

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

R. P. RANDOLPH AND W. P. MCCAFFERTY

(RPR) Division of Evolution and Ecology, University of California, Davis, CA 95616 (e-mail: rprandolph@ucdavis.edu); (WPM) Department of Entomology, Purdue University, West Lafayette, IN 47907 (e-mail: patmccafferty@entm.purdue.edu)

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, *Caudaella* Edmunds, *Ecdyonurus* Eaton, *Ironodes* Traver, *Paraleptophlebia* Lestage, *Plauditus* Lugo-Ortiz and McCafferty, *Procloeon* Bengtsson, and *Siphonurus* 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. *Rhithrogena 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, *Rhithrogena 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 Beringia'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



Fig. 1. Map of Alaska.

Rhithrogena Eaton and the first North American records of *Acentrella lapponica* [nec *A. feropagus*] and *Ephemerella nuda*. The first records of nominal species of the genera *Callibaetis* Eaton, *Caudatella* Edmunds, *Ecdyonurus* Eaton, *Ironodes* Traver, *Paraleptophlebia* Lestage, *Plauditus* Lugo-Ortiz and McCafferty, *Procloeon* Bengtsson, and *Siphonurus* 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. fluctuans*, *Diphetero hageni*, *Ephemerella dorrothea*, *Paraleptophlebia debilis*, *Plauditus dubius*, *Heptagenia pulla*, and *Siphonurus alternatus*. *Cinygmula subaequalis* is found outside of Alaska only in eastern and southeastern 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 mimus*, *C. par*, *C. tarda*, *Drunella coloradensis*, *D. doddsii*, *D. grandis*, *D. spinifera*, *Epeorus albertae*, *E. deceptivus*, *E. grandis*, *E. longimanus*, *Ironodes nitidus*, *Rhithrogena futilis*, *Serratella tibialis*, and *Siphonurus 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 Holarctic (Danks 1981), and the 11 Holarctic 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*, *Metretopus alter*, *Ecdyonurus simplicioides*, *Parameletus chelififer*, 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 Holarctic species tend to be more widespread in North America. The commonness of the Holarctic 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. *Rhith-*

rogena 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

Previous records.—Edmunds et al. (1976): No data provided. Zloty (1996): No data provided. Wipfli et al. (1998): KETCHIKAN GATEWAY.

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

Previous records.—Harper and Harper (1981) as *Baetis lapponica*: NORTH SLOPE. Waltz and McCafferty (1987) as *A. lapponica*: YUKON-KOYUKUK.

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)

New records.—NORTH SLOPE: Canning R, mid-Canning gill net station, 69/27/15N 146/13/15W, VIII-28-1972; Canning R 5 mi from mouth on main channel, 70/04/30N 145/33/30W, VI-27-1972; Middle Canning R ¼ mi below Shublik Falls, 69/27/15N 146/13/15W, VIII-8-1972; Cache

Cr $\frac{3}{8}$ mi above mouth, 69/23/45N 146/05/00W, VII-27-1972; Kavik R #1, VIII-17-1973; Canning R at mouth unnamed trib, 69/35/30N 146/19/30W, VII-27-1972; Canning R at unnamed Canning R spring, 69/05/45N 145/59/30W, IX-24-1973; Kuparuk R, VIII-27-1971; YUKON-KOYUKUK: South Slope, Sheenjek R 1 mi above pipeline crossing, 67/37/45N 143/17/00W, VII-29-1972; South Slope, Old Woman Cr 1 mi from confl Sheenjek R, 68/21/00N 144/00/00W, VII-28-1972; South Slope, Monument Cr, trib Sheenjek R, 67/57/45N 143/13/00N, VIII-17-1972; South Slope, Pass Cr 5 mi below origin, trib Coleen R, 67/53/15N 142/50/00W, VII-29-1972.

Acentrella turbida (McDunnough)

New records.—NORTH SLOPE: Antigon R, VIII-15-1971; Kuparuk R, VI-24-1971; Canning R 5 mi from mouth on main channel, 70/04/30N 145/33/30W, VII-27-1972; YUKON-KOYUKUK: South Slope, Coleen R 1 mi above pipeline route, 67/57/30N 142/09/00W, VII-29-1972; South Slope, Monument Cr 1 mi above confl Sheenjek R, 67/57/45N 143/13/00W, VII-29-1972; South Slope, Pass Cr 5 mi below origin, 67/53/15N 142/50/00W, VII-29-1972; South Slope, Strangle Woman Cr 1 mi above mouth, 67/50/00N 141/41/30W, VII-29-1972.

Baetis bicaudatus Dodds

Previous records.—Duncan and Brusven (1985): PRINCE OF WALES-OUTER KETCHIKAN. Milner (1987): SKAGWAY-HOONAH-ANGOON. McCafferty (1994): MATANUSKA-SUSITNA. Wipfli et al. (1998): KETCHIKAN GATEWAY.

New records.—ANCHORAGE: Alyeska, VI-21-1997; Chugach St Prk, 18 mi from Old Seward, VI-22-1997; Chugach St Prk, 6 mi from Old Seward, VI-22-1996; FAIRBANKS NORTH STAR: Monument Cr, Chena R, VII-27-1979; JUNEAU: unidentified str, prob from water supply, N Juneau, VI-21-1958; KENAI PENINSULA: Diamond Cr nr Sterling Hwy, V-11-1968; main

trib Lower Russian R, VI-24-1968; Seward, tidewater, Northland Glacier, VI-6-2001; NORTH SLOPE: Arctic Foothills Province, Echooka R, riffle above Echooka Spr mouth, VI-6-1971; Arctic Foothills Province, Lupine Spr, VI-26-1971; Arctic Foothills Province, Nanook Cr, 69/34/30N 146/16/00W, VII-27-1972; Canning R, Marsh Frk, lower reg, 69/06/00N 145/59/00W, VI-17-1972; Canning R nr Shublick Spr, 69/27/15N 146/13/15W, VII-9-1972; Canning R, unnamed spr, 69/05/45N 145/59/30W, VI-26-1973; Marsh Frk, 69/52/15N 146/00/00W, VI-17-1972; Middle Canning R $\frac{1}{4}$ mi below Shublick Falls, 69/27/15N 146/13/15W, VIII-8-1972; South Slope, Cane Cr ca 5 mi above confl Chandalar R, 68/39/30N 144/54/00W, VIII-17-1972; unnamed Canning R trib 400 m above mouth, 69/23/45N 146/09/00W, VII-27-1972; unnamed Canning Spr 20 yds from mouth, 69/08/30N 145/55/00W, VII-26-1972; SITKA: Nakvassin Cr, Baranof Island, Port Herbert, VII-1-1958; SKAGWAY-HOONAH-ANGOON: North Arm Hood Bay, VI-21-1969.

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, Strangle 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, Strangle

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

New records.—NORTH SLOPE: Arctic Foothills Province, Echooka Spr, VII-1-1971; Cache Cr $\frac{3}{8}$ mi above mouth, 69/23/45N 146/05/00W, VII-27-1972; Canning R Marsh Frk, next to pool, 69/05/45N 145/59/30W, VII-23-1973; Canning R spring (CS-10) 275 m above weir, 69/05/45N 145/59/30W, V-24-1973; Canning Spr 200 yds from spring source, 69/52/15N 146/04/30W, VI-16-1972; Canning R at mouth unnamed trib, 69/35/30N 146/19/30W, VII-27-1972; Echooka R, V-27-1971; Kavik R, VIII-17-1973; Kuparuk R, VIII-29-1971; unnamed trib Canning R 400 m above mouth, 69/23/45N 146/09/00W, VIII-27-1972.

Baetis tricaudatus Dodds

Previous records.—Duncan and Brusven (1985): PRINCE OF WALES-OUTER KETCHIKAN. Milner (1987): SKAGWAY-HOONAH-ANGOON. Wipfli et al. (1998): KETCHIKAN GATEWAY.

New records.—KENAI PENINSULA: Crooked Cr, VIII-20-1965, E Charnov; Hidden Lake Cr nr Sterling Hwy, V-11-1968; Six Mile Cr, VII-22-1965; Slicock Cr at Kalafonsky Rd brdg, V-26-1968; KODIAK ISLAND: Lower Olga L, Kodiak Island, VI-13-1979; LAKE AND PENINSULA: Aniakchak National For Mon., Alas Peninsula, 56/56N 158/06W, VII-1988 (adults); MATANUSKA-SUSITNA: 1 mi SE Wasilla, Cottonwood Cr at Matanusak Rd, VI-19-1958; Knik, Fish Cr, VI-4-1958; NORTH SLOPE: Arctic Foothills Province, Echooka Spr, V-29-1971; Arctic Foothills Province, Ribdon Spr, VI-2-1971; Canning R 5 mi from mouth on main channel, 70/04/30N 145/33/30W, VI-20-1972; Canning R, Shublick Spr, 69/27/15N 146/12/00W, VII-9-1972; unnamed trib Canning R, riffle above mouth, 69/32/45N 146/15/45W, VI-

27-1972; WRANGLE-PETERSBURG, Anan Cr, IV-26-1958; YUKON-KOYUKUK: Birch Cr between Big Cr & Preacher's Cr, 66/00N 144/50W, VIII-17-1962; Rat Cr 1.6 mi upstr from Dorena Dam, VI-14-1958; 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.

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.

Dipheter hageni (Eaton)

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

Plauditus dubius (Walsh)

New records.—YUKON-KOYUKUK: Beaver Cr, 66/07N 146/15W, VIII-21-1962.

Procloeon pennulatum (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.

New records.—JUNEAU: unidentified str, prob overflow water system, N Juneau, VI-21-1958; FAIRBANKS NORTH STAR: Mile 27, Steece Hwy, N U Alaska, X-8-1962; W Fk Chena R, VII-21-1979, AL Howe; Chatanika R Power Plant, mile 32-33, Steece Hwy, X-8-1962; KENAI PENINSULA: Diamond Cr nr Sterling, V-11-1968, E Charnov; Moose Cr at Tustamena L, VI-18-1968; Russian R (Lower), VII-1-1968; Russian R (Lower) above falls, VI-24-1968; Six Mile Cr, VII-22-1965; MATANUSKA-SUSITNA: Cottonwood Cr at Matanuska Rd 1 mi SE Wasilla, VI-19-1958; PRINCE OF WALES-OUTER KETCHIKAN: unidentified str 1 mi N Game Cove in Hawk Inlet behind PE Cannery, Admiralty Island, VII-13-1958; SITKA: Nakvisson Cr, Baranof Island, Port Herbert, VII-1-1958; WRANGLE-PETERSBURG: Anan Cr, IV-26-1958.

Drunella grandis (Eaton)

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

Drunella spinifera (Needham)

New records.—SKAGWAY-HOONAH-ANGOON: North Arm Hood Bay, VI-18-1970.

Ephemerella aurivillii (Bengtsson)

Previous records.—McDunnough (1924) as *E. norda* McDunnough; ALEUTIANS EAST. Allen and Edmunds (1965): WRAN-

GLE-PETERSBURG. Lee and Hershey (2000): NORTH SLOPE.

New records.—FAIRBANKS NORTH STAR: North Frk Chena R, brdg 83, VI-11-1980 (adults); Mile 27 Steece Hwy, N U Alaska, X-8-1962; W Fork Chena R, VII-21-1979; KENAI PENINSULA: Kasilof R at Sterling Hwy brdg, V-21-1968, E Charnov; Russian R (Lower), above falls, VI-24-1968; Russian R (Lower) near lake, VI-2-1968; Slicock Cr at Kalafonsky Rd brdg, V-30-1968.

Ephemerella 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. lacustris* Allen and Edmunds: NORTH SLOPE.

Ephemerella nuda Tshernova

New records.—YUKON-KOYUKUK: South Slope, Monument Cr 1 mi above confl Sheenjok 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)

Previous records.—McCafferty (1985): NORTH SLOPE; Milner (1987): SKAGWAY-HOONAH-ANGOON.

New records.—PRINCE OF WALES-OUTER KETCHIKAN: Prince of Wales Island, Skowl Arm Inlet, Cabin Cr, VIII-14-1962; YUKON-KOYUKUK: South Slope, Sheenjok R 1 mi above pipeline crossing, 67/37/45N 143/17/00W, VII-29-1972.

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 minus (Eaton)

New records.—KENAI PENINSULA: East Rd, Homer, VIII-26-1980 (adults); NORTH SLOPE: Prudhoe Bay to Can Pipeline, 1972 (adults); FAIRBANKS NORTH STAR: W Frk Chena R, VI-11-1980 (adults).

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)

New records.—YUKON-KOYUKUK: South Slope, unnamed E Frk trib Chandalar R, 68/25/00N 145/12/00W, VIII-13-1972 (adults).

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)

New records.—FAIRBANKS NORTH STAR: Monument Cr, Chena R, IX-8-1972; PRINCE OF WALES-OUTER KETCHIKAN: Prince of Wales Island, Skowl Arm Inlet, Virginia Cr, VII-29-1962; SKAGWAY-HOONAH-ANGOON: unidentified stream 0.5 mi N Cape Fanshaw, mainland VII-9-1958; YUKON-KOYUKUK: Birch

Cr at confl with Crooked Cr & Acme Cr, VIII-8-1973 (adults).

Epeorus grandis (McDunnough)

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

New records.—ANCHORAGE: Aleyska, VI-21-1997; Anchorage, Campbell Cr, IV-21-1948; Chugach St Prk 18 mi from Old Seward, VI-22-1997; KENAI PENINSULA: Diamond Cr nr Sterling Hwy, V-11-1968; main trib lower Russian R, VI-24-1968; Moose Cr at Tustamena L, VI-18-1968; Russian R (Lower), VII-1-1968; torrential trib Lower Russian Lake, VI-23-1968.

Epeorus longimanus (Eaton)

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

New records.—KENAI PENINSULA: N Arm Hood Bay, VI-21-1969; PRINCE OF WALES-OUTER KETCHIKAN: Prince of Wales Island, Skowl Arm Inlet, Cabin Cr, VIII-14-1962; SITKA: Nakvissen Cr, Baranof Island, Port Herbert VII-1-1958.

Heptagenia pulla (Clemens)

New records.—KENAI PENINSULA: Slicock Cr at Kalafonsky Rd brdg, V-30-1968; MATANUSKA-SUSITNA: Cottonwood Cr at Matanusak Rd 1 mi SE Wasilla, VI-19-1958.

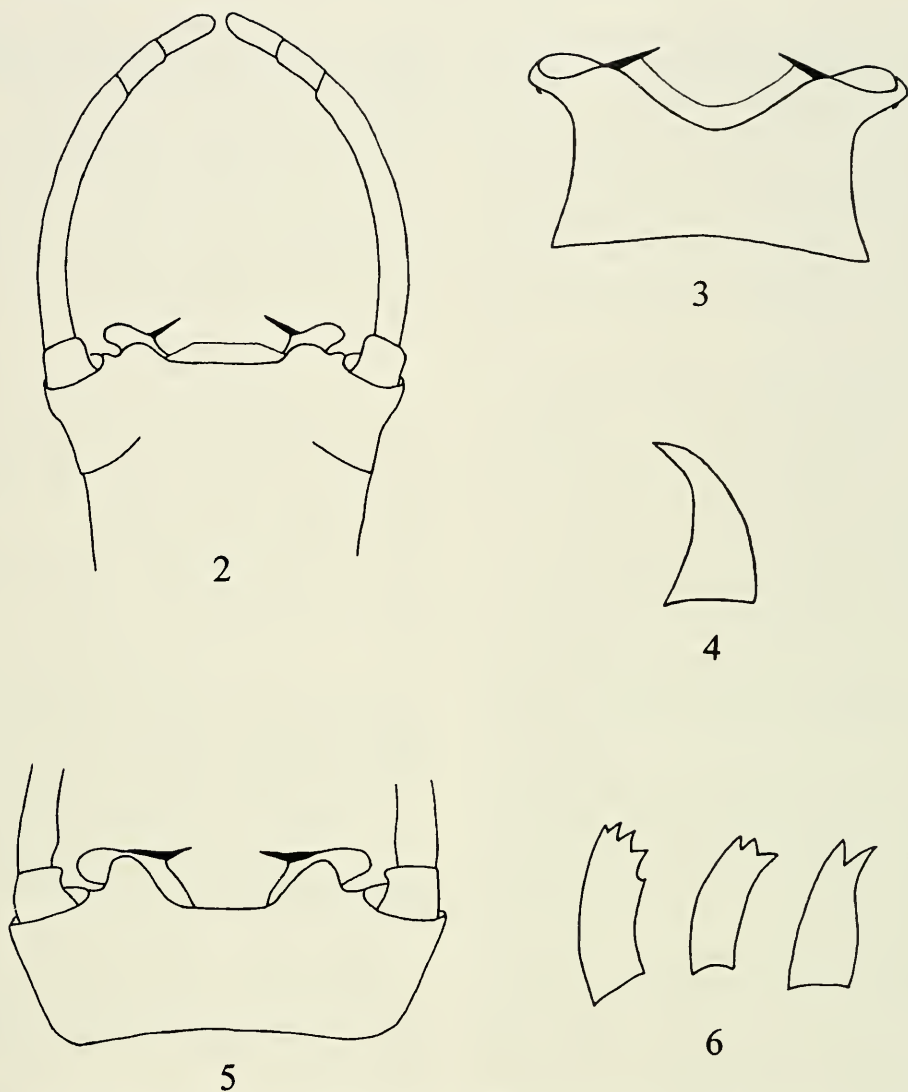
Ironodes nitidus (Eaton)

New records.—PRINCE OF WALES-OUTER KETHICKAN: 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).



Figs. 2-6. *Rhithrogena* male genitalia. 2, *R. ingalik* (ventral). 3, *R. ingalik* (dorsal). 4, *R. ingalik* titillators. 5, *R. baikovae* (ventral) [after Sowa (1973)]. 6, *R. lepnevae* titillators [after Sowa (1973)].

***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: euparal)].

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.—*Rhithrogena ingalik* is easily distinguished from all known North American *Rhithrogena* 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. lepnevae* Brodsky. The new species is differentiated from the latter two by the following: The titillators (best seen slide-mounted) of *R. lepnevae* are spatulate and have two or more teeth apically (Fig. 6). The titillators of *R. ingalik* (Fig. 4) and *R. baikovae* [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. baikovae* 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. baikovae* (Fig. 5). Also, *R. baikovae* adults have distinct abdominal patterning [figs. 5d,e (Sinitschenkova 1982 as *R. quadrinotata* Sinitschenkova)] 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)

New records.—PRINCE OF WALES-OUTER KETCHIKAN: Cabin Cr, Prince of Wales Island, Skowl Arm, VIII-14-1962; SKAGWAY-HOONAH-ANGOON: N Arm Hood Bay, VIII-15-1970.

METRETOPODIDAE

Metretopus alter Bengtsson

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

New records.—NORTH SLOPE: Kavik R, Weir Cr, VIII-4-1973.

SIPHONURIDAE

Parameletus chelifer Bengtsson

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

Siphonurus alternatus (Say)

New records.—NORTH SLOPE: unnamed Canning R Spr above Aufies, 69/22/45N 146/07/30W, VIII-8-1972.

Siphonurus occidentalis (Eaton)

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

ACKNOWLEDGMENTS

We thank George Edmunds (Salt Lake City, UT) and Luke Jacobus (West Lafayette, IN) for their contributions to this study. The research was supported by NSF Grant DEB-9901577 to WPM.

LITERATURE CITED

- Alba-Tercedor, J. and W. P. McCafferty. 2000. *Acen-trella feropagns*, new species (Ephemeroptera: Baetidae): Formal new name for North American *A. lapponica* sensu Morihara and McCafferty. Entomological News 111: 137–139.
- Allen, R. K. and G. F. Edmunds, Jr. 1962. A revision of the genus *Ephemerella* (Ephemeroptera,

- Ephemerellidae). V. The subgenus *Drunella* in North America. *Miscellaneous Publications of the Entomological Society of America* 3: 147–179.
- . 1965. A revision of the genus *Ephemerella* (Ephemeroptera, Ephemerellidae). VIII. The subgenus *Ephemerella* in North America. *Miscellaneous Publications of the Entomological Society of America* 4: 244–282.
- Berner, L. 1978. A review of the mayfly family Me-tretropodidae. *Transactions of the American Entomological Society* 104: 91–137.
- Chapin, F. S. and C. Körner. 1994. Arctic and alpine biodiversity: patterns, causes and ecosystem consequences. *Tree* 9: 45–47.
- Danks, H. V. 1981. Arctic arthropods. A review of systematics and ecology with particular reference to the North America fauna. Biological Survey Project, Entomological Society of Canada, Ottawa.
- Downes, J. A. 1962. What is an Arctic insect? *The Canadian Entomologist* 94: 143–162.
- Duncan, W. F. and M. A. Brusven. 1985. Benthic macroinvertebrates in logged and unlogged low-order southeast Alaska streams. *Freshwater Invertebrate Biology* 4: 125–132.
- Edmunds, G. F., Jr., S. L. Jensen, and L. Berner. 1976. *The Mayflies of North and Central America*. University of Minnesota Press, Minneapolis, 330 pp.
- Elias, S. A., D. Berman, and A. Alfimov. 2000. Late Pleistocene beetle faunas of Beringia: where east meets west. *Journal of Biogeography* 27: 1349–1363.
- Harper, F. and P. P. Harper. 1981. Northern Canadian mayflies (Insecta: Ephemeroptera), records and descriptions. *Canadian Journal of Zoology* 59: 1784–1789.
- Harper, P. P. and F. Harper. 1997. Mayflies (Ephemeroptera) of the Yukon, pp. 151–167. In Danks, H. V. and J. A. Downes, eds. *Insects of the Yukon*. Biological Survey of Canada (Terrestrial Arthropods), Ottawa, 1034 pp.
- Höfle, C., C. L. Ping, M. E. Edwards, D. H. Mann, and D. M. Hopkins. 1994. Pedological investigations of the Late-Pleistocene Bering Land Bridge, pp. 179–185. In Meeha, R. H., V. Sergienko, and G. Weller, eds. *Bridges of Science Between North America and the Russian Far East*. Proceedings of the 45th Arctic Science Conference. American Association for the Advancement of Science (Arctic and Pacific Divisions), Fairbanks, Alaska, 205 pp.
- Johnson, S. C. 1978. Larvae of *Ephemerella inermis* and *E. infrequens* (Ephemeroptera: Ephemerellidae). *Pan-Pacific Entomologist* 54: 19–25.
- Lee, J. O. and A. E. Hershey. 2000. Effects of aquatic bryophytes and long-term fertilization on arctic stream insects. *Journal of the North American Benthological Society* 19: 697–708.
- Lehmkuhl, D. M. 1979. The North American species of *Cinygma* (Ephemeroptera: Heptageniidae). *Canadian Entomologist* 111: 675–680.
- McCafferty, W. P. 1985. The Ephemeroptera of Alaska. *Proceedings of the Entomological Society of Washington* 87: 381–386.
- . 1994. Additions and corrections to the Ephemeroptera of Alaska. *Proceedings of the Entomological Society of Washington* 96: 177.
- McCafferty, W. P. and R. P. Randolph. 1998. Canada mayflies: A faunistic compendium. *Proceedings of the Entomological Society of Ontario* 129: 47–97.
- McDunnough, J. 1924. New North American Ephemeridae. *Canadian Entomologist* 56: 221–226.
- Milner, A. M. 1987. Colonization and ecological development of new streams in Glacier Bay National Park, Alaska. *Freshwater Biology* 18: 53–70.
- Poff, N. L., P. L. Angermeier, S. D. Cooper, P. S. Lake, K. D. Fausch, K. O. Winemiller, L. A. K. Mertes, M. W. Oswood, J. Reynolds, and F. J. Rahel. 2001. Fish diversity in streams and rivers, pp. 315–349. In Chapin, F. S., O. E. Sala, and E. Huber-Sannwald, eds., *Global Biodiversity in a Changing Environment*. Springer, New York.
- Randolph, R. P. and W. P. McCafferty. 2000. Nunavut mayflies (Ephemeroptera) a supplement for far northern North America. *Entomological News* 112: 56–58.
- Sinitshenkova, N. D. 1982. New species of mayflies of the genera *Iron* and *Rhithrogena* in the fauna of the far-east and Transbaikal (Ephemeroptera, Heptageniidae). *Bulletin Moskovskogo Obshchestva Ispytatelei Prirody Otdel Biologicheskii* 87: 53–67.
- Sowa, R. 1973. Note sur quelques espèces paléarctiques de *Rhithrogena* Eaton (Ephemeroptera, Heptageniidae). *Bulletin de l'Académie Polonaise des Sciences, II Série des Sciences Biologiques* 21: 21–26.
- Ulmer, G. 1932. Die Trichopteren, Ephemeropteren und Plecopteren des arktischen Gebietes. *Fauna Arctica* 6: 207–226.
- Waltz, R. D. and W. P. McCafferty. 1987. Systematics of *Pseudocloeon*, *Acentrella*, *Baetiella*, and *Liebebiella*, new genus (Ephemeroptera: Baetidae). *Journal of the New York Entomological Society* 95: 553–568.
- Wipli, M.S., J. Hudson, and J. Caouette. 1998. Influence of salmon carcasses on stream productivity: response of biofilm and benthic macroinvertebrates in southeastern Alaska, USA. *Canadian Journal of Fisheries and Aquatic Sciences* 55: 1503–1511.
- Zloty, J. 1996. A revision of the Nearctic *Ameletus* mayflies based on adult males, with descriptions of seven new species (Ephemeroptera: Ameletidae). *Canadian Entomologist* 128: 293–346.