, C, EC, CC.

\* *Rhithrogena pellucida* Daggy, 1945

Taxonomy (N) & (A): Daggy (1945); Leonard and Leonard (1962); Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 2–4, erosional and shallow transitional areas; Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Nymphs occurred among loose large gravel and poorly sorted large fine sediment in swift shallow riffles where they clung to edges and undersides of larger substrate particles and were sympatric with *R. jejuna*.

Seasonal Occurrence (A): July.

Biology (N) & (A): Flowers and Hilsenhoff (1978).

Distribution (N): S7; (A): F16 (M).

Nearctic Range: SE, NE, C.

Primarily a species of the central and southeastern United States, its occurrence in Maine greatly extends the northeastern limits of its range.

+ *Rhithrogena uhari* Traver, 1933?

Taxonomy (N) & (A): Needham et al. (1935).

Reared material is required for positive determination.

Ecology & Habitat (N): Streams, erosional, pool outlet (shallow).

Seasonal Occurrence (N): June.

Biology (N) & (A): Unknown.

Distribution (Map 22), (N): Wn11.

Nearctic Range: SE, NE.

Previously, it had only been reported from the southern Appalachian Mountains.

\* *Stenacron candidum* (Traver), 1935

Taxonomy (N) & (A): Spieth (1947); Jensen (1974), establish genus *Stenacron*; Lewis (1974).

Ecology & Habitat (N): Stream order 3, depositional; lake, littoral zones, Lewis (1974).

Seasonal Occurrence (A): July–August.

Biology (N) & (A): Unknown.

Distribution (A): F22 (F), Ps26 (M,F).

Nearctic Range: NE, C, CC.

***Stenacron interpunctatum* (Say), 1839**

Taxonomy (N) & (A): Spieth (1947); Leonard and Leonard (1962); Jensen (1974); Lewis 1974; Flowers and Hilsenhoff (1975).

Ecology & Habitat (N): Stream orders 1–5, erosional and transitional; pond/lake, wave-wash zone; Leonard (1965), Michigan, Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978).

Seasonal Occurrence (N): March–September; (A): June–August.

Biology (N) & (A): Ide (1935c); Needham et al. (1935); Lyman (1955); Coleman and Hynes (1970); McCafferty and Huff (1978); Mingo (1978a); Harper et al. (1983).

Distribution (N): Ak6, Ak9, Ak13, Ak15, Ak18, F9, F20, H1, H16, L2, P5, P7, P13, P23, P26, P31, Ps2, Ps5, Ps10, Wn1, Wn4, Wn5; (A): Ak30 (M,F), C3 (M), C4 (F), F13 (M,F), F16 (M), F20 (M), F22 (M), O3 (M,F), P16 (M,F), P31 (M,F), Ps1 (F), W5 (M), Wn3 (F), Wn13, Y2 (M,F), Y3 (M,F).

Nearctic Range: SE, NE, C, EC.

**\* *Stenacron pallidum* (Traver), 1933**

Taxonomy (N) & (A): Spieth (1947); Jensen (1974); Lewis (1974).

According to Lewis (1974) this species had previously only been collected in the Appalachians of North Carolina. However, there has been some question as to the status of this species. Spieth (1947) believed it to be synonymous with *Stenacron interpunctatum*; Lewis (1974) thought the species merited individual status. The one specimen collected in Maine closely matched the description given by Traver (1933) and is different from other *Stenacron* collected so far, but these differences are subtle and until this matter is resolved caution should be used in making determinations.

Ecology & Habitat (N): Stream order 5, erosional (?); Lewis (1974).

Seasonal Occurrence (A): July.

Biology (N) & (A): Unknown.

Distribution (A): P16 (M).

Nearctic Range: SE, NE.

***Stenonema (M.) ithaca* (Clemens & Leonard), 1925**

Taxonomy (N) & (A): Leonard and Leonard (1962); Lewis (1974); Bednarik and McCafferty (1979).

Ecology & Habitat (N): Stream orders 3–5, transitional and erosional with secondary depositional areas; Leonard (1965), Michigan; Lewis (1974); Hubbard and Peters (1978); Bednarik and McCafferty (1979).

Nymphs occurred among loose upper layers of gravel and poorly sorted large fine sediment in areas of lesser flow. Nymphs were especially abundant among gravel of shallow streams that had algae

and a thick film of a periphyton on the larger substrate particles.  
Seasonal Occurrence (N): May–July.  
Biology (N) & (A): Needham et al. (1935).  
Distribution (N): P3, P22, Ps2, Ps10, S8.  
Nearctic Range: SE, NE, EC.

\* *Stenonema (M.) luteum* (Clemens), 1913

Taxonomy (N) & (A): Leonard and Leonard (1962); Lewis (1974);  
Bednarik and McCafferty (1979).  
Ecology & Habitat (N): Stream orders 1–4, erosional areas; Leonard  
(1965), Michigan; Lewis (1974); Bednarik and McCafferty (1979).

Although the species has been reported from lentic wave-wash  
zones in the Great Lake States and south-central Canada, it has not  
yet been collected from this habitat in Maine. Nymphs were sympa-  
tric with *S. vicarium* among gravel, well-sorted large fines, and  
clumps of CPOM trapped between the substrate particles.

Seasonal Occurrence (N): May–June and August.

Biology (N) & (A): Unknown.

Distribution (N): F8, P3, P7, P37, K2, W2, Wn4.

Nearctic Range: NE, C, EC, CC.

*Stenonema (M.) mediopunctatum* (McDunnough), 1926a

Taxonomy (N) & (A): Leonard and Leonard (1962); Lewis (1974);  
Flowers and Hilsenhoff (1975); Bednarik and McCafferty (1979).  
Ecology & Habitat (N): Stream orders 2–4, erosional areas; Ide (1935b),  
as *S. nepotellum* in Ontario; Leonard (1965), as *S. nepotellum* in  
Michigan; Flower and Hilsenhoff (1975; 1978), Wisconsin; Lewis  
(1974).

Nymphs occurred under large gravel and small boulders in swift  
riffles and transitional runs. In the Sheepscot River at North White-  
field (Site L1), it was the dominant heptageniid collected and was  
especially abundant under rubble and small boulders where CPOM  
was trapped.

Seasonal Occurrence (N): June–September; (A): June–August.

Biology (N) & (A): Flowers and Hilsenhoff (1978).

Distribution (N): Ak19, L1, L2, P8, Ps8; (A): L1 (F), O3 (F), P16 (M).

Nearctic Range: SE, NE, C, EC, CC.

*Stenonema (M.) mexicanum integrum* (McDunnough), 1924b

Taxonomy (N) & (A): Leonard and Leonard (1962); Lewis (1974);  
Flowers and Hilsenhoff (1975); Bednarik and McCafferty (1979);  
McCafferty (1984a), establishes *S. integrum* as a junior synonym of  
*S. mexicanum* (Ulmer) and delegates Nearctic populations to sub-  
specific status.

**Ecology & Habitat (N):** Stream orders 2–4, depositional with secondary erosional areas; Leonard (1965), Michigan; Flowers and Hilsenhoff (1975; 1978), Wisconsin; Lewis (1974); Bednarik and McCafferty (1979).

Lewis (1974) indicated that nymphs prefer large deep rivers, but occur in most other types of streams and are tolerant of enriched waters. In his study he listed specimens collected from the Crooked River and Carsley Brook in Harrison, Cumberland County. In this area these streams have many pools, and it is thought that his specimens were from these depositional lotic habitats. New specimens collected from Oxford County were also adults and local ecology and habitat of nymphs is unknown.

**Seasonal Occurrence (A):** July–August.

**Biology (N) & (A):** Flowers and Hilsenhoff (1978); Berner and Pescador (1988).

**Distribution (A):** C4 (F), O3 (F).

**Nearctic Range:** SE, NE, C.

#### *Stenonema (M.) modestum* Banks, 1910

**Taxonomy (N) & (A):** Leonard and Leonard (1962); Lewis (1974), as *S. annexum*, *S. rubromaculatum*, *S. rubrum*, and *S. smithae*; Bednarik and McCafferty (1979).

**Ecology & Habitat (N):** Stream orders 1–5, erosional and transitional; pond/lake wave-wash zones; temporary, forest pools; Lewis (1974); Bednarik and McCafferty (1979); Kondratieff and Voshell (1980), Virginia.

Nymphs occurred in a wide range of habitats from small shallow rocky streams to large rivers and lake shorelines. However, within these areas nymphs usually occurred among the loose upper layers of gravel and rubble. Nymphs collected from intermittent habitats were found among gravel and CPOM in areas of greatest flow or near the upwellings of small springs.

**Seasonal Occurrence (N):** March–September; (A): June–August.

**Biology (N) & (A):** Harper and Magnin (1971); Kondratieff and Voshell (1980); Harper et al. (1983); Berner and Pescador (1988).

During the day several specimens were collected from the underside of leaves of vegetation growing along stream banks. At night large numbers of males and females were collected from lights at the University of Maine campus in Orono and along streams by using a black-light tube.

**Distribution (N):** Ak1, C3, F4, H1, H2, H3, K1, P2, P3, P6, P9, P10, P24, Ps2, Ps5, S3, W1, W2, W3, W7, W11, W12, Wn1, Wn3, Wn17; (A): An1 (F), C4 (M,F), F16 (M), H1 (M), K1 (M), O3 (F), P3 (M,F), P13

(M), P16 (M,F), P24, P30 (M,F), P31 (M,F), P32 (M,F), Ps2 (M), S8 (M,F), W2 (F).

Nearctic Range: SE, NE, C, EC, CC.

\* ***Stenonema (M.) terminatum* (Walsh), 1862**

Taxonomy (N) & (A): Lewis (1974), as *S. ares*, *S. bipunctatum*, *S. lepton*, and *S. plactium*; Flowers and Hilsenhoff (1975), as *S. bipunctatum*; Bednarik and McCafferty (1979).

Ecology & Habitat (N): Stream orders 2–4, depositional and transitional areas; Lewis (1974); Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978); Bednarik and McCafferty (1979).

Seasonal Occurrence (A): June and August.

Biology (N) & (A): Flowers and Hilsenhoff (1978); Hubbard and Peters (1978).

Individual adults were collected at dusk above pools on the Carrabassett River and Birch Stream (in Alton) in June, 1986.

Distribution (A): Ak1 (F), F7 (M), P8 (M), P16 (F), P35 (F).

Nearctic Range: SE, NE, C, EC, CC.

***Stenonema (M.) vicarium* (Walker), 1853**

Taxonomy (N) & (A): Leonard and Leonard (1962); Lewis (1974); Flowers and Hilsenhoff (1975); Lager and Lewis (1978), notes on color variation of northeastern nymphs; Bednarik and McCafferty (1979).

Ecology & Habitat (N): Stream orders 2–5, erosional; pond/lake outlets; Pond/lake wave-wash zone; Ide (1935b), Ontario; Leonard (1965), Michigan; Lewis (1974); Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978); Bednarik and McCafferty (1979).

Nymphs occurred among the loose upper layer of gravel and poorly sorted large fine sediment. In lotic habitats, nymphs with dark wing pads were most abundant in areas of lesser flow where CPOM had accumulated in large packs. Younger nymphs, however, occurred most frequently in more swiftly flowing areas. Although nymphs tolerated a wide range of ecological conditions, they were most abundant in cool swift streams.

Seasonal Occurrence (N): April–August; (A): May–July.

Biology (N) & (A): Ide (1935c); Needham et al. (1935); Leonard and Leonard (1962), Michigan; Coleman and Hynes (1970); Harper and Magnin (1971); Huff and McCafferty (1974); Richardson and Tarter (1976); Flowers and Hilsenhoff (1978); Harper et al. (1983); Harper and Harper (1984).

Imagos took refuge among the streamside vegetation during the early part of the day and became active in the late afternoon. On June 4, 1986, at Beaver Brook a swarm was observed which formed at

dusk (about 8:30 p.m.) and continued until about 9:15 p.m. Male flight behavior was similar to that described by Leonard and Leonard (1962) for swarms in Michigan.

Distribution (N): Ak7, Ak8, Ak10, Ak11, Ak13, Ak15, Ak20, Ak22, Ak23, F9, F20, F21, H9, P3, P7, P10, Ps2, S5, W2, Wn11, Wn16, Wn17; (A): Ak30 (M), F20 (F), F21 (F), P7 (M), P8 (M), P16 (F), P35 (M), Ps2 (M), S8 (M), W2 (M,F), W15 (M), Wn4 (F), Wn5 (M).

Nearctic Range: SE, NE, C, EC, CC.

*Stenonema (S.) femoratum* (Say), 1823

Taxonomy (N) & (A): Spieth (1947), as *S. tripunctatum*; Lewis (1974), including *S. tripunctatum*; Flowers and Hilsenhoff (1975), as *S. tripunctatum*; Bednarik and McCafferty (1979).

Ecology & Habitat (N): Pond/lake, littoral and wave-wash zone; Lewis (1974); Flowers and Hilsenhoff (1975; 1978), Wisconsin; Hubbard and Peters (1978); Bednarik and McCafferty (1979).

Seasonal Occurrence (N): August; (A): July–September.

Biology (N) & (A): Ide (1935c); Needham et al. (1935); Lyman (1955); Huff and McCafferty (1974); McCafferty (1974); Richardson and Tarter (1976); Flowers and Hilsenhoff (1978).

Distribution (A): Ps12 (F), Ps26 (M).

Nearctic Range: SE, NE, C, EC, CC.

### Leptophlebiidae

The Leptophlebiidae are represented in Maine by five genera and 15 species. Except for *Choroterpes (C.) basalis* and *Paraleptophlebia moerens*, most species are widely distributed in a variety of habitats. Peters (1980) summarized the phylogeny of the family and commented on plesiomorphic and apomorphic character states within the group. McCafferty and Edmunds (1979) indicated that, along with the Siphlonuridae, the Leptophlebiidae represent a major stem-group in the evolution of the Ephemeroptera.

Ranges of water quality parameters for *Choroterpes* sp., *Leptophlebia* sp., and *Paraleptophlebia* sp. are provided by Roback (1974). Clifford (1982) characterized life cycle patterns and voltinism of several genera of the Leptophlebiidae.

#### + *Choroterpes (C.) basalis* (Banks), 1900

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); (N): Needham (1905).

Ecology & Habitat (N): Stream orders 3–5, depositional; pond/lake, littoral zone; Needham 1905, New York; Clemens 1915b, Ontario; Lyman (1955; 1956), Michigan.

Seasonal Occurrence (A): May.

Biology (N) & (A): Lyman (1955).

Distribution (A): Southwest Harbor (Procter 1946).

During a recent intensive survey of the mayflies of Mount Desert Island (Mack 1988) an effort was made to recollect the species, but no new specimens were obtained.

Nearctic Range: SE, NE, C, EC.

#### \* *Choroterpes (C.) fusca* Spieth, 1938

Taxonomy (N) & (A): Spieth (1938).

This species is very similar to *Choroterpes (C.) basalis*, but differs from it by the darker coloration of the thorax and abdomen. Slight differences in abdominal maculations are also evident. Comparison of specimens from the type series of both species with new collections indicate that *C. (C.) fusca* is probably a junior synonym of *C. (C.) basalis*, but for now it is retained as a separate species.

Ecology & Habitat (N): Stream orders 2–5, erosional (deepest part of channel under stones); Pond/lake, profundal (under logs and debris).

Nymphs occurred under cobbles, boulders, and woody debris in the deeper parts of quiet stream pools and on the bottom of lakes. In the Stillwater River nymphs occurred on large gravel and cobbles that were resting on the bottom or loosely embedded in small gravel. Nymphs were agile swimmers and quick to avoid light. In the late

summer, parts of the river channel below the dam at Stillwater Ave. became intermittent, forming large pools. Here, nymphs occurred under large pieces of rubble in the deepest water available. In addition, some nymphs were collected from the rubble of pools with bedrock bottoms, which occasionally experienced torrential flow. During times of torrential flow most small and medium-sized substrate particles were scoured from the pool leaving only the larger particles. *Choroterpes (C.) fusca* is one of the few nonburrowing mayflies collected from areas below the littoral zone of lakes.

Seasonal Occurrence (N): July–September; (A): August–September.

Biology (N) & (A): The species appears to be univoltine in Maine.

Nymphs with dark wing pads and adults occurred only in the late summer. Emergence began in late July and continued into early fall. Transition from nymph to subimago took place at the water's surface. New subimagos rafted momentarily on the nymphal exuviae before taking flight. In rearing dishes under natural daylight conditions subimagos emerged between 3:00–7:00 p.m., and by 7:00 a.m. the next morning subimagos had completed their final moult to the imago stage. Adults were active from noon into the later half of the day. Individual males were observed at two locations in September as they flew above sunlit stream pools late in the afternoon.

Distribution (N): P41, S13; (A): Ak35 (M), K1 (M), P41 (M,F), Ps2 (M).

Nearctic Range: NE, EC.

#### *Habrophlebia (H.) vibrans* Needham, 1907

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Edmunds et al. (1976); Berner (1975); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 1–3, erosional (among crevices of larger particles); Edmunds et al. (1976); Hubbard and Peters (1978); Lauzon and Harper (1986), Quebec.

Nymphs occurred among loose rubble and gravel in cool streams. On the larger particles, nymphs clung to grooves and crevices and were difficult to dislodge. Occasionally nymphs were collected from dense *Fontinalis* mats that grew in the current of swift streams.

Seasonal Occurrence (N): May–August; (A): June–July.

Biology (N) & (A): Needham et al. (1935); Harper and Magnin (1971); Harper et al. (1983); Lauzon and Harper (1986).

Subimagos were collected as they clung to blades of grass just above the water on an inundated gravel island in Lazy Tom Stream. Individual adult males were often collected in the vicinity of *Habrophlebiodes americana* swarms. On June 18, 1986, a small swarm of *Habrophlebia (H.) vibrans* was observed about mid-morning in a sunlit clearing along a small stream off Turner Ridge Road, Palermo (site W3).

Distribution (N): Ak4, F5, H1, H2, H9, P8, P22, Ps2, Ps5, Ps7, Ps20, W11, Wn1, Wn4, Wn5; (A): F5 (M), Ps2 (M,F), S4 (F), W3 (M), Wn1 (M,F), Wn5 (M), Wn9 (M), Wn11 (M,F), Wn14 (M).  
Nearctic Range: SE, NE, C, EC.

#### *Habrophlebiodes americana* (Banks), 1903

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Berner (1975).

Ecology & Habitat (N): Stream orders 1–3, erosional with secondary depositional (among smaller particle deposits) areas; Ide (1935b), Ontario; Roback (1974); Hubbard and Peters (1978).

Nymphs occurred in slower flowing areas of streams among gravel and poorly sorted large fine sediment, especially where there were clumps of CPOM trapped between the larger substrate particles.

Seasonal Occurrence (N): April–September; (A): June–August.

Biology (N) & (A): Harper and Harper (1984).

Emergence occurred at the surface of the water from 1:30–3:30 p.m. Subimagoes quickly left the water and took cover among riparian vegetation where they clung to the underside of leaves. Some individuals that emerged near large culverts took refuge inside the culverts. Mating swarms were observed in June and July from 11:00 a.m. through the afternoon. The nucleus of most swarms was composed of 15–20 males, which flew in a quick bobbing or darting motion that spanned about 20 cm. The nucleus remained relatively stationary in bright sunlit areas adjacent to the water. Females formed a diffuse outer shell around the nucleus of males. Mating pairs left the swarm immediately and flew out of sight down the stream.

Distribution (N): H1, H9, K1, P3, P8, Ps2, W11; (A): F5 (M,F), F10 (F), H9 (M), K1 (M,F), P9 (M), Ps2 (M,F), Wn1 (M,F), Wn6 (M), Wn11 (M), Wn13 (M), Wn14 (M), Y4 (M,F).

Nearctic Range: SE, NE, C, EC.

#### *Leptophlebia cupida* (Say), 1823

Taxonomy (N) & (A): Needham et al. (1935), as *Blasturus cupidanus*; Leonard and Leonard (1962); (A): Burks (1953).

Ecology & Habitat (N): Stream orders 1–5, depositional (stream margins); stream backwaters; temporary, flood plain pools; pond/lake, littoral zone; Morgan (1911), as *B. cupidanus* in New York; Traver (1925), New York; Neave (1930), Manitoba; Leonard (1965), Michigan; Clifford (1970a; 1972), Alberta; Hayden and Clifford (1974), Alberta; Hubbard and Peters (1978).

Nymphs occurred among organic detritus of quiet pools, flooded stream margins, and littoral zone vegetation early in the spring. Nymphs using inundated flood plains were often stranded when early season water levels dropped. On one occasion, a mature nymph was collected from a leaf-filled pool that had been isolated from a nearby stream for at least two weeks.

Seasonal Occurrence (N): March-June; (A): April-early June.

Biology (N) & (A): Traver (1925); Lyman (1955); Clifford (1969, 1970a, 1970b); Coleman and Hynes (1970); Harper and Magnin (1971); Clifford and Boerger (1974); Sweeney and Vannote (1978); Clifford et al. (1979); Harper et al. (1983).

Although the biology of this species has been extensively investigated, much remains to be learned about the behavior of nymphs and adults and their interactions with the sympatric species *L. intermedia* and *L. nebulosa*. Early spring emergence occurred from mid-afternoon until dark. As evening temperatures increased in the later part of June, emergence occurred later into the evening. Mating swarms were observed near both lotic and lentic habitats. Lentic populations swarmed over the water and in bright sunlit spots above the shore. Swarms over water usually occurred about 30–40 m offshore (during calm periods when the lake or pond had a very smooth surface) and about 12–15 m above the water. Males flew in a rhythmic rising and falling pattern that spanned about 1 m. Females were observed flying from the shore into the swarm. Mating pairs left the swarm and flew toward the shore where they separated. The females usually oviposited within 2–3 m of the shore. Oviposition was always in sunlit areas; females avoided the shadows of large trees along the shore. Swarms adjacent to lentic habitats usually occurred in bright sunlit spots no more than 5–10 m from the water. No specific swarm markers were obvious, but swarms were usually near some type of tree or shrub. On May 29, 1986, several swarms were observed in the late afternoon near the tops of small trees or shrubs along Moosehead Lake. The behavior of males was similar to that noted for swarms over water.

Swarms observed near lotic habitats were similar to those occurring near the shore of ponds and lakes. Swarming males seemed to prefer sunlit spots near riparian vegetation. Late afternoon sunlight reflected from the concrete support walls of bridges also seems to provide acceptable swarming locations as was observed on May 9, 1987, at the outlet of Third Machias Pond.

Distribution (N): F1, F9, L3, P3, Ps2, Ps22, Ps23, S5, Wn3, Wn14; (A): F1 (M,F), H9, P3 (M,F), P7 (F), P9 (F), P28 (M,F), P36 (M,F), P44

(M), P46 (M,F), Ps4 (M), Ps9 (M,F), Ps13 (M), Ps27 (M,F), S10 (M,F), W2 (F), W11 (F), W13 (F), W16 (F), W17 (F), W18 (F), Wn5 (F), Wn6 (M,F), Wn11 (M), Wn18 (M), Y5 (F).

Nearctic Range: SE, NE, C, EC, CC, WC.

***Leptophlebia intermedia* (Traver), 1932**

Taxonomy (N) & (A): Traver (1932), as *Blasturus intermedius*; Needham et al. (1935), as *B. intermedius*; Berner (1975); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 1–5, depositional (stream margins); stream backwaters; temporary, floodplain pools; pond/lake, littoral zones; Roback (1974); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred among organic detritus and were sympatric with those of *L. cupida* and *L. nebulosa*. Similar to *L. cupida*, nymphs migrated into flooded pools along streams and ponds in the early spring.

Seasonal Occurrence (N): March–June; (A): April–early June.

Biology (N) & (A): Sweeney et al. (1986); Berner and Pescador (1988).

Compared to *L. cupida*, little is known about the life history of this species. Nymphs were larger at the dark wing pad stage than those of either *L. cupida* or *L. nebulosa*. Usually where large numbers of *L. intermedia* occurred, relatively few nymphs of the other two species were found. In May, 1986, emergence occurred about 1:30 p.m. and continued until dark. Subimagoes rafted on the nymphal exuviae for some time before they flew away from the water. Swarms were not observed, but individual males were collected as they flew in the same rhythmic pattern noted for *L. cupida* over dirt roads and in clearings as far as 100 m from permanent water suggesting that the species may swarm inland away from its emergence site.

Distribution (N): F7, H2, H3, H9, H14, H15, H20, K1, P7, P9, P36, P47, Ps5, S11; (A): Ak31 (M,F), H2 (M,F), H4 (M,F), H14 (M,F), H15 (M,F), H19 (M), P2 (M), P9 (M), P28 (M,F), P33 (M,F), P36, Ps2 (F), Ps6 (M,F), Ps12 (M), Ps27 (M,F), W1 (F), W13 (F), W19 (F), W20 (F), Wn5 (M,F).

Nearctic Range: SE, NE.

***Leptophlebia johnsoni* McDunnough, 1924a**

Taxonomy (N) & (A): McDunnough (1924a); Traver (1932), as *Blasturus gracilis*; Needham et al. (1935); (N): Ide (1935a); (A): Burks (1953).

Ecology & Habitat (N): Stream orders 1–4, transitional and depositional areas (occasionally in isolated pools of intermittent streams).

Nymphs occurred among well-sorted small fines in quiet pools

and flooded marshes where there was an accumulation of organic detritus. At site Ps6 several well-developed nymphs were collected from a shallow isolated pool away from the main stream channel. In this pool nymphs seemed unaffected by lower pH, higher specific conductance, and warmer temperatures than those of the adjacent stream. Except for a few *Eurylophella* nymphs, *L. johnsoni* was the only mayfly present in the pool. A search of other nearby pools and the permanent stream failed to produce other specimens.

Seasonal Occurrence (N): April-July; (A): June-early July.

Biology (N) & (A): Nymphs of this species matured later in the spring than any of the other species of *Leptophlebia*. Mature nymphs were collected through July; whereas, nymphs of the other species had molted to the imago by the middle to the end of June. Nymphs were also much smaller at the dark wing pad stage than the other species. Subimagoes emerged at the waters' surface and momentarily rafted on the nymphal exuviae before they took flight. In rearing dishes kept under natural daylight conditions, emergence occurred in the late afternoon. Individual males were collected from 2:30-4:00 p.m. as they flew near the shore of streams and ponds. On May 29, 1986, at Sawyer Pond, Greenville (site Ps12), a male was observed flying in a rhythmic rising and falling pattern about 4 m above the edge of a pond in a sunlit spot among some birch trees.

Distribution (N): Ps6, W11, Wn6; (A): Ak1 (M,F), Bar Harbor (Procter 1946), H16 (M), H25 (M,F), H26 (M,F), H27 (M,F), Ps6 (M,F), Ps12 (M), Wn6 (M).

Nearctic Range: SE, NE, EC, CC.

#### *Leptophlebia nebulosa* (Walker), 1853

Taxonomy (N) & (A): Traver (1932), as *Blasturus nebulosa*; Needham et al. (1935); Leonard and Leonard (1962); (N): Clemens (1913); (A): Burks (1953).

Ecology & Habitat (N): Stream orders 1-3, depositional (stream margins); stream backwaters; temporary floodplain pools and vernal pools; pond/lake, littoral zone; Lyman (1956), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978); Wiggins et al. (1980), Ontario. Nymphs were frequently sympatric with *L. cupida* and *L. intermedia*.

Seasonal Occurrence (N): April and September; (A): April-June.

Biology (N) & (A): Leonard and Leonard (1962); Clifford and Boerger (1974); Boerger and Clifford (1975); Clifford et al. (1979); (N): Ide (1935a).

Little is known about the biology of nymphs; however, nymphs at the dark wing pad stage were usually smaller than those of the other

two sympatric species. Leonard and Leonard (1962) and Boerger and Clifford (1975) have both noted that emergence occurs earlier in the season than that of *L. cupida* and lasts for a much shorter time. This might explain low numbers of nymphs collected at most sites compared to those of either *L. cupida* or *L. intermedia*. Subimagoes reared under natural daylight conditions in the laboratory emerged in the afternoon and early evening. Individual males were often collected in the vicinity of *L. cupida* swarms.

Distribution (N): Ak11, Ak15, Ak18, F1, F7, H9, Ps2, Wn6; (A): Ak1 (F), Ak31 (M,F), F1 (F), K1 (F), H14 (M,F), H23 (M), H24 (M), H25 (M), P2 (M), P9 (F), P24 (M,F), P28 (M,F), P33 (M), P48 (M), Ps6 (F), Ps9 (M), Ps26 (M), W2 (M), W13 (F), W18 (F), W19 (F), W21 (F), Wn6 (M,F).

Nearctic Range: SE, NE, C, EC, CC, WC.

#### \* *Paraleptophlebia adoptiva* (McDunnough), 1929

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); (N): Ide (1930); Corkum (1978), characters for separating nymphs of *P. adoptiva* and *P. mollis*.

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow) areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred among loose gravel and rubble in shallow swift riffles and transitional zones.

Seasonal Occurrence (N): April–June and August; (A): April–early June.

Biology (N) & (A): Harper and Magnin (1971); Corkum (1978); Harper et al. (1983).

Nymphs were sympatric with *P. mollis*, but matured earlier in the spring. *Paraleptophlebia adoptiva* nymphs were large in comparison to other conspecifics except *P. debilis*. In the laboratory nymphs reared at 15°C under simulated photoperiod for May usually completed their molt to the subimago in the afternoon.

Distribution (N): F6, F9, F18, F20, F21, K1, P10, Ps2, Ps5, Ps7, W11, Wn4; (A): F9 (M,F), P3 (M), P7 (F), W2 (M,F), W11 (F), W17 (M).

Nearctic Range: SE, NE, C, EC, CC.

#### *Paraleptophlebia debilis* (Walker), 1853

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Harper and Harper (1986); (N): Ide (1930).

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow) areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred in the loose lower layers (down to about 10 cm) of gravel and poorly sorted large fines in shallow swift riffles and transitional zones. Nymphs were also collected from under *Fontinalis* mats in swift shallow streams east of Moosehead Lake.

Seasonal Occurrence (N): July–August; (A): July–October.

Biology (N) & (A): Lehmkuhl and Anderson (1971); Clifford and Boerger (1974); Harper and Harper (1984).

Nymphs matured in late summer and early fall. Adults were active in the late afternoon and early evening. A mating swarm was observed on July 29, 1986, at the outlet of First Roach Pond in Kokadjo at 7:00 p.m. It formed about 3 m above the riprap along the outlet spillway and near a small shrub. The swarm was composed of 20–30 individuals, which flew in a quick bobbing pattern that spanned about 12–15 cm. Within the swarm, small clusters of 6–10 individuals formed, dispersed, and reformed. This behavior continued until dark, but no females were observed entering the swarm.

Distribution (N): H6, Ps5, Ps8, Wn1, Wn6; (A): Great Heath, Mount Desert Island (Procter 1946), Ps4 (M,F), Ps5 (M,F), Ps14 (M), Ps26 (M).

Nearctic Range: SE, NE, C, SW, NW, EC, CC, WC.

#### *Paraleptophlebia guttata* (McDunnough), 1924c

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); Harper and Harper (1986); (N): Ide (1930).

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow) areas; Leonard (1965), Michigan; Roback (1974); Hubbard and Peters (1978).

Nymphs occurred among loose upper layers of gravel and rubble in swift shallow riffles and transitional zones and were abundant where there were clumps of CPOM trapped between the larger substrate particles. In the upper Carrabassett Valley nymphs were more abundant in the shallow 1st and 2nd order tributaries than the main stem of the river. In the lower valley nymphs were collected from the shallow, well-sorted gravel and sandy areas above the North Anson gorge.

Seasonal Occurrence (N): June–September; (A): June–August.

Biology (N) & (A): In rearing dishes maintained at 15°C under simulated June–July photoperiod, emergence occurred in the afternoon. In the Carrabassett Valley in June and July swarms were observed over small rock-filled pools of 1st order tributaries to the Carrabassett River. Swarms were usually composed of 5–6 males that flew in short bobbing circuits that spanned about 20 cm. Most swarms were observed about 12:00 noon. Streams where swarms were observed

were well shaded by riparian vegetation and swarming males did not seem to seek out the few brighter areas. Swarms were usually only about 1–1.5 m above the stream and frequently occurred over the outlets of small pools.

Distribution (N): Ak1, Ak21, F5, F12, Ps2, Ps7, W7, Wn4, Wn5, S1, S8;  
(A): Ak1 (M), F10 (M,F), H9 (M), S1 (M), Wn4 (F), Wn16 (F).

Nearctic Range: SE, NE, C, EC, CC.

#### *Paraleptophlebia moerens* (McDunnough), 1924c

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); (A): Harper and Harper (1986).

Ecology & Habitat (N): Stream orders 1–2, transitional and depositional areas; Ide (1935b), Ontario.

Seasonal Occurrence (N): September.

Biology (N) & (A): Coleman and Hynes (1970); Grant and Masteller (1984).

In Ontario, Coleman and Hynes (1970) found that *P. moerens* had an early season phenology similar to *P. adoptiva* and that young nymphs did not appear in streams until the fall. The collection of an early instar nymph in the upper St. John drainage system in September agrees with their observations and suggests that Maine populations may be similar to those in adjacent areas of Canada.

Distribution (N): Ak9.

Nearctic Range: SE, NE, C, EC.

#### *Paraleptophlebia mollis* (Eaton), 1871

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); (N): Ide (1930).

Ecology & Habitat (N): Stream orders 1–3, erosional (shallow) areas; Ide (1935b), Ontario; Hubbard and Peters (1978); Kohler (1983), Alberta.

Nymphs occurred in loose upper layers of gravel and rubble in shallow swift streams. Nymphs tolerated a wide range of temperatures and were most abundant where clumps of CPOM were trapped between the larger substrate particles. Although present in most headwater streams, nymphs occurred in greater numbers in higher order streams where they were sympatric with *P. adoptiva*, *P. guttata*, and possibly *P. moerens*.

Seasonal Occurrence (N): May–July & September; (A): May–August.

Biology (N) & (A): Coleman and Hynes (1970); Corkum (1978).

On July 1, 1986, at Little Tomah Stream (site Wn4), subimagoes were collected about 10:00 a.m. from the leaves of birch trees along the stream. In July swarming occurred at dusk and continued in the early evening. Swarms were usually composed of 5–6 males that

flew in a rhythmic rising and falling pattern, which spanned about 1 m. Swarms occurred near streams and close to the ground, usually near grass or tall sedges growing along the stream bank. Females entered the swarms from below, flying in an arc, up through the cluster of males until clasped. The mating pair always exited from the top of the swarm and flew out over the stream. At Little Tomah Stream (site Wn4), females oviposited in the area of a pool just before the turbulent riffle at the pools outlet.

Distribution (N): Ak7, Ak10, Ak11, Ak15, Ak16, Ak18, Ak19, Ak21, Ak22, Ak23, F6, F8, F20, H9, K1, K2, P3, P7, P22, P23, Ps2, Ps10, W2, Wn1, Wn4, Wn11; (A): Ak1 (M,F), F3 (M,F), F7 (M), F8 (M), F13 (M), F20 (M,F), P10 (M), P35 (M), Ps2 (M), Ps4 (M,F), Ps17 (M), Ps18 (M), Wn1 (M,F), Wn4 (M,F).

Nearctic Range: SE, NE, C, EC.

\* *Paraleptophlebia strigula* (McDunnough), 1932

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Leonard and Leonard (1962).

Ecology & Habitat (N): Stream orders 2–3, depositional transitional areas.

One nymph was found among the loose upper layers of gravel, well-sorted large fine sediment, and CPOM in a less turbulent transition area.

Seasonal Occurrence (N): August; (A): July.

Biology (N) & (A): Unknown.

Distribution (N): Wn5; (A): F12 (M).

Nearctic Range: NE, C, EC.

*Paraleptophlebia volitans* (McDunnough), 1924c

Taxonomy (N) & (A): Gordon (1933); Needham et al. (1935); Burks (1953); Berner and Pescador (1988); (N): Ide (1930).

Ecology & Habitat (N): Stream orders 1–3, depositional and transitional areas; Roback (1974); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred among the loose upper layers of gravel, well-sorted large fines, and CPOM at pool outlets and less turbulent areas of transitional zones. On the West Branch of the Sheepscot River, specimens were collected from gravel and sand-filled cracks in the bottom of bedrock pools. More tolerant of warmer temperatures than are other species of *Paraleptophlebia*, this species was common in a wide range of lotic habitats.

Seasonal Occurrence (N): June–August; (A): June–July.

Biology (N) & (A): Harper and Magnin (1971); Harper et al. (1983); Berner and Pescador (1988).

In rearing dishes maintained at 15°C under simulated June-July photoperiod, emergence occurred in the late morning and afternoon. In the field, subimagoes were collected in the morning and afternoon from riparian vegetation and from sedges growing on submerged gravel bars in mid-stream. Adults were active in the late afternoon and swarming occurred just before dusk. On July 3, 1986, a large swarm was observed at Rt. 2 bridge over Sunkhaze Str. (site P17) about 6:00 p.m. It formed about 4 m above the stream near the branches of a large oak on the stream bank. Males flew in a quick rising and falling pattern. Females entered the swarm from below and flew upwards through the males until clasped. Mating pairs exited from the top of the swarm and flew down to within about 2 m of the water. There the pair separated, and the female usually flew upstream; the male returned to the swarm.

Distribution (N): K1, P3, P7, P8, P19, Wn4, Wn5; (A): K1 (F), L1 (M), P8 (M), P13 (M,F), P17 (M,F), P35 (M), Ps2 (M), Wn5 (M).

Nearctic Range: SE, NE, C, EC.

### Potamanthidae

In North America the Potamanthidae are a small family represented by a single genus and eight species. Edmunds et al. (1976) indicated that the family attains its maximum diversity in the Palearctic and Oriental regions. Currently, the taxonomy of Nearctic potamanthids is poorly understood, and the nymphal forms of several species remain unknown. The Potamanthidae are members of the superfamily Ephemeroidea (McCafferty and Edmunds 1979). Because of their internal anatomy and semi-burrowing life style, they are believed to represent an early side-branch of the Ephemeroidea lineage (McCafferty 1979).

Although little has been published on the biology of potamanthids of United States and Canada, Ide (1935a) commented on the life history of *Anthopotamus* (as *Potamanthus*) from Ontario and described a new species that has not yet been reported from the United States. Bartholomae and Meier (1977) studied the nymphal life history and habitat of *A. myops* (as *P. myops*) in Michigan. Munn and King (1987a, 1987b) studied the ecology and life history of both nymphs and adults of *A. myops* (as *P. myops*) in Michigan and commented on swarming behavior.

#### \* *Anthopotamus distinctus* (Traver, 1935)

Taxonomy (N): Traver (1937); McCafferty (1975); McCafferty and Bae (1990). (A): Needham et al. (1935), Traver (1937); Burks (1953); Lord and Meier (1977).

Ecology & Habitat (N): Stream orders 2–4, erosional with secondary depositional areas; Traver (1937), North Carolina.

Nymphs occurred among large fines, gravel, and well-sorted rubble where there was a thin film of small fines covering the substrate in shallow transition zones with moderate flow. In the upper St. John River drainage a few nymphs were collected by Mingo et al. (1979) from gravel in quiet eddies and among aquatic vegetation at stream margins.

Seasonal Occurrence (N): Late May–July and October; (A): June–July.

Biology (N) & (A): In the Aroostook River nymphs with dark wing

pads were collected from the last week in May through June and were only found in shallow water, 2–3 m from the shore; whereas, smaller, less-developed nymphs were evenly distributed across the river bottom. In laboratory rearing dishes maintained under natural daylight conditions nymphs left the water before emergence, which then occurred within 12–15 min. All subimagoes reared in the laboratory emerged between 8:00 and 11:00 p.m., and most molted to the imago within 48 h.

Distribution (N): Ak1, Ak2, Ak5, Ak20; (A): Ak1 (M,F).

Nearctic Range: SE, NE, C.

### Polymitarcyidae

In North America the Polymitarcyidae contains a single genus and two species. However, there has been some question of whether the eastern and western forms are distinct species. The western species intergrades with the eastern species in the upper Mississippi drainage, but they are otherwise separated by the Mississippi River. The polymitarcyids are members of the superfamily Ephemeroidea (McCafferty and Edmunds 1979) and are depicted by McCafferty (1979) as being derived from the Euthyplocciidae, which lack specialized structures for burrowing.

#### *Ephoron leukon* Williamson, 1802

Taxonomy (N) & (A): Ide (1935a); Needham et al. (1935); Burks (1953); (N): McCafferty (1975).

Ecology & Habitat (N): Stream orders 4–5, erosional with secondary depositional areas; Roback (1974); McCafferty (1975); Hubbard and Peters (1978).

Nymphs occurred in deposits of large fines and gravel under rubble in shallow riffles and transitional zones and in deeper less turbulent areas in the lower sections of large rivers.

Seasonal Occurrence (N): July-August; (A): August.

Biology (N) & (A): Ide (1935a); Bratt (1962); Edmunds et al. (1976).

Mature nymphs occurred in large numbers in shallow riffles and runs from the end of July into August. In early August in the Penobscot River at the town of Winn (site P23), a single kick sample usually contained hundreds of nymphs. Emergence and swarming occurred after sunset and almost at the same time. Nymphs were noted by Edmunds et al. (1976) to migrate into shallow water before emergence. Nymphs simply swam to the surface and emergence occurred very quickly. Male subimagoes molted to the imago within a few minutes. Adults were attracted to lights and several hundred could be collected at one time. Swarming seemed to occur continuously from about 8:00 p.m. on and males did not form the typical cluster, but flew rapidly back and forth about 0.5 m above the water searching for females. Females mated, oviposited, and died as subimagoes. This was one of the few species in Maine that exhibited a large synchronous emergence.

Distribution (N): P18, P19, P22, P23; (A): P13 (M,F), P16 (M,F), P19 (M,F), P23 (M,F), P35 (M,F), Y3 (F).

Nearctic Range: SE, NE, C.

### Ephemeridae

In Maine, the Ephemeridae has three genera and eight species. Commonly referred to as the burrowing mayflies, they are typical of lentic or depositional lotic habitats. Most species are abundant and broadly distributed. The Ephemeridae are part of the superfamily Ephemeroidea, which according to McCafferty and Edmunds (1979), originated within the Leptophlebiidae.

In addition to biological references cited for each species, a general synthesis of life cycle patterns and voltinism of the *Ephemera* and *Hexagenia* is provided by Clifford (1982).

#### *Ephemera (E.) guttulata* Pictet, 1843

Taxonomy (N) & (A): Kennedy (1926); Needham et al. (1935); Burks (1953); (N): McCafferty (1975).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas; Ide (1935b), Ontario; McCafferty (1975); Hubbard and Peters (1978).

Nymphs occurred in deposits of well-sorted large fines and small gravel in areas of lesser flow behind rubble and small boulders in riffles and transition zones.

Seasonal Occurrence (N): May–June and September; (A): May–June.

Biology (N) & (A): Kennedy (1926); McCafferty (1975).

Subimagoes reared in the laboratory at 15°C under simulated May photoperiod emerged in the late afternoon. On May 19, 1986, a swarm was observed at dusk about 6–7 m above a stream pool. The swarm was composed of 5–6 males, changed position frequently, and often momentarily dispersed with individuals flying away from the stream close to the ground. After a few minutes, swarming activity resumed above the stream. Females were not collected in or near the swarm. Swarming activity was observed from dusk until 8:00 p.m. when it was no longer possible to see the insects.

Distribution (N): Ak1, Ak2, P3; (A): Ak2 (M), Ak3 (M), P7 (M), P8 (M).

Nearctic Range: SE, NE, EC.

#### *Ephemera (E.) simulans* Walker, 1853

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas and mostly depositional zones; pond/lake, littoral areas; Lyman (1956), Michigan; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Roback (1974); McCafferty (1975); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred in well-sorted small and large fines in pools and transition zones.

Seasonal Occurrence (N): April–June and August–September;  
(A): June–July.

Biology (N) & (A): Ide (1935c); Needham et al. (1935); Spieth (1936),  
Britt (1962); Eriksen (1968); McCafferty (1975); Berner and Pesca-  
dor (1988).

Adults were active from sunset into the evening. On Mount Desert  
Island *E. (E.) simulans* was observed to emerge continually through  
the later half of June at Echo Lake swimming area (Mack 1988). At  
Echo Lake, swarming occurred at dusk about 10 m above the edge  
of the lake.

Distribution (N): Ak17, H12, P22, Ps2, S4, Wn14; (A): F23 (F), H12 (M),  
Ps26 (M,F).

Nearctic Range: SE, NE, C, SW, NW, EC, CC, WC.

#### *Ephemera (E.) varia* Eaton, 1883

Taxonomy (N) & (A): Needham et al. (1935); Burks (1953);  
(N): McCafferty (1975).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary  
depositional areas and mostly depositional zones; Hubbard and  
Peters (1978).

Nymphs occurred in well-sorted large fines and gravel in deposi-  
tional pockets behind large rubble and boulders in riffles and transi-  
tional zones of cool shallow streams. Nymphs also occurred in well-  
sorted small fines and organic debris in deeper pools.

Seasonal Occurrence (N): April–July; (A): June–August.

Biology (N) & (A): Needham et al. (1935)

In the laboratory subimagoes reared under June daylight conditions  
emerged at the water's surface from noon until about 3:30 p.m. and  
immediately attempted flight. Subimagoes molted to imagoes within  
24–48 h during the evening or early morning.

Distribution (N): Ak34, F7, F9, F12, F13, F15, F19, P3, P6, S4, S8,  
Wn13; (A): Ak30 (F), F9 (M,F), F13 (M), F16 (F), F20 (M,F), F22  
(F), Ps26 (F).

Nearctic Range: SE, NE, C, EC.

#### *Litobrancha recurvata* (Morgan), 1913

Taxonomy (N) & (A): Needham et al. (1935), as *Hexagenia recurvata*;  
Spieth (1941b), as *H. recurvata*; Burks (1953), as *H. recurvata*; Le-  
onard and Leonard (1962), as *H. recurvata*; McCafferty (1971;  
1975).

Ecology & Habitat (N): Stream orders 1–3, depositional; pond/lake, fine  
sediments in wave-wash zone; Leonard and Leonard (1962), Michi-  
gan; McCafferty (1975); Hubbard and Peters (1978).

Nymphs occurred in a mixture of well-sorted small fines and

organic debris in pools and along the wave-wash zones of lakes. At Lagoon Brook (site Ps6) a few mature nymphs were collected from thick muck deposits in an isolated pool of an intermittent stream.

Seasonal Occurrence (N): April–June; (A): May.

Biology (N) & (A): Synchronous emergences were common along Moosehead Lake and small streams draining to the lake as indicated by rafts of nymphal exuviae found along the shore and stream banks. On May 28, 1986, imagoes were collected in the late afternoon.

Distribution (N): Ak2, Ak17, Ak18, Ak19, Ak34, H9, Ps5, Ps7, Ps8, S4; (A): Ps1 (M), Ps5 (F).

Nearctic Range: SE, NE, C, EC, CC.

#### *Hexagenia (H.) limbata* Serville, 1829

Taxonomy (N) & (A): Needham et al. (1935); Spieth (1941b); Burks (1953); Leonard and Leonard (1962); McCafferty (1984b), designation of *H. munda* as junior synonym of *H. limbata*; McCafferty and Pereira (1984); Berner and Pescador (1988); (N): McCafferty (1975).

Ecology & Habitat (N): Stream orders 2–5, depositional; Pond/lake, littoral and profundal zones; Lyman (1956), Michigan; Leonard (1965), Michigan; Eriksen (1968), Michigan; Fremling (1970), upper Mississippi drainage; Roback (1974); Boerger and Clifford (1975), Alberta; Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred in thick deposits of well-sorted small fines and organic detritus in quiet pools and transitional zones of streams. In lentic habitats, nymphs occurred in similar fine sediment deposits that extended beyond the littoral zone into deeper water. Large numbers of nymphs with dark wing pads were collected from muck deposits along the banks of the Sunkhaze Stream at the Studmill Rd. (site P3) bridge on July 3 and August 5, 1986.

Seasonal Occurrence (N): June–September; (A): late June–August.

Biology (N) & (A): Fremling (1970); Zimmerman and Wissing (1980); Keltner and McCafferty (1986); Berner and Pescador (1988).

Large synchronous emergences were common on most ponds and lakes throughout the summer. On June 21, 1987, large numbers of females were observed ovipositing on Eskutasis pond after sunset (about 8:45 p.m.).

Distribution (N): Ak18, An3, F2, K1, P3, P9, P27, P36, Ps11, Ps29, W6, Wn3, Wn14; (A): An1 (M), F16 (F), K3 (M), K4 (F), K7 (M), O3 (F), P3 (M,F), P9 (F), P16 (M), P31 (M,F), P42 (M,F), Ps11 (F), Ps25 (F), Ps28 (M), Ps29 (M), S15 (M,F), Wn13 (M,F), Y3 (F).

Nearctic Range: SE, NE, C, EC, CC.

**+ *Hexagenia (H.) limbata affiliata* McDunnough, 1927**

Taxonomy (N) & (A): Spieth (1941b).

Although the subspecies of *H. (H.) limbata* have not been formally synonomized, McCafferty and Pereira (1984) indicated that variation in abdominal color patterns (on which the subspecific determinations were based) are mostly temperature dependent. This suggests, as McCafferty (1975) noted, that subspecific designation within this taxon is unwarranted. Until this question is resolved subspecific names will be listed for older records, but not applied to new collections.

Ecology & Habitat (N): Unknown, but probably similar to *H. (H.) limbata*.

Seasonal Occurrence (A): June–August.

Biology (N) & (A): Lyman (1955).

Distribution (A): Jefferson, Passadumkeag, Woodstock (Spieth 1941b)

Nearctic Range: NE, C, EC.

**\* *Hexagenia (H.) limbata occulta* Walker, 1853**

Taxonomy (N) & (A): Spieth (1941b).

See note under *H. (H.) limbata affiliata* regarding subspecific status within *H. (H.) limbata*.

Ecology & Habitat (N): Unknown, but probably similar to *H. limbata*.

Seasonal Occurrence (A): July.

Biology (N) & (A): Morgan (1911); Neave (1932).

Distribution (A): Ps26 (M).

Nearctic Range: SE, NE, C, EC, CC.

***Hexagenia (H.) rigida* McDunnough, 1924c**

Taxonomy (N) & (A): Needham et al. (1935); Spieth (1941b); Burks (1953); Leonard and Leonard (1962); (N): McCafferty (1975).

Ecology & Habitat (N): Pond/lake, littoral and profundal zones; Neave (1932), Manitoba; Spieth (1941b), Michigan; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan.

Seasonal Occurrence (A): June.

Biology (N) & (A): Neave (1932); Spieth (1941b); Friesen and Flanagan (1976); Friesen et al. (1979).

Distribution (A): S16 (M).

Nearctic Range: SE, NE, C, EC, CC.

### Ephemerellidae

The Ephemerellidae are represented in Maine by six genera and 27 species. Most species are widely distributed in clean lotic habitats, but some occur on the bottom of lakes and in stagnant wetland pools. The Ephemerellidae are part of the superfamily Ephemerelloidea, which is one of three superfamilies comprising the suborder Pannota (McCafferty and Edmunds 1979).

In addition to the life history studies cited for each species, Clifford (1982) provides a general synthesis of life cycle data and comments on voltinism.

#### *Attenella attenuata* (McDunnough), 1925c

Taxonomy (N) & (A): Allen and Edmunds (1961); Allen (1980); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas and transitional areas; Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred among deposits of CPOM, well-sorted large fines, and gravel that was covered with a thin layer of small fines in transitional runs, pools, and reduced flow pockets behind rubble in riffles.

Seasonal Occurrence (N): June–August; (A): June–July.

Biology (N) & (A): Allen and Edmunds (1961); Berner and Pescador (1988).

Subimagoes were collected in June from the underside of leaves of alders and birches along the Sheepscot River (site W2). Individual male imagoes were observed flying in rhythmic rising and falling patterns at sites W1 and W2 in the late afternoon.

Distribution (N): P3, P7, P22, S8, W2 Wn5; (A): W1 (M,F), W2 (M,F), W7 (M,F).

Nearctic Range: SE, NE, C, EC.

#### + *Attenella margarita* (Needham), 1927

Taxonomy (N) & (A): Allen and Edmunds (1961); Allen (1980).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas and transitional runs; Allen and Edmunds (1961); Hubbard and Peters (1978).

Seasonal Occurrence (A): July.

Biology (N) & (A): Hawkins (1985).

The paper by Hawkins (1985) provided information on types of food ingested by specimens from Oregon; nothing is known about the biology of eastern populations.

Distribution (A): H8.

Nearctic Range: NE, SW, NW, EC, WC.

**\* *Dannella simplex* (McDunnough), 1925c**

Taxonomy (N) & (A): Allen and Edmunds (1962a); Allen (1977); McCafferty (1977b); Allen (1980); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 1–4, depositional with secondary erosional areas and transitional runs; Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred on the surface of deposits of well-sorted large fines mixed with some gravel and CPOM that was covered by a thin film of well-sorted small fines. Nymphs were distinctly hairy and were often covered with detritus.

Seasonal Occurrence (N): June–July; (A): July.

Biology (N) & (A): Allen and Edmunds (1962a); Berner and Pescador (1988).

Nymphal exuviae from a recent emergence were collected about mid-morning along the stream margins at site F8 on June 20, 1986. One specimen reared in the laboratory at 15°C under a simulated June-July photoperiod emerged late in the afternoon and completed its final molt within 48 h.

Distribution (N): F8, F12, F13, Ps8; (A): Wn4 (F).

Nearctic Range: SE, NE, C, EC, CC.

***Drunella cornuta* (Morgan), 1911**

Taxonomy (N) & (A): Allen and Edmunds (1962b); Leonard and Leonard (1962); Allen (1980).

Ecology & Habitat (N): Stream orders 1–2, erosional areas; Morgan (1911), New York; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred among large gravel and rubble in shallow swift riffles and among the rubble at the outlets of pools where there were clumps of CPOM trapped between the larger substrate particles.

Seasonal Occurrence (N): June–July; (A): July.

Biology (N) & (A): Subimagos reared in the laboratory at 15°C under simulated June–July photoperiod emerged from late afternoon into early evening.

Distribution (N): Ak17, F3, F8, F10, P22, Wn4, Wn11; (A): F6 (M,F), F8 (F), F10 (M,F), P3 (M).

Nearctic Range: SE, NE, C, EC.

***Drunella cornutella* (McDunnough), 1931b**

Taxonomy (N) & (A): Allen and Edmunds (1962b); Allen (1980).

Ecology & Habitat (N): Stream orders 1–2, erosional areas; Hubbard and Peters (1978).

Nymphs occurred among clean large gravel and rubble in swift shallow riffles.

Seasonal Occurrence (N): June–July and September; (A): July.  
 Biology (N) & (A): A female subimago reared in the laboratory under conditions noted for *D. cornuta* emerged in the late afternoon.  
 Distribution (N): Ak17, F5, F6, F8, F10, Ps2, Ps7, Wn1, Wn3, Wn4, Wn11; (A): Wn1 (F).  
 Nearctic Range: SE, NE, C, EC.

### ***Drunella lata* (Morgan), 1911**

Taxonomy (N) & (A): Allen and Edmunds (1962b); Leonard and Leonard (1962); Allen (1980).

Ecology & Habitat (N): Stream orders 2–5, erosional with secondary depositional areas; Morgan (1911), New York; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan.

Nymphs occurred in deposits of well-sorted large fines and gravel in quiet pockets behind large rubble and boulders in riffles and transitional runs. In the lower Carrabassett River above the North Anson gorge, nymphs were collected from the small gravel patches among the massive deposits of well-sorted large and small fines.

Seasonal Occurrence (N): May–August; (A): July.

Biology (N) & (A): Living nymphs were usually dark green to black with distinctive iridescent marks at the apices of each femur, on the pronotum, and on the eighth and ninth tergites. These marks were similar to those noted for *Leucrocuta* nymphs, which occurred sympatrically with this species. In transport-cups *D. lata* nymphs were observed feeding on small baetid nymphs. Male subimagoes, reared in the laboratory under conditions noted for *D. cornuta*, emerged in the afternoon.

Distribution (N): F8, P3, P8, P23, P37, S1, S8, W7; (A): P3 (M), W7 (M).  
 Nearctic Range: SE, NE, C, EC.

### ***Drunella tuberculata* (Morgan), 1911**

Taxonomy (N) & (A): Allen and Edmunds (1962b); Allen (1980).

Ecology & Habitat (N): Stream orders 3–4, erosional areas; Morgan (1911), New York; Roback (1974); Hubbard and Peters (1978).

Nymphs occurred among large gravel and rubble in swift shallow riffles, especially where the larger substrate particles were covered with a dark green algal film.

Seasonal Occurrence (N): June–July; (A): July.

Biology (N) & (A): A male subimago reared in the laboratory, under conditions noted for *D. cornuta*, emerged in the early afternoon.

Distribution (N): L1, P8, Wn11; (A): L1 (M).

Nearctic Range: SE, NE, EC.

***Drunella walkeri* (Eaton), 1884**

Taxonomy (N) & (A): Allen and Edmunds (1962b); Leonard and Leonard (1962); Allen (1980).

Ecology & Habitat (N): Stream orders 1–3, erosional areas; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan.

Nymphs occurred under rubble (occasionally large gravel) where clumps of CPOM were trapped in swift shallow riffles.

Seasonal Occurrence (N): June–July; (A): July.

Biology (N) & (A): Subimagos reared in the laboratory, under conditions noted for *D. cornuta*, emerged in the early afternoon.

Distribution (N): P3, P7, Wn11; (A): F8 (M), P3 (F).

Nearctic Range: SE, NE, C, EC.

***Ephemerella aurivillii* (Bengtsson), 1908**

Taxonomy (N) & (A): Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 1–3, erosional areas; Ide (1935b), Ontario; Hubbard and Peters (1978).

Nymphs occurred among poorly sorted large gravel and rubble in cool swift riffles.

Seasonal Occurrence (N): May–June and August; (A): May–June.

Biology (N) & (A): Hawkins (1985); Sweeney et al. (1987).

In June 1985, at the Carrabassett River at the Sugarloaf ski area (site F21) subimagos were collected on the outsides of emergence traps in the early morning. One female subimago reared in the laboratory, under condition noted for *D. cornuta*, emerged between 8:00 p.m. and 7:00 a.m.

Distribution (N): Ak15, Ak16, Ak18, F18, F21, Ps5, Ps21, Wn11; (A): F21 (M,F), Ps5 (F).

Nearctic Range: NE, C, SW, NW, A, EC, WC.

***Ephemerella dorothaea* Needham, 1907**

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 1–3, erosional areas; pond/lake, wave-wash zones; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan.

Nymphs occurred among poorly sorted large fines, gravel, and rubble especially where clumps of CPOM were trapped between the larger particles.

Seasonal Occurrence (N): May–July; (A): June.

Biology (N) & (A): Needham et al. (1935); Sweeney and Vannote (1981); Sweeney et al. (1987).

Subimagos were collected on June 25, 1986, about 5:00 p.m. from alders and the interiors of culverts at Lagoon Brk. (site Ps5).

Distribution (N): F1, F8, F10, H2, Ps5, Ps6, Ps7, Ps10, S8, Wn1, Wn2, Wn4; (A): F7 (M), F20 (M), P7 (F), Ps5 (M,F).  
Nearctic Range: SE, NE, C, EC.

***Ephemerella invaria* (Walker), 1853**

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 1–3, erosional areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred among poorly sorted large fines, gravel, and rubble in riffles and transitional runs especially where clumps of CPOM were trapped under the larger particles. Nymphs were sympatric with *E. dorothea*.

Seasonal Occurrence (N): April–June; (A): May–June.

Biology (N) & (A): Sweeney et al. (1987).

Subimagoes reared in the laboratory, under conditions noted for *D. cornuta*, emerged in the early afternoon. On June 9, 1986, swarming was observed in early afternoon in bright sunlit areas above rocky pools at Birch Stream (sites P7 and P9). Males flew in sunlit patches among the branches of alders and other riparian vegetation that overhung the water.

Distribution (N): F6, F21, K1, P3, P7, P10, P37, Ps2, Ps7, Ps8, Wn16; (A): H2 (M,F), P7 (M,F), Ps2 (F), Ps8 (M), Wn1 (F).

Nearctic Range: SE, NE, C, EC.

***Ephemerella needhami* McDunnough, 1925a**

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas; pond/lake outlets, erosional areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred on large gravel, rubble, and boulders that were covered with dense patches of filamentous green algae or a thick periphyton film. Nymphs were especially abundant in these habitats at the outlet of Sheepscot Pond and below the outlet pipe of the Palermo Fish Culture Station (site W2).

Seasonal Occurrence (N): May–June; (A): June.

Biology (N) & (A): Needham et al. (1935); McShaffrey and McCafferty (1988).

In June at the East Branch Sheepscot River at Palermo Fish Hatchery (sites W2 and W7), subimagoes were collected about 12:00 noon from alder and birch trees. Most specimens were taken from trees

about 12–15 m from the river. In the field subimagoes usually molted to the imago within 12 h.

Distribution (N): P7, W2; (A): W2 (M,F), W7 (M,F).

Nearctic Range: SE, NE, C, EC.

#### *Ephemerella rotunda* Morgan, 1911

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1965); Allen (1980); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 1–3, erosional; pond/lake outlets, erosional areas; Leonard and Leonard (1962), Michigan; Hubbard and Peters (1978).

Nymphs occurred among gravel and rubble especially where there were dense patches of filamentous green algae and clumps of CPOM trapped between the particles. This species was sympatric with *E. invaria* and *E. dorothea*.

Seasonal Occurrence (N): April–June; (A): May–June.

Biology (N) & (A): Needham et al. (1935); Sweeney et al. (1987).

Individual male imagoes were collected over pools and riffles at pool outlets in the late afternoon and early evening.

Distribution (N): F7, K1, P3, P7, P8, P37, Ps2, Ps8, W2, Wn11; (A): P23 (M), P35 (M), P45 (M), Wn4 (M).

Nearctic Range: SE, NE, C, EC.

#### *Ephemerella septentrionalis* McDunnough, 1925a

Taxonomy (N) & (A): Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 1–2, depositional with secondary erosional areas (usually among filamentous algae and FPOM).

Nymphs occurred on substrates of well-sorted large fines and small gravel that were covered by a film of organic debris (both CPOM and FPOM) and filamentous algae that combined to form a flocculent cover.

Seasonal Occurrence (N): April–June; (A): June.

Biology (N) & (A): Sweeney et al. (1987).

Nymphs were hairy and often covered with organic debris. Nymphs collected from Tussel Brook (site Ps10) were observed feeding on the long strands of algae that grew up from the substrate.

Distribution (N): F20, H9, P3, Ps8, Ps10, Wn4; (A): F20 (M), P3 (M).

Nearctic Range: SE, NE, EC.

#### *Ephemerella subvaria* McDunnough, 1925b

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1965); Allen (1980).

Ecology & Habitat (N): Stream orders 1–3, erosional areas; Ide (1935b), Ontario; Leonard and Leonard (1962), Michigan; Leonard (1965),

Michigan; Hubbard and Peters (1978).

Nymphs occurred among clean gravel and rubble in swift riffles and transitional runs. Nymphs were sympatric with *E. dorothea*, *E. invaria*, and *E. rotunda*.

Seasonal Occurrence (N): April–May; (A): May–June.

Biology (N) & (A): Ide (1935c); Sweeney and Vannote (1978; 1981); Harper and Harper (1984); Sweeney et al. (1987).

Although nymphs were sympatric with several other species of *Ephemerella*, the species seemed to be temporally separated by having peak emergence earlier in the spring than the other species. Mature nymphs with dark wing pads occurred in many streams soon after ice-out. Subimagos and imagos were found on the undersides of leaves away from the stream banks. Adults were active in the late afternoon and early evening on June 17, 1986, individual males were observed flying about sunset in rhythmic rising and falling patterns above riffles.

Distribution (N): Ak7, Ak8, Ak15, Ak20, Ak22, Ak23, F9, K1, K2, P3, P7, P22, P37, Ps2, Wn11; (A): P3 (M,F), W2 (M,F).

Nearctic Range: SE, NE, C, EC.

#### *Eurylophella aestiva* (McDunnough), 1931a

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Funk et al. (1988).

Only mature nymphs can be determined with certainty.

Ecology & Habitat (N): Stream orders 1–2, depositional areas; Pond/lake, wave-wash and littoral zones; Hubbard and Peters (1978).

Nymphs occurred on substrates ranging from well-sorted small fines and FPOM to well-sorted large fines, small gravel, and CPOM.

Nymphs were sympatric with *E. bicolor*, *E. funeralis*, *E. prudentalis*, *E. temporalis*, and *E. verisimilis*.

Seasonal Occurrence (N): April–August; (A): June–July.

Biology (N) & (A): Funk et al. (1988).

Subimagos reared in the laboratory, at 15°C under simulated June-July photoperiod, emerged between mid-morning and late afternoon. Emergence occurred at the water's surface.

Distribution (N): H8, H9, K1, Wn9; (A): K1 (M), Ps2 (F), Ps8 (M).

Nearctic Range: SE, NE, C, EC.

#### *Eurylophella bicolor* (Clemens), 1913

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Funk et al. (1988).

Ecology & Habitat (N): Stream orders 1–2, depositional areas; pond/lake, wave-wash and littoral zones; Ide (1935b), Ontario; Roback (1974); Hubbard and Peters (1978).

Nymphs were particularly abundant along the wave-wash zones of ponds and lakes.

Seasonal Occurrence (N): May–July and September; (A): June–July.  
Biology (N) & (A): Lyman (1955); Funk et al. (1988).

Populations in Maine seem to be univoltine. After the disappearance of nymphs during August, small nymphs appeared in streams and lakes in September. Subimagoes reared in the laboratory, under conditions noted for *E. aestiva*, emerged from mid-afternoon into the evening.

Distribution (N): Ak7, Ak8, Ak10, Ak11, Ak12, Ak17, Ak21, Ak23, F9, P5, P22, Ps8, S6, S8, Wn3, Wn10; (A): F20 (M,F), P13 (F).

Nearctic Range: SE, NE, C, EC.

#### *Eurylophella coxalis* (McDunnough), 1926a

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980).

Ecology & Habitat (N): Hubbard and Peters (1978).

This species has rarely been reported since it was first described by McDunnough (1926a). Only a few specimens were collected from an isolated pool of an intermittent stream. In the pool, nymphs occurred among rubble covered with well-sorted small fines and a mixture of FPOM and CPOM. The pool was not spring fed and seemed to be maintained by rainfall and seepage from a nearby swamp.

Seasonal Occurrence (N): June–July.

Biology (N) & (A): Unknown.

Distribution (N): Oquossoc (Allen and Edmunds 1963b), Ps6.

Nearctic Range: SE, NE, E, EC.

#### *Eurylophella funeralis* (McDunnough), 1925b

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Funk et al. (1988).

Ecology & Habitat (N): Stream orders 1–2, erosional with secondary depositional areas; Hamilton and Tarter (1977), West Virginia; Hubbard and Peters (1978).

Nymphs occurred among loose upper layers of poorly sorted large fines, gravel, and rubble with small clumps of trapped CPOM under the larger particles in riffles and transitional runs. Nymphs were collected from Little Birch Stream (site P10) which had a pH of 5.85 on August 5, 1986.

Seasonal Occurrence (N): May–July and September; (A): June.

Biology (N) & (A): Hamilton and Tarter (1977); Fiance (1978); Sweeney and Vannote (1978; 1981; 1987); Funk et al. (1988).

Although this species has been reported by Fiance (1978) to be semi-voltine, no indication of this was shown from Maine collec-

tions. Nymphs were abundant in small shallow streams.

Distribution (N): Ak10, Ak17, Ak18, Ak19, F6, H5, P7, P10, Ps2, Ps5, Ps7, Ps8, Wn1, Wn2; (A): P7 (F).

Nearctic Range: SE, NE, C, EC.

\* *Eurylophella minimella* (McDunnough), 1931a

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Funk et al. (1988).

Ecology & Habitat (N): Stream order 2, erosional (outlet of pool) areas; Hubbard and Peters (1978).

Nymphs occurred among well-sorted large fines, gravel, rubble, and clumps of CPOM that was trapped between the larger particles in transitional runs.

Seasonal Occurrence (N): June.

Biology (N) & (A): Coleman and Hynes (1970); Funk et al. (1988).

Only a few nymphs from Little Tomah Stream (site Wn4) were positively determined to be *E. minimella*.

Distribution (N): Wn4.

Nearctic Range: SE, NE, C, EC.

*Eurylophella prudentalis* (McDunnough), 1931a

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Funk et al. (1988).

Ecology & Habitat (N): Stream orders 1–3, depositional with secondary erosional areas; pond/lake, wave-wash and littoral zones (among plant debris); Hubbard and Peters (1978).

Nymphs occurred on substrates composed of a mixture of well-sorted small fines and both FPOM and CPOM. In ponds and lakes, nymphs were collected from the lower limits of the littoral zone up into the wave-wash area. Nymphs were especially abundant among CPOM at the edges of stream pools, ponds, and lake margins.

Seasonal Occurrence (N): May–June; (A): May–July.

Biology (N) & (A): Harper and Harper (1984); Funk et al. (1988).

In the field subimagoes were collected in the early afternoon from sedge stems and leaves that protruded just above the water on inundated gravel islands at the outlet of a pool at site Ps2.

Distribution (N): K1, Wn6; (A): Ak1 (M,F), F1 (M), F2 (M), F20 (M), H14 (M), P7 (M), P8 (M), P13 (M), Ps2 (M), W2 (M), Wn6 (M).

Nearctic Range: SE, NE, C, EC.

*Eurylophella temporalis* (McDunnough), 1924a

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Berner (1984); Funk et al. (1988).

Ecology & Habitat (N): Stream orders 1–5, erosional and depositional areas; pond/lake, wave-wash and littoral zones; wetlands; stream

backwaters; Lyman (1956), Michigan; Leonard and Leonard (1962), Michigan; Roback (1974); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred on a wide variety of substrates ranging from gravel and rubble in streams to well-sorted small fines and CPOM in ponds and lakes. *Eurylophella temporalis* was one of the few mayflies collected from marshes and swamps. It was especially abundant in stream backwaters and wetlands that were flooded in the early spring.

Seasonal Occurrence (N): April–July; (A): May–July.

Biology (N) & (A): Lyman (1955); Berner and Pescador (1988); Funk et al. (1988).

Subimagoes reared in the laboratory, under conditions noted for *E. aestiva*, emerged from mid-afternoon through early evening.

Distribution (N): F1, F2, F9, F13, H4, H14, H15, P4, P5, P9, Ps5, Ps8, S2, S5, S6, S7, S8, W1, W4, W5, W6, Wn1, Wn3, Wn4, Wn10, Wn13; (A): F20 (F), H14 (M,F), P2 (F), Ps8 (F), W1 (F), Wn6 (M).

Nearctic Range: SE, NE, C, EC.

#### *Eurylophella verisimilis* (McDunnough), 1930

Taxonomy (N) & (A): McDunnough (1931a); Allen and Edmunds (1963b); Allen (1980); Berner and Pescador (1988); Funk et al. (1988).

Ecology & Habitat (N): Stream orders 1–3, depositional areas.

Nymphs occurred on well-sorted small and large fines covered with organic debris (mixture of FPOM and CPOM) in pools and quiet areas along stream margins.

Seasonal Occurrence (N): May–July and September; (A): June–July.

Biology (N) & (A): Sweeney and Vannote (1981); Harper et al. (1983); Sweeney et al. (1987); Funk et al. (1988).

Subimagoes reared in the laboratory, under conditions noted for *E. aestiva*, emerged from noon through the late afternoon. Adults were collected in the field in the late afternoon.

Distribution (N): Ak9, F8, P8, Ps6, Wn1, Wn6, Wn3, Wn16; (A): F1 (F), F13 (M), Ps5 (M,F), Ps8 (M).

Nearctic Range: SE, NE, C, EC.

#### *Serratella deficiens* (Morgan), 1911

Taxonomy (N) & (A): Leonard and Leonard (1962); Allen and Edmunds (1963a); Allen (1980); Berner and Pescador (1988).

Ecology & Habitat (N): Stream orders 1–4, erosional with secondary depositional areas; Morgan (1911), New York; Ide (1935b), Ontario; Berner and Allen (1961); Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Roback (1974); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred among large fines, gravel, and rubble in depositional pockets behind large pieces of rubble and boulders. Nymphs were especially common among clumps of CPOM trapped between the particles in these pockets. They also occurred in dense mats of *Fontinalis* that grew on small boulders in riffles.

Seasonal Occurrence (N): June–August; (A): June–August.

Biology (N) & (A): Coleman and Hynes (1970); Sweeney and Vannote (1981).

Subimagoes reared in the laboratory, under conditions noted for *E. aestiva*, emerged from about 9:30 a.m. through noon. In the field adults were collected from noon until dark on vegetation along streams. Individual males were collected in sunlit spots above riffles just before sunset. Usually only 2–3 males were observed at one time, and these did not stay together in a group. Rhythmic flight consisted of quick vertical rising and falling movements repeated 3–4 times in succession. At the end of a series of movements, if no female appeared, the individual flew a short distance away and began again. After mating, females oviposited in the riffle below the male, or flew away downstream.

Distribution (N): F6, F13, K1, P3, P8, P22, S1, W4, W7, Wn1, Wn11;

(A): K1 (M), L1 (M), P3 (F), Ps2 (M), S1 (M,F), W2 (M), Wn1 (M).

Nearctic Range: SE, NE, C, EC.

#### \* *Serratella serrata* Morgan, 1911

Taxonomy (N) & (A): Allen and Edmunds (1963a); Allen (1980).

Ecology & Habitat (N): Stream orders 3–4, erosional with secondary depositional areas; Morgan (1911), New York; Ide (1935b), Ontario; Berner and Allen (1961); Hubbard and Peters (1978).

Nymphs occurred among poorly sorted large fines and gravel in depositional pockets behind and under large rubble and boulders in shallow swift riffles of large streams and rivers.

Seasonal Occurrence (N): July.

Biology (N) & (A): Sweeney and Vannote (1981).

Distribution (N): L1, S1.

Nearctic Range: SE, NE, C, EC.

#### *Serratella serratoides* (McDunnough), 1930

Taxonomy (N) & (A): Allen and Edmunds (1963a); Allen (1980).

Ecology & Habitat (N): Stream orders 2–4, erosional with secondary depositional areas; Berner and Allen (1961); Hubbard and Peters (1978).

Nymphs occurred among poorly sorted large fines, gravel, and rubble in quiet pockets behind large pieces of rubble and boulders and occasionally in patches of filamentous green algae growing on

the sides and tops of boulders.

Seasonal Occurrence (N): July–August; (A): July–August.

Biology (N) & (A): Subimagos reared in the laboratory, under conditions noted for *E. aestiva*, emerged in the late afternoon and early evening. Imagos were active from dusk into the evening. On July 11 and August 4, 1986, several male imagos were collected from lights on the University of Maine campus in Orono from 9:00–9:30 p.m.

Distribution (N): L2, P3, W7; (A): P16 (M), P30 (M), Ps2 (M).

Nearctic Range: SE, NE, EC.

+ *Serratella sordida* (McDunnough), 1925c

Taxonomy (N) & (A): Allen and Edmunds (1963a); Allen (1980).

Ecology & Habitat (N): Stream order 3, erosional areas (?); Berner and Allen (1961); Hubbard and Peters (1978).

Seasonal Occurrence (A): July.

Biology (N) & (A): Unknown.

Distribution (A): Wn10.

Nearctic Range: SE, NE, C, EC.

### Tricorythidae

The Tricorythidae are represented in Maine by one genus and four species. Because of its southern origin, the family attains its greatest diversity in the Neotropical and Ethiopian regions. In the Nearctic region only the Leptocephinae are present and within this taxon *Tricorythodes* is the smallest genus. The Tricorythidae are members of the Ephemeroelloidea (McCafferty and Edmunds 1979) and are generally thought to have originated within the Ephemeroellidae. Recently, Landa and Soldan (1985) proposed a modified higher classification of the Ephemeroptera based on their study of internal anatomy. They proposed that Leptocephinae be split off from the Tricorythidae as a new family, the Leptocephidae. This change in classification has not been widely accepted by mayfly workers in the United States. In a recent book on immature insects (Stehr 1987), Edmunds and Allen noted this change, but did not include it in their classification, key, or discussion of North American genera.

In addition to life history studies cited for each species, Clifford (1982) provided a general synthesis of life cycle data and comments on voltinism. Supplemental ecological data on water quality tolerances for *Tricorythodes* spp. are given by Roback (1974).

#### \* *Tricorythodes allectus* Needham, 1905

Taxonomy (A): McDunnough (1931c); Needham et al. (1935).

McDunnough (1931c) discussed the similarities between this species and *T. atratus* and suggested that *T. atratus* is probably a junior synonym of *T. allectus*. Nymphs of Nearctic *Tricorythodes* are not yet identifiable to species without associated adults.

Ecology & Habitat (N): Stream orders 1–5, depositional and transitional areas; Morgan (1911), New York; Lyman (1956), Michigan; Hubbard and Peters (1978)

Seasonal Occurrence (A): August–September.

Biology (N) & (A): Subimagoes were collected on August 10, 1986, from 8:00–9:30 p.m. with a portable UV-light. Subimagoes collected about 9:00 p.m. molted to the imago between 6:30–7:00 a.m. next morning and were dead by 9:00 a.m. One swarm was observed on August 13, 1986, at 8:30 a.m. at Tomah Stream at Rt. 6 bridge (site Wn5). Males formed a loose cluster over the shallow outlet of a pool. The prenuptial flight of males was most distinctive. The pattern consisted of a series of rhythmic rising and falling motions that became progressively shorter in amplitude as the individuals moved horizontally about 2–3 m. At this point the males discontinued rhythmic flight and repositioned themselves near the starting point and repeated the pattern. By 10:00 a.m. the swarm had dispersed and only one female had appeared during the 1 1/2 h the swarm was

observed. Swarming occurred in bright sunlight directly over the water, and no swarm markers were obvious.

Distribution (A): F12 (M,F), P8 (M), P13 (M), P35 (M), Wn5 (M).  
Nearctic Range: SE, NE, C.

### *Tricorythodes atratus* McDunnough, 1923

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953). See *T. allactus* for note on possible synonymy.

Ecology & Habitat (N): Stream orders 1–5, erosional with secondary depositional areas, depositional, and transitional areas; Ide (1935b), Ontario; Hall et al. (1975; 1980), Minnesota; Edmunds et al. (1976).

Nymphs occurred on deposits of small fine sediment and gravel covered with FPOM and CPOM in quiet areas along stream margins and in pools. Nymphs were often covered with organic debris and were difficult to see until they moved.

Seasonal Occurrence (A): July–September.

Biology (N) & (A): Lyman (1955); Hall et al. (1975; 1980); Edmunds et al. (1976); Sweeney and Vannote (1978); Harper et al. (1983); Edmunds and McCafferty (1988).

In the field several subimagoes were collected using a portable UV-light. Imagoes did not live more than 3–4 h after emergence.

Distribution (A): F21 (M), K1 (M,F), P35 (M).

Nearctic Range: NE, C, EC.

### *Tricorythodes minutus* Traver, 1935

Taxonomy (A): Needham et al. (1935); Edmunds et al. (1976)

Edmunds et al. (1976) discussed the status of this species and *T. fallax*. They conclude that *T. fallax* is a junior synonym of *T. minutus*.

Ecology & Habitat (N): Erosional with secondary depositional areas, depositional, and transitional areas; Edmunds et al. (1976); Hubbard and Peters (1978); Newell and Minshall (1978), Idaho-Utah; Harper and Harper (1984), Ontario.

Nymphs occurred on large fine sediment and gravel covered with a thin layer of CPOM in quiet areas along stream margins, transitional runs and in pools. Nymphs were often covered in detritus and usually could not be seen unless they moved.

Seasonal Occurrence (A): August–September.

Biology (N) & (A): Edmunds et al. (1976); Newell and Minshall (1978); Edmunds and McCafferty (1988).

Distribution (A): F12 (M), H9 (M), L2 (M), P23 (M), P35 (M,F), Ps17 (M), Wn4 (M), Wn14 (M).

Nearctic Range: NE, SW, NW, CC.

**\* *Tricorythodes stygiatus* McDunnough, 1931c**

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas; Leonard and Leonard (1962), Michigan.

Seasonal Occurrence (A): August–September.

Biology (N) & (A): Subimagoes reared in the laboratory, under natural daylight conditions, emerged in the early evening. Nymphs swam to the water's surface and the subimago burst out onto the surface film. Male subimagoes completed their final molt by 6:00 a.m.

Distribution (A): F20 (M,F), Wn16 (M).

Nearctic Range: SE, NE, C, EC.

### Caenidae

The Caenidae are represented in Maine by two genera and seven species. Closely related to the Neoephemeridae, McCafferty and Edmunds (1979) place Caenidae with Neoephemeridae in the superfamily Caenoidea. Widely distributed throughout the Nearctic, caenids are common in most lentic habitats.

In addition to specific life history information cited for each species, Clifford (1982) provided a general synthesis of life cycle data for the genus and comments on voltinism. Supplemental ecological data on water quality tolerances for *Caenis* spp. are provided by Roback (1974).

#### *Brachycercus lacustris* (Needham), 1908b

Taxonomy (N) & (A): Needham et al. (1935); Leonard and Leonard (1962); (N): Soldan (1986).

Ecology & Habitat (N): Stream orders 2–5, depositional with secondary erosional areas and transitional areas; Lyman (1956), Michigan; Leonard and Leonard (1962), Michigan; Roback (1974); Hubbard and Peters (1978).

Nymphs sprawled on well-sorted fine sediment substrates covered with a thin layer of FPOM and were usually covered with mixed organic debris.

Seasonal Occurrence (N): June–August; (A): August.

Biology (N) & (A): Lyman (1955).

The species is known primarily from nymphs; only one adult specimen has been reared (Mingo and Gibbs 1980).

Distribution (N): F13, P3, P22, Wn14; (A): Wn14 (M).

Nearctic Range: NE, C, EC.

#### *Caenis amica* Hagen, 1861

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Provonsha (1990).

Provonsha (1990) placed *Caenis simulans* as a new junior synonym of *C. amica*.

Ecology & Habitat (N): Stream orders 2–5, depositional and transitional among plants; pond/lake, littoral zone; Lyman (1956), Michigan; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Hubbard and Peters (1978).

Nymphs occurred on well-sorted fine sediment substrates covered with CPOM and FPOM and around the stems and roots of aquatic macrophytes. Nymphs were often covered with organic debris.

Seasonal Occurrence (N): June–August; (A): June–August.

Biology (N) & (A): Lyman (1955); Boerger and Clifford (1975); Sweeny and Vannote (1978); Harper et al. (1983); Corkum (1985).

On August 16, 1986, emergence occurred from 7:00 p.m. into the late evening at Birch Stream (site P13). Nymphs floated to the

surface and the subimagoes emerged quickly. Most rested on the water's surface for a few minutes before taking flight. Subimagoes molted to imagoes 5-6 minutes after arriving at the UV-light. After molting imagoes flew out of sight over the water. On August, 10, 14, and 26, 1986, emergence occurred from the West Branch of the Sheepscot River, Birch Stream, and Moosehead Lake (sites K1, P13, and Ps11) after sunset and continued into the evening. Subimagoes and imagoes were readily attracted to lights and most specimens were collected by using a portable UV-light.

Distribution (A): F2 (M,F), K1 (M,F), K5 (M,F), P4 (M,F), P8 (M,F), P13 (M,F), P16 (M,F), P23 (M), Ps 11 (M,F), Wn 5 (F).

Nearctic Range: SE, NE, C, SW, NW, EC, CC, WC.

#### *+Caenis anceps* Traver, 1935

Taxonomy (N) & (A): Provonsha (1990); (A) Traver (1935).

Ecology & Habitat (N): Stream order 5, depositional (well-sorted sand and gravel) with secondary erosional areas; Hubbard and Peters (1978); Provonsha (1990).

Provonsha (1990) notes that this species rarely occurs in ponds and lakes.

Seasonal Occurrence: (N) August; (A) Unknown.

Provonsha (1990) indicates adults emerge, in general, from mid-July through mid-September.

Biology (N) & (A): Provonsha (1990).

Distribution (N): K8.

Nearctic Range: SE, NE, C.

#### *Caenis diminuta* Walker, 1853

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953); Berner and Pescador (1988); Provonsha (1990).

Ecology & Habitat (N): Stream orders 2-5, depositional; pond/lake, littoral; stream backwaters; wetlands, marshes and swamps; Edmunds et al. (1976); Hubbard and Peters (1978); Berner and Pescador (1988), Florida.

Nymphs occurred in ecological conditions similar to those noted for *C. amica*, but they also occurred on well-sorted fines and organic debris in a variety of wetland habitats. *Caenis diminuta* occurred more frequently in stagnant pools and small ponds than any of the other species of *Caenis* found in Maine.

Seasonal Occurrence (N): June-August; (A): June-August.

Biology (N) & (A): Edmunds et al. (1976); Berner and Pescador (1988).

On July 29, 1986, at Moosehead Lake (site Ps11) emergence occurred at the water's surface from sunset until about 10:30 p.m. Subimagoes molted to the imago within a few minutes. Swarming occurred almost simultaneously with emergence. Males did not

form small clusters, but were spread out in a diffuse cloud that was about 1-3 m above the water. Females entered the swarm from all directions.

Distribution (A): F1 (M,F), H14 (M,F), K5 (M), P2 (M,F), P4 (M,F), Ps2 (M,F), W1 (F), W5 (M,F), Wn3 (M,F), Wn4 (M,F).

Nearctic Range: SE, NE, EC.

### *Caenis latipennis* Banks, 1907

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953); Leonard and Leonard (1962); Provonsha (1990).

Provonsha (1990) placed *Caenis jocosa* and *C. forcipata* as new junior synonyms of *C. latipennis*.

Ecology & Habitat (N): Stream orders 2-5, depositional; lake, littoral zone; Leonard and Leonard (1962), Michigan; Hubbard and Peters (1978).

Seasonal Occurrence (N): June-August; (A): June-August.

Biology (N) & (A): Harper and Harper (1984).

On July 29, 1986, male imagos were collected at about 10:30 p.m. using a portable UV-light at Rowell Cove on Moosehead Lake (site Ps11).

Distribution (A): K5 (M,F), P8 (M), P23 (M), Ps11 (M,F), Ps26 (M,F), S14 (M).

Nearctic Range: SE, NE, C, EC, CC.

### \* *Caenis punctata* McDunnough, 1931c

Taxonomy (A): McDunnough (1931c); Needham et al. (1935); Burks (1953).

Ecology & Habitat (N): Stream orders 2-5, depositional and transitional area.

Seasonal Occurrence (N): July-August; (A): July-August.

Biology (N) & (A): Adults were collected in the vicinity of stream pools.

On August 6, 1986, several male and female imagos were attracted to a portable UV-light about 8:30 p.m. at Birch Stream (site P8).

Distribution (A): Ak30 (M,F), P8 (M,F), P23 (M).

Nearctic Range: NE, EC.

### \* *Caenis tardata* McDunnough, 1931c

Taxonomy (A): McDunnough (1931c); Needham et al. (1935).

Ecology & Habitat (N): Stream orders 2-4, depositional and transitional areas.

Seasonal Occurrence (N): July-August; (A): July-August.

Biology (N) & (A): On August 6, 1986, at Birch Stream (site P8) both subimagos and imagos were attracted to a portable UV-light used with a white reflector.

Distribution (A): F12 (M,F), K6 (M,F), P8 (M,F), P13 (M,F).

Nearctic Range: NE, CC, WC.

### Baetiscidae

The Baetiscidae are endemic to the Nearctic region and contain a single genus and 12 species. In Maine five species were present and were mostly restricted to western and northern parts of the state. As a branch of the ephemerellid lineage, McCafferty and Edmunds (1979) placed Baetiscidae in the superfamily Prosopistomatoidea. Landa and Soldan (1985), in their revision of the higher classification of the Ephemeroptera, placed the Prosopistomatoidea under the Caenoidea, based on their study of internal anatomy. As with the Tricorythidae, this change does not seem to have gained wide acceptance among American mayfly workers.

General information on the biology of *Baetisca* is provided by Pescador and Peters's (1974) study of *B. rogersi*. Clifford (1982) summarizes information on voltinism.

#### \* *Baetisca berneri* Tarter & Kirchner, 1978

Taxonomy (N) & (A): Pescador and Berner (1981); (N): Tarter and Kirchner (1978).

Ecology & Habitat (N): Stream orders 2–3; Tarter and Kirchner (1978), West Virginia; Pescador and Berner (1981), Florida; Tarter et al. (1982), West Virginia.

Seasonal Occurrence (N): September.

Biology (N) & (A): Pescador and Berner (1981).

Distribution (N): O1.

In Maine, the species is known from a single specimen (collector was not given).

Nearctic Range: SE, NE.

#### \* *Baetisca carolina* Traver, 1931

Taxonomy (N) & (A): Traver (1931); Pescador and Berner (1981).

Ecology & Habitat (N): Stream orders 3–4, depositional and transitional areas; Traver (1931), North Carolina; Hubbard and Peters (1978); Pescador and Berner (1981), Florida; Tarter et al. (1982), West Virginia.

Nymphs occurred on deposits of well-sorted large fines and gravel behind large pieces of rubble and boulders in shallow pools and transitional areas. Most deposits of this type occurred in quiet areas near the stream margins.

Seasonal Occurrence (N): May–June; (A): June.

Biology (N) & (A): Traver (1931); Pescador and Berner (1981).

Distribution (N): Ak1; (A): Ak1 (F).

Nearctic Range: SE, NE, EC.

***Baetisca lacustris* McDunnough, 1932**

Taxonomy (N) & (A): Pescador and Berner (1981); (N): Hilsenhoff (1984).

Ecology & Habitat (N): Stream orders 2–3, depositional and transitional areas; Roback (1974); Hubbard and Peters (1978), as *B. bajkovi*; Pescador and Berner (1981), Florida; Tarter et al. (1982), West Virginia.

Nymphs occurred on well-sorted large fines in pools and among the stems of aquatic macrophytes in shallow quiet areas along stream margins.

Seasonal Occurrence (N): September.

Biology (N) & (A): Unknown.

Distribution (N): Ak2, Ak7, Ak16, AK18.

Nearctic Range: NE, C, EC, CC.

***Baetisca laurentina* McDunnough, 1932**

Taxonomy (N) & (A): Leonard and Leonard (1962); Pescador and Berner (1981); Berner and Pescador (1988); (N): Hilsenhoff (1984).

Ecology & Habitat (N): Stream orders 3–4, depositional; pond/lake, wave-wash zone; stream backwaters; Leonard and Leonard (1962), Michigan; Leonard (1965), Michigan; Pescador and Berner (1981); Berner and Pescador (1988), Florida.

Nymphs occurred on well-sorted large fines covered with a thin layer of mixed organic debris and among organic debris around aquatic macrophytes along stream margins.

Seasonal Occurrence (N): April–June; (A): May–June.

Biology (N) & (A): Pescador and Berner (1981); Berner and Pescador (1988).

Subimagoes reared in the laboratory, under natural daylight conditions, emerged from mid-morning until mid-afternoon. On June 4, 1986, several nymphal exuviae were found clinging to sedge stems in the flooded meadows along Tomah Stream indicating a recent emergence.

Distribution (N): Ak7, Ak11, F1, Ps8, Wn6, Wn11, Wn14, ; (A): F1 (M), Wn6 (M,F).

Nearctic Range: SE, NE, C, EC, CC, WC.

***Baetisca rubescens* (Provancher), 1876**

Taxonomy (N) & (A): Pescador and Berner (1981).

Ecology & Habitat (N): Stream orders 2–3, erosional with secondary depositional areas and depositional.

Nymphs occurred among large fines and small gravel in shallow transitional runs and in pockets of well-sorted large fines, gravel, and clumps of CPOM behind rubble in pools (most commonly along

pool margins where there was a thin film of small fines covering the substrate). Nymphs did not burrow, but dug into the surface enough to cover most of their legs and abdomen. In rocky areas nymphs sought shelter in crevices between gravel particles and could not be detected until the substrate was disturbed.

Seasonal Occurrence (N): April-June; (A): May-June.

Biology (N) & (A): All observations on the biology of this species are based on specimens from the Carrabassett River. Nymphs with dark wing pads occurred in the river about the first week in May. By the second or third week in June, only a few mature nymphs were found, suggesting a short emergence period. Subimagoes reared in the laboratory, under natural daylight conditions, emerged in the early evening.

Distribution (N): Ak18, F6, F7, F9, F20, F21; (A): F7 (F), F20 (F).

It has also been collected from the South branch of the Dead River (R. VanRiper, pers. comm.). It was the only species of *Baetisca* present in the Carrabassett River.

Nearctic Range: SE, NE, EC.

Previously thought to be restricted to the St. Lawrence drainage, Kondratieff and Voshell (1983) have now reported it from Virginia.

## DISCUSSION

Maine has a rich mayfly fauna: 43 genera and 160 species have now been recorded from 231 sites. This study indicates that Maine contains 80% of the possible 200 species predicted for the region (Edmunds et al. 1976). Forty-eight species are recorded for the first time in Maine and one species, for the first time in the United States. In addition, several specimens have been collected that may eventually be determined to be new species.

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**Table 1.** List of site code locations for distribution information presented in the text.

County	Site Code	Location	Year
Androscoggin	An1	Sabbattus, Extension Service Light Trap	1985
	An2	Poland Springs, Extension Service Light Trap	1985
	An3	Martin Stream, North Turner	1978
	An4	Poland	1986
Aroostook	Ak1	Aroostook River, Washburn	1978,87
	Ak2	Allagash River, Allagash	1978
	Ak3	Headwaters of St. John River 20 miles west of Clayton Lake	1978
	Ak4	Oxbow Pond, T18R11 wels	1978
	Ak5	Aroostook River, Presque Isle	1978
	Ak6	Conroy Lake, Monticello	1979
	Ak7	St. John River survey, site #1	1977 (Mingo et al. 1979)
	Ak8	St. John River survey, site #2	"
	Ak9	St. John River survey, site #3	"
	Ak10	St. John River survey, site #4	"
	Ak11	St. John River survey, site #5	"
	Ak12	St. John River survey, site #6	"
	Ak13	St. John River survey, site #7	"
	Ak14	St. John River survey, site #8	"
	Ak15	St. John River survey, site #9	"
	Ak16	St. John River survey, site #10	"
	Ak17	St. John River survey, site #11	"
	Ak18	St. John River survey, site #12	"
	Ak19	St. John River survey, site #13	"
	Ak20	St. John River survey, site #14	"
	Ak21	St. John River survey, site #15	"
	Ak22	St. John River survey, site #16	"
	Ak23	St. John River survey, site #17	"
	Ak24	St. John River survey, site #18	"
	Ak25	Island Falls, Extension Service Light Trap	1985
	Ak26	Merrill, Extension Service Light Trap	1985
	Ak27	Bridgewater, Extension Service Light Trap	1985
	Ak28	Monticello, Extension Service Light Trap	1985
	Ak29	Houlton, Extension Service Light Trap	1985

Table 1 continued.

County	Site Code	Location	Year
	Ak30	Clayton Lake, Forest Service Light Trap	1985
	Ak31	Intersection Alternate 2 & Route 171	1985
	Ak32	Aroostook River at Squa Pan	1978
	Ak33	Macwahoc Stream, Macwahoc Plantation	1979
	Ak34	Frazier Brook., T7R5 Wels	1975
	Ak35	Allagash Waterway	1985
Cumberland	C1	Cape Elizabeth, Extension Service Light Trap	1985
	C2	Royal River, Cumberland	1978
	C3	Carsely Brook, Harrison	1971 (Lewis 1978)
	C4	Crooked River, Harrison	1971 (Lewis 1978)
Franklin	F1	North Branch Dead River at bridge behind cemetery, Eustis	1986
	F2	Flagstaff Lake marsh area off Route 27	1986
	F3	Stoney Brook downstream of bridge on Route 16	1986
	F4	Third small spring brook crossing dirt road to Sugarloaf USA golf course	1985, 86
	F5	Redington Pond outlet, Route 16	1986
	F6	Carrabassett River at Fenderson's camp	1986
	F7	Carrabassett River confluence of small brook, west end of rest area on Rt. 16	1986
	F8	Carrabassett River confluence with Hammond Field Brook., Route 16	1986
	F9	Carrabassett River east of rest area on Route 16 (at ford)	1986
	F10	Reed Brk. above confluence with Carrabassett River, Route 16	1986
	F11	Ledge Brook, Route 16 west of Kingfield	1986
	F12	Carrabassett River at meander near Department of Transportation garage, Route 16 west of Kingfield	1986
	F13	Carrabassett River confluence of West Branch Carrabassett River at Kingfield	1986
	F14	Sandy River, Route 4, Phillips	1909 (Allen &Edmunds 1962b), 1978
	F15	Kennebago River, Oquossoc	1978
	F16	Farmington, Extension Service Light Trap	1985
	F17	Caribou Pond, outlet (Carrabassett River)	1985

Table 1 continued.

County	Site Code	Location	Year
	F18	Unnamed stream, tributary to Carrabassett River at base of Sugarloaf Ski area	1985, 87
	F19	Small stream flowing through Gondola Village complex, Sugarloaf Ski area	1986
	F20	Carrabassett River east of the entrance of Sugarloaf Ski area, Route 16	1985, 86
	F21	Carrabassett River at Sugarloaf golf course pump house	1985
	F22	Kingfield, Forest Service Light Trap	1985
	F23	Rangeley Lake State Park	1987
Hancock	H1	Breakneck Brook, Acadia National Park boundary, Hull's Cove, Mount Desert Island	1986
	H2	Duck Brook at bridge to carriage path on New Eagle Lake Road, Mount Desert Island	1986
	H3	Outlet of first Breakneck Pond, Acadia National Park, Mount Desert Island	1986
	H4	Breakneck Pond, Acadia National Park, Mount Desert Island	1986
	H5	Small spring brook on east side of first Breakneck Pond, Acadia National Park, Mount Desert Island	1986
	H6	Duck Brook outlet of Eagle Lake, Route 233, Mount Desert Island	1986
	H7	Marshall Brook Tributary, Western Mountain Road, Acadia National Park, Mount Desert Island	1986
	H8	Narraguagus River survey, site #2	1973, 74 (Mingo & Gibbs 1980)
	H9	Narraguagus River survey, site #3	"
	H10	Union River, Amherst	1976
	H11	Union River, Route 9 Aurora	1974
	H12	Echo Lake, Mount Desert Island	1977
	H13	Basset's Pond, Amherst (44° 49'N, 68° 21' W)	1974
	H14	Salmon Pond at Tunk Mountain	1985, 86
	H15	Mud Pond at Tunk Mountain	1983, 85, 86
	H16	Myra near Sunkhaze Stream	1985
	H17	Pinkham's Pond, Aurora (44° 48'N, 69° 19' W)	1974
	H18	Bracey Pond area	1973, 75

Table 1 continued.

County	Site Code	Location	Year
Kennebec	H19	Bucksport	1985
	H20	Aunt Betty's Pond, Mount Desert Island	1986
	H21	New Mill Meadow Flowage, Mount Desert Island	1986
	H22	Small stream on carriage path to Witch Hole Pond from Duck Brook bridge	1986
	H23	Studmill Road near Dear Lake, T34 MD	1987
	H24	Upper Hadlock Pond, Mount Desert Island	1987
	H25	Pool next to Great Brook, Mount Desert Island	1987
	H26	Pool next to Hunters Brook, Mount Desert Island	1987
	H27	Drainage ditch along Crooked Road, Mount Desert Island	1987
	K1	West Branch Sheepscot River upstream and down stream of bridge, Route 3	1986
	K2	West Branch Sheepscot River, Dirigo Road	1986
	K3	Monmouth, Extension Service Light Trap	1985
	K4	North Readfield, Extension Service Light Trap	1985
	K5	Mt. Vernon	1986
	K6	Winslow	1986
	K7	Cobbsseecontee Lake	1986
	K8	Kennebec River, 2 miles below Hinckley (Provonsha 1990)	1975
Lincoln	L1	Sheepscot River (mainstem), Route 126, North Whitefield	1986
	L2	West Branch Sheepscot River, Howe Rd south of Coopers Mills	1986
	L3	Damariscotta	1978
Oxford	O1	Swift River, Route 17, Roxbury	1978
	O2	Bear River, Route 26, Grafton Notch	1978
	O3	Oxford, Extension Service Light Trap	1985
Penobscot	P1	Penobscot River, Boombridge Brook, Route 2	1986
	P2	Pleasant Pond outlet, Stetson	1986
	P3	Sunkhaze Stream, upstream and downstream of Stud Mill Road bridge	1979, 81, 86
	P4	Pushaw Lake at Cook's Landing	1986
	P5	Mud Pond picnic area	1986
	P6	Small tributary to Mattagodus Stream east of South Springfield Road, Route 6	1986

Table 1 continued.

County	Site Code	Location	Year
	P7	Birch Stream, upstream and downstream of bridge on County Road, Milford	1986
	P8	Birch Stream, at bridge on Argyle Road, Alton	1986
	P9	Baker Brook, upstream and downstream of culvert on County Road, Milford	1979, 81, 86
	P10	Little Birch Stream, downstream of culvert on County Road, Milford	1978, 86
	P11	Small tributary to Penobscot River along Greenfield Road, Milford	1986
	P12	Pushaw Stream, Route 16 bridge, from canoe	1986
	P13	Birch Stream, Route 116 bridge, Argyle	1986
	P14	Lights at pay telephone at Mobil gas station at I-95 exit 51 (Stillwater Avenue)	1986
	P15	Lights at Maineway store in Old Town	1986
	P16	Lights at University Maine campus, Orono (behind Nutting Hall)	1977, 78, 79 80, 82, 86
	P17	Sunkhaze Stream at Route 2 bridge downstream to Penobscot River	1986
	P18	Penobscot River, Veazie	1986
	P19	Penobscot River, Costigan	1978, 79
	P20	East Branch Penobscot River, Route 11	1978
	P21	Penobscot River, Route 178 Bradley	?
	P22	Penobscot River, sites #2,5,& 10	1974 (Rabeni, 1977)
	P23	Penobscot River, Winn	1979, 80, 87
	P24	Pushaw Stream, Route 43	1973, 76, 77, 79
	P25	Dead Stream, Hudson	1976
	P26	Boynont Brook, Bradley	1979
	P27	Hoyt Brook, Howland	1976
	P28	Ayer Brook, Passadumkeag	1974, 76, 78
	P29	Rivera's Pond, Aurora (44° 49 N; 68° 22 W	1974
	P30	Lincoln, Extension Service Light Trap	1985
	P31	Stillwater, Extension Service Light Trap	1985
	P32	Patten, Forest Service Light Trap	1985
	P33	Newburgh, Light Trap	1985
	P34	East Branch Penobscot River at Grindstone Falls	1986
	P35	Stillwater River, Orono	1972, 77, 80, 85

Table 1 continued.

County	Site Code	Location	Year
	P36	Otter Chain Ponds at County Road, Milford	1977, 78, 79
	P37	Souadabscook Stream at Rt. 9	1975, 77, 86
	P38	K.E. Gibbs house, Hampden	1986
	P39	Orland River, Orland	1986
	P40	Brook's Pond, Dover Foxtrot (45° 13' N, 69° 12' W)	1978
	P41	Stillwater River below dam at Stillwater Avenue, Old Town	1987
	P42	Eskutassis Pond, Burlington	1987
	P43	Perkin's Pond, Milo	1974
	P44	Jordan Brook at Dahlia Farm Road	1986
	P45	Pushaw Stream at Route 16 bridge	1977
	P46	Bog stream off of Studmill Road	1986
	P47	Brown's Brook, Hampden	1986
	P48	University Park, Orono	1973
Piscataquis	Ps1	Lazy Tom Stream flowage marsh upstream of spillway bridge on road to Spencer Bay	1986
	Ps2	Lazy Tom Stream upstream and downstream of spillway bridge on road to Spencer Bay	1986
	Ps3	Boat ramp on north shore of First Roach Pond	1986
	Ps4	Roach River below outlet of First Roach Pond	1986
	Ps5	Lagoon Brook, upstream and downstream of culverts on road to Big Lyford Pond	1986
	Ps6	Small intermitent tributary to Lagoon Brook on road to Big Lyford Pond	1986
	Ps7	Lily Bay Brook above confluence with North Brook and South Brook	1977, 78, 86
	Ps8	Lily Bay Brook System confluence with Moosehead Lake	1986
	Ps9	Moosehead Lake at Lily Bay picnic area	1986
	Ps10	Tussel Brook above inlet to Moosehead Lake	1986
	Ps11	Moosehead Lake, Lily Bay State Park, Rowell Cove	1986
	Ps12	Sawyer Pond, Greenville	1986
	Ps13	Maine Fish and Game Headquarters boat dock, Greenville	1986
	Ps**	Piscataquis River 1/2 m west of Guilford	1986
	Ps14	McMannus Brook, Baxter State Park	1974, 79

Table 1 continued.

County	Site Code	Location	Year
	Ps15	Katahdin Stream, Baxter State Park	1977, 78, 79
	Ps16	Abol Stream, Baxter State Park	1979, 80
	Ps17	Nesowadnehunk Stream below Sourdnahunk Lake, Baxter State Park	1979
	Ps18	Little Nesowadnehunk Stream, Baxter State Park	1979
	Ps19	Roaring Brook, Baxter State Park	1979
	Ps20	Squaw Brook, Greenville	1974
	Ps21	North Brook, Greenville	1977
	Ps22	Peabody's Pond, Dover (45° 11' N, 69° 17' W)	1976
	Ps23	Klimavic's Pond, Orono (44° 53' N, 68° 43' W)	1974
	Ps24	Brown Brook, Greenville	1974
	Ps25	North Pond, Elliotsville	1986
	Ps26	Moosehead, Town of	1970
			(D. A. Wilson)
	Ps27	Debsconeag Stream and Lake T2R10	1986
	Ps28	Little Nesowadnehunk Lake	1986
	Ps29	Moosehead Lake west of Carleton Point	1986
Somerset	S1	East Outlet of Moosehead Lake downstream of Route 15/6 bridge	1986
	S2	Moosehead Lake on lake side of West Outlet (small cove)	1986
	S3	West Outlet of Moosehead Lake downstream of Rt. 15/6 bridge	1986
	S4	Misery Stream, Route 6 Tarratine	1979, 87
	S5	Carrabassett River below confluence of Gilman Stream, Route 146	1986
	S6	Gilman Stream downstream of Route 146 bridge	1986
	S7	Carrabassett River below confluence of Gilman Stream where river splits around large island	1986
	S8	Carrabassett River 1.5 miles west of North Anson, Route 16	1986
	S9	East Branch Sandy Stream, Rt. 201 Sandy Stream Mountain	1977
	S10	Beaver Pond, Holeb	1980
	S11	Round Pond, Holeb	1980
	S12	Boggy Stream next to Route 16 east of Kingfield	1985
	S13	Wyman Lake, from sunken logs	1981
			(P. Eiler)

Table 1 continued.

County	Site Code	Location	Year
	S14	South Branch Penobscot River west of Jackman at Route 201	1966 (Koss 1970)
	S15	Wesserunsett lake, Madison	1986
	S16	Jackman, from store window	1966
	S17	Great Moose Lake, Hartland	1986
Waldo	W1	Sheepscot Pond at Palermo Fish Culture Station	1986
	W2	East Branch Sheepscot River about 50 m below Sheepscot Pond outlet spillway	1986
	W3	Small brook on Turner Ridge Road leading into Palermo Fish Culture Station	1986
	W4	St. George River at junction of Route 220 & Route 173	1986
	W5	East Branch Sheepscot River upstream of Route 3 bridge	1986
	W6	Sheepscot Pond margin (emergent and floating leaf plants) at boat ramp, Route 3	1986
	W7	East Branch Sheepscot River downstream of bridge on road into Palermo Fish Culture Station	1986
	W8	East Branch Sheepscot River below Fish Culture Station outfall	1986
	W9	Colson Stream upstream of Route 1A bridge north of Prospect	1986
	W10	Winterport, Washington Street from side of house next to Penobscot River	1986
	W11	Small stream at intersection of Back Road and North Palermo Road, Palermo	1986
	W12	Shore of Lake St. George (marsh area) at Route 3	1986
	W13	Fifteen Mile Stream, Benton	1986
	W14	Back Brooks Road, Monroe	1986
	W15	Haley Road, Winterport	1986
	W16	Unity Telephone Company parking lot	1986
	W17	Intersection of Dickey Hill Road & road to Toddy Pond, Monroe	1986
	W18	Sandy Stream, Unity	1986
	W19	Thistle Pond, Monroe	1986
	W20	Harmony Pond, Monroe	1986
	W21	Twentyfive Mile Stream at Route 139, Unity	1986

Table 1 continued.

County	Site Code	Location	Year
Washington	Wn1	Flood Brook downstream of culvert at Route 6	1986
	Wn2	Small brook at Route 6 rest area on East Musquash Lake, upstream of culvert	1986
	Wn3	East Musquash Lake outlet, Route 6	1986
	Wn4	Little Tomah Stream pool/riffle downstream of Route 6 culvert	1986
	Wn5	Tomah Stream, upstream and downstream of bridge at Rt. 6	1977, 78, 79, 80, 81, 82, 85, 86, 87
	Wn6	Tomah Stream confluence with Beaver Brook	1977, 78, 79, 80, 81, 82, 83, 85, 86, 87
	Wn7	Machias River, Route 9	1978
	Wn8	Jonesboro, Extension Service Light Trap	1985
	Wn9	Narraguagus River survey, site #1	1973, 74 (Mingo & Gibbs 1980)
	Wn10	Narraguagus River survey, site #4	"
	Wn11	Narraguagus River survey, site #5	"
	Wn12	Narraguagus River survey, site #6	"
	Wn13	Narraguagus River survey, site #7	"
	Wn14	Narraguagus River survey, site #8	"
	Wn15	Narraguagus River survey, site #9	"
	Wn16	Narraguagus River survey, site #10	"
	Wn17	Narraguagus River	1973, 74
	Wn18	Outlet of 3rd Machias Pond	1987
York	Y1	Springvale, Extension Service Light Trap	1985
	Y2	York, Extension Service Light Trap	1985
	Y3	Wells, Extension Service Light Trap	1985
	Y4	Merriland River at outlet of Hobbs Pond, Wells	1986
	Y5	Mill Brook at Portland Avenue, Old Orchard Beach	1986

Table 2. Location records for Maine *Ameletus* from the Philadelphia Academy of Sciences Collection (provided by Dr. David Funk).

County	Site Code	Location	Date
Penobscot	CRY3	Crystal Brook 3.6 miles north of Patten at Route 11, elevation 670', 46°03'13"N, 68°26'36"W	V-3&26-82
Piscataquis	AB02	Tributary to Abol Stream in Baxter State Park, elevation 1144', 45°51' 41"N, 68°57'36"W	VI-6&21-82
	WAD2	Tributary of Nesowadnehunk Stream Baxter State Park, elev. 1050', 45°54'13"N, 69°02'16"W	VI-13&28-82
	WAD5	Nesowadnehunk Stream in Baxter State Park, elevation 1050', 45°54'02"N, 69°02'22"W	VI-2&6-82

Table 3. Nearctic mayfly range distribution codes (modified from Edmunds et al. 1976) used in the text.

Code	Region	Geo-Political Units in each Region
SE	Southeastern U.S.	States: AL, DE, FL, GA, LA, MD, MS, NC, SC, TN, VA, WV
NE	Northeastern U.S.	CT, MA, ME, NH, NJ, NY, PA, RI, VT
C	Central U.S.	AR, IA, IN, IL, KY, KS, MI, MN, MO, NE, ND, OH, OK, SD, TX, WI
SW	Southwestern U.S.	AZ, CA, CO, NM, NV, UT
A	Arctic U.S.	AK
EC	Eastern Canada	Provinces: Nf, N.B., N.S., P.E., P.Q.
CC	Central Canada	Mb, On, Sk, N.T. (in part)
WC	Western Canada	Ab, B.C., N.T. (in part), Yk