THE MAYFLIES (Ephemeroptera) OF ALASKA, INCLUDING A NEW SPECIES OF HEPTAGENIIDAE

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Abstract.—Forty-six species of mayflies (Ephemeroptera) are reported from Alaska, and 27 of those are reported from the state for the first time. Nominal species in the genera Callibaetis Eaton, Caudatella Edmunds, Ecdyonurus Eaton, Ironodes Traver, Paraleptophlebia Lestage, Plauditus Lugo-Ortiz and McCafferty, Procloeon Bengtsson, and Siphlonurus Eaton are also reported from Alaska for the first time. The fauna consists mainly of species with widespread general or western distributions in North America, but also includes 11 confirmed Holarctic species. Rhiithrogena ingalik, new species, is described from male adults; it differs from other congeners in genitalia morphology and is most closely related to certain Siberian species.

Key Words: Alaska, Ephemeroptera, mayflies, Rhiithrogena ingalik, new species, new records

Because of concerns of global warming of Arctic and alpine habitats and the potential impacts on those ecosystems (Chapin and Körner 1994), it is important that documentation of the organisms within those regions be completed. Studies of ecosystems of low diversity, such as those found in the Arctic, may provide a ready means of understanding these systems and any changes they may undergo (Danks 1981, Chapin and Körner 1994, Poff et al. 2001). In addition, such data may be valuable for understanding historical biogeography involving circumpolar species.

Considerable recent work has contributed to the documentation of the Ephemeroptera fauna of far northern North America (e.g., Harper and Harper 1981, 1997; McCafferty 1985, 1994, McCafferty and Randolph 1998, Alba-Tercedor and McCafferty 2000, Randolph and McCafferty 2000). Species distributional data for certain subregions of the North had not been readily available previously and as a result faunal data have remained fragmentary, making any ecological or biogeographic assessments difficult (Harper and Harper 1997). For example, of the 63 species reported from the combined subregions of Alaska, Yukon, Northwest Territories, and Nunavut, relatively few have been known from Alaska (McCafferty 1985, 1994; Zloty 1996; Lee and Hershey 2000). A more complete documentation of Alaska is critical for hypothesizing Berin- gia’s role in mayfly dispersal during the Pleistocene (see Höfle et al. 1994, Elias et al. 2000), and the possible role of Alaska in providing historical refugia in its unglaciated areas (McCafferty 1985, Elias et al. 2000).

Herein we provide new state records for 27 species and 71 new county records for 39 of the 46 species we document from Alaska. This includes a new species of
Rhithrogena Eaton and the first North American records of Acentrella lapponica [nec A. feropagus] and Ephemera nuda. The first records of nominal species of the genera Callibaetis Eaton, Caudatella Edmonds, Ecdyonurus Eaton, Ironodes Traver, Paraleptophlebia Lestage, Plauditus Lugo-Ortiz and McCafferty, Procloeon Bengtsson, and Siphlonurus Eaton are given. This study also rectifies previous records based on misidentifications. Several species are shown to occur above the Arctic Circle, and in all, mayflies are now known from 16 of the 25 counties in Alaska (Fig. 1).

Many Arctic species have widespread distribution patterns (Downes 1962, Chapin and Körner 1994). This was also noted by McCafferty (1985) for the Alaskan mayfly fauna and is further documented here. There are 11 Alaskan species that are widespread North American species, including Acentrella turbida, Baetis flavistriga, B. tricaudatus, Callibaetis ferrugineus, C. fluc tuans, Diphetor hageni, Ephemera dorothea, Paraleptophlebia debilis, Plauditus dubius, Heptagenia pulla, and Siphlonurus alternatus. Cinygmuia subaequalis is found outside of Alaska only in eastern and south-eastern North America, and this disjunct pattern is suggestive of a faunal remnant from the Arcto-Tertiary Forest regime (McCafferty 1985). The predominant distributional pattern expressed by Alaskan mayflies involves 17 species that are wide-
spread in, and limited to, western North America. These include *Acentrella insignificans*, *Ameletus validus*, *Cinygmula minus*, *C. par*, *C. tarda*, *Drunella coloradensis*, *D. doddsii*, *D. grandis*, *D. spinifera*, *Epeorus albertae*, *E. deceptivus*, *E. grandis*, *E. longimanus*, *Ironesites nitidus*, *Rhithrogena futilis*, *Serratella tibialis*, and *Siphlonurus occidentalis*. This is also the most common pattern for Yukon mayflies (Harper and Harper 1997). Such far-reaching western species are often limited to mountain ranges. *Caudatella jacobi* and *Paraleptophlebia vaciva* occur in Alaska and also occur southward into regions of western Canada and USA, but they have a more fragmented pattern and do not range into southwestern USA.

Many Arctic arthropod species are Holartic (Danks 1981), and the 11 Holartic Alaskan species account for about one-fourth of the known mayfly fauna of Alaska. These include *Acentrella lapponica*, *Ameletus inopinatus*, *Baetis bicaudatus*, *B. bundyae*, *Brachycercus harrisella*, *Ephemerella aurivillii*, *Ephemerella nuda*, *Metrotopus alter*, *Ecdyonurus simplicioides*, *Parameletus chelifer*, and *Procloeon pennulatum*. The only occurrences in North America of *A. lapponica*, *E. nuda*, and *M. alter* are confined to Alaska, and *A. inopinatus* and *B. bundyae* are strictly northern boreal species in North America. Other Holartic species tend to be more widespread in North America. The commonness of the Holartic species *B. bicaudatus* in western North America and its only sparse occurrence in far East Asia may suggest east to west dispersal via Beringia as recently as the Pleistocene, whereas the opposite scenario is suggested for *Ephemerella nuda*. *Acentrella lapponica* and *M. alter* are also known from Scandinavia, and their restricted North American distribution is apparently relictual.

*Acentrella feropagus* is limited to Alaska, Canada, and northern conterminous USA. *Baetis foemina* is limited to Alaska, Northwest Territories, and Nunavut. *Rhithrogena ingalik*, n. sp., is more closely related to some Siberian congeners than to any known North American species, suggesting allopatric speciation in Alaska.

Alaskan records below are alphabetical by family, genus, and species. County names appear in upper case. Material on which new records are based are larvae unless stated otherwise and are held in the Purdue Entomological Research Collection, West Lafayette, Indiana.

**AMELETIDAE**

*Ameletus inopinatus* Eaton

Previous records.—Zloty (1996): FAIRBANKS NORTH STAR.

*Ameletus validus* McDunnough


New records.—NORTH SLOPE: Canning R 5 mi from mouth on main channel, 70/04/30N 145/33/30W, VI-20-1972.

**BAETIDAE**

*Acentrella feropagus* Alba-Tercedor and McCafferty


*Acentrella insignificans* (McDunnough)

New records.—YUKON-KOYUKUK: South Slope, Sheenjek R 1 mi above pipeline crossing, 67/37/45N 143/17/00W, VII-29-1972.

*Acentrella lapponica* (Bengtsson)


Acentrella turbida (McDunnough)


Baetis bicaudatus Dodd


Baetis bundyae Lehmkuhl

Previous records.—Harper and Harper (1981): NORTH SLOPE.

New records.—YUKON-KOYUKUK: South Slope, Monument Cr 10 mi below origin, 67/57/45N 143/13/00W, VII-28-1972; South Slope, unnamed trib to E Frk Chandalar R, 68/25/00N 145/12/00W, VII-28-1972; South Slope, Strange Woman Cr 10 mi above mouth, 67/50/00N 141/40/30W, VII-29-1972.

Baetis flavistriga McDunnough

New records.—YUKON-KOYUKUK: South Slope, Monument Cr 10 mi below origin, 67/57/45N 143/13/00W, VII-28-1972; South Slope, Old Woman Cr 1 mi from confl Sheenjek R, 68/21/00N 144/00/00W, VII-28-1972; South Slope, Pass Cr 5 mi below origin, 67/53/15N 142/50/00W, VII-29-1972; South Slope, Sheenjek R 1 mi above pipeline crossing, 67/37/45N 143/17/00W, VII-29-1972; South Slope, Strange
Woman Cr 10 mi above mouth, 67/50/00N 141/40/30W, VII-29-1972; South Slope, unnamed trib E Frk Chandalar R, 68/25/00N 145/12/00W, VII-28-1972.

*Baetis foemina* McDunnough


*Baetis tricaudatus* Dodds


*Callibaetis ferrugineus* (Walsh)

New records.—FAIRBANKS NORTH STAR: Mile 27, Steece Hwy, N U Alaska, X-2-8-1962.

*Callibaetis fluctuans* (Walsh)

New records.—FAIRBANKS NORTH STAR: Mile 27, Steece Hwy, N U Alaska, X-8-1962.

*Diphetor hageni* (Eaton)

Previous records.—Duncan and Brusven (1985): PRINCE OF WALES-OUTER KETCHIKAN.

*Plauditus dubius* (Walsh)


*Procloeon pennullatum* (Eaton)

New records.—YUKON-KOYUKUK: Birch Cr between Big Cr & Preacher’s Cr, 66/00N 144/50W, VIII-17-1962.

**CAENIDAE**

*Brachycercus harrisella* Curtis

New records.—YUKON-KOYUKUK: Birch Cr between Big Cr & Preacher’s Cr, VIII-17-1963.

**EPHEMERELLIDAE**

*Caudatella jacobi* (McDunnough)

New records.—JUNEAU: Juneau, Fish Cr, VI-24-29-2000.

*Drunella coloradensis* (Dodds)

Previous records.—Allen and Edmunds (1962): JUNEAU; SKAGWAY-HOONAH-
ANGOON; WRANGLE-PETERSBURG; YUKON-KOYUKUK.

New records.—HAINES: Klukshu R 117.6 mi Haines Cutoff Hwy nr Alaska & BC border, VI-13-1932; SKAGWAY-HOONAH-ANGOON; North Arm Hood Bay, VI-19-1932; unidentified stream 0.5 mi N Cape Fanshaw, VII-9-1958.

*Drunella doddsii* (Needham)

Previous records.—Allen and Edmunds (1962): ANCHORAGE; Wipfli et al. (1998): KETCHIKAN GATEWAY.


*Drunella grandis* (Eaton)

Previous records.—Ulmer (1932): ALEUTIANS EAST. Allen and Edmunds (1962): WRANGLE-PETERSBURG.

*Drunella spinifera* (Needham)


*Ephemera aurivillii* (Bengtsson)


*Ephemera dorothea* Needham

Previous records.—Allen and Edmunds (1965), misidentified as *E. inermis* [Johnson (1978) as *E. infrequens* McDunnough]: FAIRBANKS-NORTH STAR; misidentified as *E. inermis* [McCafferty (1994) as *E. infrequens*]: WRANGLE-PETERSBURG; YUKON-KOYUKUK. McCafferty (1985), misidentified as *E. laeustris* Allen and Edmunds: NORTH SLOPE.

*Ephemera nuda* Tshernova

New records.—YUKON-KOYUKUK: South Slope, Monument Cr 1 mi above confl Sheenjek R, 67/57/45N 143/13/00W, VII-29-1972; South Slope, Strangle Woman Cr 10 mi above mouth, 67/50/00N 141/40/30W, VII-29-1972.

*Serratella tibialis* (McDunnough)


**Heptageniidae**

*Cinygma lyriforme* (McDunnough)

Previous records.—Lehmkuhl (1979): FAIRBANKS NORTH STAR; McCafferty (1985): NORTH SLOPE.

New records.—MATANUSKA-SUSIT-
NA: Bonanza Cr, 12 mi N Old Man, VIII-4-1979 (adults).

*Cinygmula mimus* (Eaton)


*Cinygmula par* (Eaton)

Previous records.—Harper and Harper (1981): NORTH SLOPE.

*Cinygmula subaequalis* (Banks)

Previous records.—McCafferty (1985): NORTH SLOPE.

New records.—MATANUSKA-SUSITNA: Bonanza Cr, 12 mi N Old Man Cr, VIII-4-1979 (adults).

*Cinygmula tarda* (McDunnough)


*Ecdyonurus simplicioides* (McDunnough)

New records.—YUKON-KOYUKUK: Birch Cr between Preacher Cr and Birch Cr Village, 66°30'N 145°00'W, VIII-18-1962.

*Epeorus albertae* (McDunnough)

New records.—PRINCE OF WALES-OUTER KETCHIKAN: Prince of Wales Island, Skowl Arm Inlet, Virginia Cr, VII-29-1962.

*Epeorus deceptivus* (McDunnough)


*Epeorus grandis* (McDunnough)

Previous records.—Wipfl et al. (1998): KETCHIKAN GATEWAY.


*Epeorus longimanus* (Eaton)

Previous records.—Edmunds et al. (1976): no data provided. Wipfl et al. (1998): KETCHIKAN GATEWAY.


*Heptagenia pulla* (Clemens)


*Ironodes nitidus* (Eaton)

New records.—PRINCE OF WALES-OUTER KETCHIKAN: Virginia Cr, VI-21-1963.

*Rhithrogena futilis* McDunnough

Previous records.—Harper and Harper (1981): NORTH SLOPE.

New records.—FAIRBANKS NORTH STAR: Mile 69, Steese Hwy, Chatanika R, NE Fairbanks, VIII-7-1967 (adults).
Rhithrogena ingalik Randolph and McCafferty, new species
(Figs. 2–4)

Male adult.—Body Length: 7.6 mm; forewing length: 7.0–7.3 mm; hindwing length: 2.3–2.6 mm. Head: Color gray brown. Compound eyes purple, separated dorsally by less than diameter of median ocellus. Thorax: Prothorax light brown. Meso- and metathorax olive brown. Fore-wing with stigma clouded with white and with no anastomosed veins. Legs missing. Abdomen: Color generally light gray, with segments 8–10 gray brown, otherwise lacking distinct color pattern. Subgenital plate (Fig. 2) with relatively broad, shallow emargination; posterolateral lobes extending posteriorly to level subequal to level distal margin of basal forceps segment. Penes (Figs. 2–3) broadly rounded distally, extending posteriorly beyond base of me-
dially directed spine; titillators (Fig. 4) minute, strongly narrowing to single pointed apex. Caudal filaments missing.

Material examined.—Holotype: Male adult, Alaska, YUKON-KOYUKUK: Birch Creek 10 mi upstream from mile 147, Steece Hwy, VIII-11-1973 (deposited in the Purdue Entomological Research Collection). Paratype: Male adult, same data and deposition as holotype [genitalia on slide (medium: euparol)].

Etymology.—The specific epithet is a noun in apposition in honor of a group of Native Americans known as the Ingalik who once inhabited the interior of Alaska.

Remarks.—Rhiithrogena ingalik is easily distinguished from all known North American Rhiithrogena by the unique shape of the male genitalia (Figs. 2–3), which are most similar to those of the far eastern Russian species R. baikovae Sowa and R. lepnevæ Brodsky. The new species is differentiated from the latter two by the following: The titillators (best seen slide-mounted) of R. lepnevæ are spatulate and have two or more teeth apically (Fig. 6). The titillators of R. ingalik (Fig. 4) and R. baikovæ [fig. 20 (Sowa 1973)] instead narrow to a single point apically. The posterior margin of the penes lobes of R. ingalik is broadly rounded and extends beyond the basal level of the medially directed spine (Fig. 3), whereas the posterior margin of the penes lobes of R. baikovæ is relatively straight and does not extend beyond the base of the medially directed spine (Fig. 5). The subgenital plate emargination appears broad and shallow in R. ingalik (Fig. 2), and by comparison somewhat narrower and deeper in R. baikovæ (Fig. 5). Also, R. baikovæ adults have distinct abdominal patterning [figs. 5d,e (Sinitshenkova 1982 as R. quadrinotata Sinitshenkova)] that is not apparent in our specimens of R. ingalik.

LEPTOPHLEBIIDAE

Paraleptophlebia debilis (Walker)

New records.—PRINCE OF WALES-OUTER KETCHIKAN: Old Tom Cr, Skowl Arm Inlet, Prince of Wales Island, VIII-3-1962; Cabin Cr, Prince of Wales Island, Skowl Arm Inlet, VIII-14-1962.

Paraleptophlebia vaciva (Eaton)


METRETOPODIDAE

Metretopus alter Bengtsson

Previous records.—Berner (1978) misidentified as M. borealis (McCafferty 1994): YUKON-KOYUKUK.


SIPHLONURIDAE

Parameletus chelifer Bengtsson

Previous records.—Harper and Harper (1981): NORTH SLOPE.

Siphlonurus alternatus (Say)


Siphlonurus occidentalis (Eaton)

New records.—FAIRBANKS NORTH STAR: Mile 27, Steece Hwy, N U Alaska, IX-20, X-8-1962.

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