

COLORADO MAYFLIES (EPHEMEROPTERA):
AN ANNOTATED INVENTORYW. P. McCAFFERTY, RICHARD S. DURFEE, AND
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ABSTRACT—Fourteen families, 41 genera, and 97 species of Ephemeroptera are confirmed for the state of Colorado. Of these, two families, 11 genera (*Acerpenna*, *Apobaetis*, *Barbaetis*, *Camelobaetidius*, *Centroptilum*, *Heterocloeon*, *Ironopsis*, *Lachlania*, *Macdunnoa*, *Neochoroterpes*, and *Pseudiron*), and 37 species are reported for the first time. The probability of certain additional genera eventually being found in Colorado is discussed. Previous and new records from 48 of the 63 Colorado counties are provided. The eastern plains region of the state remains relatively poorly known. Colorado species fit one of the following distributional patterns: continental widespread, continental mountain, northern transcontinental, northwestern, Rocky Mountain, southwestern, eastern-midwestern fringe, or western sand/silt riverine. Taxonomic, distributional, and other data that may be pertinent to Colorado Ephemeroptera are given for each species.

In this paper we present a comprehensive survey of the Ephemeroptera of Colorado. We view this as part of the important process of taking inventory of the biodiversity of the North American entomofauna and documenting the distributional ecology of a vulnerable aquatic fauna whose habitats are increasingly used and abused. Published faunal works or monographs on mayflies of western North America are not on a par with eastern works such as those dealing with the mayflies of Florida (Berner and Pescador, 1988), Illinois (Burks, 1953), or Maine (Burian and Gibbs, 1991). Nevertheless, the Ephemeroptera of western North America are, in some respects, better known than the Ephemeroptera of the eastern half of North America. This is due primarily to the work of two prolific mayfly taxonomists, R. K. Allen (deceased) and G. F. Edmunds, Jr. (Murray, Utah), along with their various co-workers, who have amassed an impressive amount of alpha-level taxonomy on western species, including keys and considerable attention to larval stages. Still, considerable research on the mayflies of the West is needed, Colorado being one of the states not well documented (McCafferty et al., 1990).

Works dealing specifically with the Ephemeroptera of Colorado have mainly involved ecological surveys, community ecology, and behav-

ioral studies pertaining to particular streams or drainage systems (e.g., Dodds and Hisaw, 1924; Elgmork and Saether, 1970; Allan, 1975; Ward, 1975, 1976a, 1976b, 1986; Ward and Berner, 1980; Rader and Ward, 1987a, 1987b, 1989, 1990; Flecker et al., 1988; Allan and Flecker, 1989; and Ward and Stanford, 1990). Only limited data on the Colorado mayflies are available from taxonomic literature. Twenty-two species were originally described from the state (see Edmunds, 1962), most of them by Dodds (1923).

MATERIALS AND METHODS—Our inventory is based on previously published records and new and additional records represented in the extensive collections of the Colorado State University Reference Collection (CSU), Fort Collins, Colorado, and the Purdue University Entomological Research Collection (PERC), West Lafayette, Indiana. Records are from 48 counties; however, only a relatively few counties, such as Boulder, Gunnison, and Larimer counties, have been collected extensively. We are unaware of any records from Adams, Cheyenne, Crowley, Custer, Fremont, Huerfano, Kiowa, Lincoln, Logan, Morgan, Phillips, Prowers, or Sedgwick counties. We know of only one record each from Alamosa, Arapahoe, Bent, Conejos, Costilla, Dolores, Ouray, Park, San Miguel, and Washington counties. As Kondratieff and Ward (1987) indicated, the eastern part of the state is in particular need of sampling. We have found only one species previously

reported from Colorado that we are unable to confirm and that we believe could not have been identified correctly. Bushnell et al. (1987) reported larvae of *Baetis rusticans* McDunnough from North Boulder Cr. (Boulder Co.), and Elgmork and Saether (1970) reported *Baetis* cf. *rusticans* from the same stream. This species is known only as adults from Quebec and New York. Since it would be impossible to make such a determination on the basis of sampled larvae only, *B. rusticans* is excluded herein.

SYSTEMATICS ACCOUNTS—In the following accounts, each species name is followed by a list of previously published reports (if any) and then by new or additional state records based on specimens at CSU or PERC. Newly reported species are asterisked and their collection records are given in full. Families are ordered according to McCafferty (1991a). We have followed the recent revision of North American Baetidae by Waltz and McCafferty (1987a, 1987b) and McCafferty and Waltz (1990). We have not followed the highly conservative reclassification of the Heptageniidae genera by Kluge (1989), but instead follow the generic concepts of Lehmkuhl (1979), Flowers (1980, 1982), Whiting and Lehmkuhl (1987a), and McCafferty and Provonsha (1988). Certain genera are presently undergoing revisions that will affect species recognized in Colorado. For example, *Ameletus* may prove to have more or fewer species in Colorado than we list. Although we have access to some of this revisionary data, including possible additional records for the state, we chose not to include such information unless we could confirm it from our collections.

Family Siphonuridae: **Siphonurus columbianus* McDunnough—PERC: Grand Co., Colorado R. at U.S. Hwy 40, VII-19-1972, A. V. Provonsha (larvae); Sargent, Tomichi Cr., VII-5-1955, C. P. Alexander (adults). This species has been known from British Columbia, California, Oregon, and South Dakota (McDunnough, 1925; Day, 1956; Allen and Edmunds, 1956; McCafferty, 1990), and there are specimens from Idaho in PERC. Day (1956) provided some key characteristics for the larvae, and stated that in California *S. columbianus* was found only at elevations above 4,000 feet.

Siphonurus occidentalis Eaton—Eaton (1885): not site specific; Dodds (1923): Boulder, Gilpin Co. (South Boulder Valley); Argyle and Edmunds (1962): Gunnison Co. (Gunnison R., Red

Cr., Soap Cr., Tomichi Cr., West Elk Cr.). CSU: Archuleta Co. (Piedra R.); Elbert Co. (Kiowa Cr.); Grand Co. (Colorado R.); Hinsdale Co.; Jackson Co. (Michigan R.); Larimer Co. (Lone Pine Cr., Poudre R., Sheep Cr.); Rio Grande Co. (Pines Cr.); Routt Co. (Yampa R.); Saguache Co. (Tomichi Cr.); Teller Co. (Florissant). PERC: Grand Co. (Colorado R., Dream Lake, Glacier Basin, Granby); Gunnison Co. (Gunnison R.); Jackson Co. (Gould); Routt Co. (Walton Cr.). This is a wide-ranging western species (see Allen and Chao, 1981). It is perhaps the most common *Siphonurus* in the West. Larvae of this species can often be collected in large numbers in overflow areas of streams throughout Colorado. This was one of the species that had been reported from the pre-impoundment study of the Gunnison River by Argyle and Edmunds (1962). Although Ward and Stanford (1990) could not find this species in their post-impoundment study of that river, there are specimens housed at both CSU and PERC that have been taken from the area since impoundments were created.

Family Ameletidae: *Ameletus aequivocus* McDunnough—McDunnough (1934): Gilpin Co. (Tolland), Gunnison Co. (Gunnison R. near Almont). CSU: Grand Co. (Colorado R.); Larimer Co. (Sheep Cr.). Until now, this species had been known only from the type material (male adults) from Colorado. Larvae remain unknown, but larvae that have been taken in Colorado and do not fit any other species precisely may prove to be this species. For example, there are distinctive larval specimens in PERC from the Piedra River, Rio Blanco, and Conejos River that are the same but that do not fit any presently published description of western *Ameletus*. Their gill 4 has a subdorsal sclerotized band but no ventral band, and the ventral border possesses 16–19 spines. Their tails are banded, but there is only slight nondescript dorsal and ventral abdominal patterning, and the gills show no distinct tracheation. They are similar to, but still distinct from, *Ameletus* sp. B of Allen and Chao (1981) from New Mexico, and therefore could be either a) a new species, b) *A. falsus* (described from Arizona but unknown as larvae), or even c) *A. aequivocus* or *A. subnotatus* (see below), although the distribution would suggest a southwestern affinity.

**Ameletus celer* McDunnough—CSU: Jackson Co., Lake Agnes, 2 km off Rt. 14, VIII-1, 2-1987, D. Funk (adults), Michigan R. below Lake Agnes, off Rt. 14, VII-28-1991, B. Kondratieff, R.

Durfee, B. Painter (adults). This species was previously known from western Canada.

**Ameletus similior* *McDunnough*—PERC: Gunnison Co., Gunnison R. 79-110 kick pick (larvae); Mineral Co., Pass Cr. 4 mi. E Wolf Cr. Pass, Hwy 160, III-23-1967, R. W. Baumann (larvae). This species was previously known from Alberta, and the first author has seen specimens from Idaho. There is a possibility that *A. celer* and *A. similior* represent variants of the same species.

Ameletus sparsatus *McDunnough*—Short and Ward (1980): Larimer Co. (Joe Wright Cr.); Ward (1986): Boulder Co. (St. Vrain R. system); Ward and Stanford (1990): Delta, Gunnison Co. (Gunnison R.). PERC: Gunnison Co. (Gunnison R.). This species was originally described from Alberta, and the first author has seen specimens from Idaho. *Ameletus cooki* *McDunnough* and *A. sparsatus* can be difficult to distinguish, and the latter may eventually prove to be a junior synonym of the former.

Ameletus subnotatus *Eaton*—Eaton (1885): not site specific; Dodds (1923): Boulder Co. (South Boulder Valley); Traver (1935): El Paso Co. (Pikes Peak). CSU: Archuleta Co. (San Juan R.); Grand Co. (Colorado R.); Larimer Co. (Poudre R.); Routt Co. (Elk R.). Dodds (1923) simply stated that a few specimens of *A. subnotatus* were found in South Boulder Valley. There is some question as to whether those specimens or the concept of Traver (1935) are applicable to this species. The species has not been reported in ecological studies and has not been clearly defined. According to J. Zloty (pers. comm.), who is presently revising the genus *Ameletus* in western North America, *A. subnotatus* is a northern boreal, transcontinental species. See also Remarks under *A. aequivocus*, above.

**Ameletus validus* *McDunnough*—CSU: Larimer Co., Buckhorn Cr., 22 mi. NW Ft. Collins, X-2-1986, S. Klahn (adults); Larimer Co., Buckhorn Cr., 21 mi. N Masonville, IX-12-1986, B. Kondratieff (larvae). This species is known from northern California north through western Canada, and the first author has seen specimens from Idaho.

Ameletus velox *Dodds*—Dodds (1923): Boulder, Gilpin Co. (South Boulder Valley, Tolland); Allan (1975): Gunnison Co. (Cement Cr.). CSU: Saguache Co. (Cave Cr.). Ward and Berner (1980) tentatively identified larvae of this species from St. Vrain Creek. The species is evidently

widespread throughout the West, and Allen and Chao (1981) redescribed the larvae from Arizona.

Family *Baetidae*: *Acentrella insignificans* (*McDunnough*)—All previous reports have been as *Baetis insignificans*. Morihara and McCafferty (1979b): Routt Co. (Yampa R.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Kondratieff and Ward (1987): Yuma Co. (Chief Cr., North Fork Republican R.); Rader and Ward (1989): Grand Co. (Colorado R.); Ward and Stanford (1990): Delta, Gunnison, Mesa Co. (Gunnison R.). CSU: Boulder Co. (North Boulder Cr., St. Vrain Cr., Silver Lake Cr.); Delta Co. (Gunnison R., Ward Cr.); Grand Co. (Sand Cr.); Gunnison Co. (Colorado R.); Jackson Co. (North Platte R.); Larimer Co. (Poudre R.); Moffat Co. (Yampa R.); Montrose Co. (Gunnison R.); Rio Blanco Co. (Piceance Cr.); Routt Co. (Mad Cr.). PERC: Gunnison Co. (Gunnison R.); Moffat Co. (Vermillion Cr.). This species is known throughout the West. Although it is known from all physiographic regions of Colorado, it is a particularly common mayfly in far western Colorado streams and rivers.

**Acentrella turbida* (*McDunnough*)—CSU: Boulder Co., North St. Vrain Cr., VIII-22-1984, H. Copeland (larvae); Summit Co., Blue R., 11 km below Dillon Reservoir, IX-22-1985, N. Voelz (larvae). PERC: La Plata Co., La Plata R., 10 mi. W Durango, Hwy 160, III-20-1967 (larvae); Rio Grande Co., Monte Vista, VII-9-1946, F. C. Harmston (adults). This species was previously reported from Alberta and Utah (as *Pseudocloeon turbidum*). The first author has recently seen material from British Columbia also. The larvae of this species has not been formally described, but will be described from the British Columbia material by McCafferty and Wigle. Adults and larvae of *A. carolina* (Banks) can be easily confused with this species, and any *Acentrella* larvae that appear to be *A. carolina* in Colorado are most likely *A. turbida*.

**Acerpenna pygmaea* (*Hagen*)—CSU: Routt Co., Yampa R. near Steamboat Springs off Rt. 13, VII-28-1991, B. Kondratieff, R. Durfee, B. Painter (larvae). This species has not been reported in western North America, although McCafferty and Davis (1992) recently found it commonly in Texas. The single larval specimen from western Colorado agrees in all respects with the variant of *A. pygmaea* shown by Morihara and McCafferty (1979b) to have a broad light stripe running dorsally from the pronotum

through the dorsal abdomen. The only exception to this fit is that the Colorado specimen has gills that are serrate on both the anterior and posterior margins. Morihara and McCafferty (1979b) separated *A. pygmaea* from *A. macdunnoughi* (Ide) by its supposed possession of gills that were serrate only on the posterior margin. The Colorado specimen, however, is clearly not *A. macdunnoughi*. This would indicate either that *A. pygmaea* is variable with respect to gill serration, or that it is possibly the undescribed larva of *A. akataleptos* (McDunnough), which is the only other species of the genus known from western North America.

**Apobaetis indeprensus* Day—CSU: Moffat Co., Green, R., Dinosaur National Monument, IX-1-1987, H. Copeland (larvae). This species has been known from California, Kansas, and Texas previously, although the specific identification of the Kansas and Texas material is somewhat tentative (McCafferty and Davis, 1992). A second species is known from Georgia (see Waltz and McCafferty, 1986). Individuals of this genus are infrequently collected because of their exceedingly small size.

**Baetis armillatus* McCafferty and Waltz—CSU: Yuma Co., Chief Cr., Rd. CC North, VI-28-1986 (larvae). This species was previously known from the Northeast and Southeast, and in the West from Alberta. It has historically been known as *Pseudocloeon parvulum* McDunnough (see McCafferty and Waltz, 1990).

Baetis bicaudatus Dodds—Dodds (1923) as *Baetis bicaudatus* and *Baetis minimus*: Gilpin Co. (Tolland); Dodds and Hisaw (1925) as *B. bicaudatus* and *B. minimus*: Boulder, Gilpin Co. (South Boulder Valley); Elgmork and Saether (1970): Boulder Co. (North Boulder Cr.); Allan (1975): Gunnison Co. (Cement Cr.); Morihara and McCafferty (1979b): El Paso Co. (Monte Vista), Gilpin Co. (Tolland); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Ward et al. (1986): Grand Co. (Bennett Cr., Colorado R.); Bushnell et al. (1987): Boulder Co. (North Boulder Cr.); Ward and Stanford (1990): Delta, Gunnison Co. (Gunnison R.). CSU: Boulder Co. (Silver Lake Cr.); Chaffee Co. (Deer Cr., Hughes Cr.); Garfield Co. (Hanging Lake Cr.); Grand Co. (Colorado R., St. Louis Cr., Tonahutu Cr.); Gunnison Co. (Cement Cr., East R., Gunnison R.); Jackson Co. (Michigan R.); La Plata Co. (La Plata R.); Larimer Co. (Dadd Gulch); Mineral Co. (Pass Cr., Willow Cr.); Rio Grande Co. (Rio

Grande R.); Routt Co. (Mad Cr.). PERC: Gunnison Co. (Gunnison R.); Rocky Mountain National Park (Loch Vale R.). This is a relatively common mountain species throughout the West. It sometimes is the only mayfly species found in alpine streams of Colorado. It is now known to range into Alaska (Milner, 1987), and the first author and N. Kluge of St. Petersburg, Russia have recently confirmed that it also occurs in Siberia. Another "two-tailed," trout-stream species of *Baetis* that may eventually be confirmed from Colorado is *B. punctiventris* (McDunnough), which has often been incorrectly known as *Pseudocloeon edmundsi* to Salmon River and Yellowstone fly fishermen.

Baetis flavistriga McDunnough—Ward and Stanford (1990): Gunnison Co. (Gunnison R.). CSU: Grand Co. (Muddy Cr.); Jackson Co. (Michigan R.); Larimer Co. (Buckhorn Cr., Poudre R.). PERC: Archuleta Co. (Piedra R.). Morihara and McCafferty (1979b) stated that this species was one of the most abundant and common *Baetis* species in eastern North America. McCafferty (1990) concluded that the Black Hills of South Dakota represented the westernmost limits of its range, and that its distribution in South Dakota was relict in nature. With the confirmation of this species from at least three areas in Colorado, it is becoming clear that it is much more widespread in mountain areas. We therefore expect it to be found in other western states as materials are studied. This must be regarded as a rather special type of mayfly distribution in North America, in that it is found primarily in mountain areas across the continent (Rocky Mountains, Black Hills, Ozark-Ouachita Mountains, and the Appalachians).

**Baetis magnus* McCafferty and Waltz—CSU: Elbert Co., Kiowa Cr. at Elbert, IV-26-1986, B. Kondratieff (larvae, adults); Larimer Co., Hewlett Gulch, Poudre Canyon, IX-24-1988 B. Kondratieff, III-10-1991, B. Kondratieff and R. Durfee, III-23-1991, M. Harris and R. Durfee (larvae, adults); Larimer Co., Redstone Cr., 2 mi. N of Co. Rd. 38E, III-16-1991, M. Harris and C. R. Nelson (larvae); Larimer Co., Buckhorn Cr., 20 mi. N Masonville, X-2-1986, S. Kahn (larvae); Larimer Co., Spring Cr., Spring Cr. Dam, Horsetooth, IV-16-1986, B. Kondratieff (larvae); Mesa Co., small creek, Monument Canyon, IV-30-1988, B. Kondratieff and E. Bergrey (larvae). PERC: La Plata Co., Beaver Cr. 15 mi. E Bayfield, III-21-1967, R. W. Baumann

(larvae). This large-sized *Baetis* species is known from Arizona, New Mexico, and Nebraska (McCafferty and Waltz, 1986). The collecting dates above suggest that it is an early developing species with adults emerging in the early spring. The newly confirmed adult stage of this species will be described elsewhere.

Baetis moffati Dodds—Dodds (1923): Gilpin Co. (Tolland); Traver (1935): El Paso Co. (Pikes Peak), Gothic. This species is known only from Colorado and has not been reconfirmed since 1935. This may be the result of it not being known in the larval stage. However, there is some possibility that *B. moffati* and *B. magnus* are equivalent. The adults of both are essentially similar, but this is not enough evidence for proposing a synonymy because the adults of all species of the *Rhodani* group of *Baetis*, to which they belong, are similar.

Baetis notos Allen and Murvosh—Ward and Stanford (1990) as *Baetis* sp. C: Delta, Gunnison, Mesa Co. (Gunnison R.). This is a southwestern species that was described from larvae by Morihara and McCafferty (1979b) as *Baetis* sp. C. Allen and Murvosh (1987) subsequently named it *B. notos*.

**Baetis propinquus* (Walsh)—CSU: Rio Blanco Co., Douglas Cr., Rt. 64, VIII-3-1986, B. Kondratieff (larvae). *Baetis propinquus* has been known primarily from the East and Midwest although the first author has recently seen larvae of this species from Texas, and Peters and Edmunds (1961) reported the species from New Mexico. *Baetis dardanus* McDunnough, another species of the *propinquus* species group (Morihara and McCafferty, 1979a) has been reported under various names from Alberta, Manitoba, Illinois, and Utah. Soluk (1981) described the larvae of *B. dardanus*, showing that it was distinct from *B. propinquus*. We expect that *B. dardanus* may eventually also be found in Colorado. We also expect that *B. propinquus* will prove to be a widespread species. Berner and Pescador (1988) commented on its extreme adaptability.

Baetis tricaudatus Dodds—Dodds (1923) as *Baetis tricaudatus* and *Baetis intermedius*: Boulder and Gilpin Co. (South Boulder Valley); Traver (1935): Denver Co. (Denver), Costilla Co. (Fort Garland); Peters and Edmunds (1961) as *B. intermedius*: Archuleta Co. (San Juan R.); La Plata Co. (Los Pinos R.); Elgmork and Saether (1970) as *B. intermedius*: Boulder Co. (North Boulder Cr.); Ward and Berner (1980) as *B. tricaudatus*

and *B. intermedius* (?): Boulder Co. (St. Vrain Cr.); Gray et al. (1983): Rio Blanco Co. (Piceance Cr.); Bushnell et al. (1987) as *B. tricaudatus* and *B. intermedius*: Boulder Co. (North Boulder Cr.); Rader and Ward (1987a, 1987b): Larimer Co. (Cache la Poudre R.); Rader and Ward (1989): Grande Co. (Colorado R.); Ward and Stanford (1990): Delta, Gunnison, Mesa, Montrose Co. (Gunnison R.). CSU: Archuleta Co. (Piedra R., Rio Blanco); Boulder Co. (Silver Lake Cr.); Chaffee Co. (Deer Cr.); Clear Creek Co. (West Chicago Cr.); Delta Co. (Ward Cr.); Dolores Co. (Dolores R.); Elbert Co. (Kiowa Cr.); Garfield Co. (Colorado R.); Grand Co. (Muddy Cr., St. Louis Cr.); Gunnison Co. (East R.); Hinsdale Co. (Lake Fork, Gunnison R.); Jackson Co. (Michigan R., North Platte R., Roaring Fork R.); La Plata Co. (La Plata R.); Larimer Co. (Hewlett Gulch, Mail Cr., Youngs Gulch); Mesa Co. (Colorado R.); Mineral Co. (Pass Cr.); Moffat Co. (Pool Cr.); Rio Blanco Co. (Black Sulphur Cr.); Routt Co. (Elk Cr., Mad Cr., Yampa R.); San Juan Co. (Lime Cr.); San Miguel Co. (San Miguel R.). PERC: El Paso Co. (Monte Vista); Gilpin Co. (Black Hawk); Grand Co. (Fall R.); Gunnison Co. (Gunnison R.); Larimer Co. (Poudre R.); Montezuma Co. (Chicken Cr.); Saguache Co. (Los Pinos R., Tomichi Cr.). This appears to be one of the most ubiquitous stream-dwelling mayfly species found in Colorado, and perhaps in North America (see Morihara and McCafferty, 1979b). It is known from many color and size variants that apparently may be correlated to a large extent with particular thermal growth regimes that vary with season and locale, similar to that demonstrated experimentally in *Stenacron* and *Hexagenia* by McCafferty and Periera (1984) and also shown by Kondratieff and Voshell (1984) in field population variants of *Isonychia*.

**Baetis virile* (McDunnough)—CSU: Jackson Co., Grizzly Cr. off Rt. 14, VII-28-1991, B. Kondratieff, R. Durfee, B. Painter (larvae). This report provides a considerable westward extension of the known range of this species, which is known from Quebec and Ontario and has not been generally reported in the literature since its description. While similar to *Acentrella* in that it lacks hindwings and has only two tails as a larva, it is otherwise distinct. The single specimen at CSU agrees with the larval key description of Traver (1935). There remains, however, some possibility that it is either a color variant of *B. punctiventris*

or that it is an undescribed species (see remarks under *B. bicaudatus*).

**Barbaetis cestus* (*Provonsha and McCafferty*)—CSU: Jackson Co., Roaring Fork R., 7 mi. SW Walden, VIII-22-1991, R. Durfee (larvae); Jackson Co., North Platte River 9 mi. SW Walden, VIII-31-1991, B. Kondratieff, R. Durfee (larvae). This find represents a considerable range extension westward not only for this species but for this genus. Provonsha and McCafferty (1982) reported this species from Arkansas, Illinois, and Indiana. The first author has also collected the species in Vermont. It is extremely common in Indiana streams, where it is predictably taken on fine pea gravel substrate in relatively shallow waters. Microhabitat data were not associated with the Colorado material. The brown band-like fifth abdominal segment, short antennae, two dark banded tails, robust body, and absence of hindwings make this species quite unmistakable in the larval stage.

Callibaetis americanus *Banks*—Banks (1900) as *C. americanus*: El Paso Co. (Clear Cr.), as *Callibaetis coloradensis*: La Plata Co. (Durango); Banks (1918) as *Callibaetis nigrinus*: Boulder Co. (Boulder); Dodds (1923) as *Callibaetis fusca*: Gilpin Co. (Tolland); Traver (1935) as *C. coloradensis*: El Paso Co. (Pikes Peak), Grand Co. (Tabernash), Larimer Co. (Estes Park); Thew (1959) as *Callibaetis evergreenensis*: Jefferson Co. (Evergreen); Ward and Dufford (1979) as *C. nigrinus*: Larimer Co. (springbrook). CSU: Clear Creek Co. (Clear Cr.); Eagle Co. (Vail); Elbert Co.; Garfield Co. (Rifle); Grand Co. (Colorado R.); Gunnison Co. (Kettle Ponds); Jackson Co. (Grizzly Cr., North Platte R.); Jefferson Co. (Reed's Pond); Larimer Co. (Dixon Reservoir, Glacier View Meadows, Poudre R., Spring Cr., Swift's Pond); Moffat Co. (Green R.); Park Co. (Antero State Wildlife Area); Pueblo Co. PERC: Alamosa Co. (Artesian Lake); Gilpin Co. (Tolland); Longmont. This is a widespread western species that ranges into Alaska. It is found in ponds, pools of streams, and even moderate current in streams. We treat *C. americanus* as distinct from the eastern *C. ferrugineus* (Walsh) (see McCafferty and Waltz, 1990).

**Callibaetis fluctuans* (*Walsh*)—CSU: Baca Co., Carrizo Cr., Carrizo Picnic Ground, X-19-1986, D. Brigham (larvae); Larimer Co., overflow pond, Lyon's Park, VIII-29-1990, B. Shafer (larvae); Mesa Co., Monument Canyon, Colorado National Monument, VIII-28-1988, B.

Kondratieff (larvae); Moffat Co., Pool Cr., Echo Park Rd., Dinosaur National Monument, VII-14-1990, B. Kondratieff (larvae); Weld Co., Dove Well, Pawnee National Grassland, IX-15-1986, R. Keith (larvae); Yuma Co., Landsmen Cr., 3 mi. SE Bonny Res., IX-23-1990, R. Durfee (larvae). This is a transcontinental species that has been primarily known from the Midwest and East. Specimens in PERC are from the Midwest, California, and Oregon. It may have been taken from other western states, probably being incorrectly identified as *Callibaetis montanus* Eaton or some other species (see McCafferty and Waltz, 1990).

Callibaetis pallidus *Banks*—Banks (1900): El Paso Co. (Clear Cr.); Traver (1935): Boulder Co. (Boulder), Denver Co. (Denver), Larimer Co. (Fort Collins). CSU: Weld Co. PERC: numerous pinned specimens are from Glacier Basin Camp, Rocky Mountain National Park and Cameron Pass. This is primarily a northern mid-western species, with its western limits in Colorado. Most specimens in PERC are from Indiana, Manitoba, Michigan, Minnesota, and South Dakota. The Colorado material in PERC was taken in 1940 and 1941 from relatively high elevations, e.g., 9,000 feet at Cameron Pass.

Callibaetis pictus *Eaton*—Dodds (1923) as *Callibaetis vitrea*: Gilpin Co. (Tolland); Traver (1935) as *Callibaetis doddsi*: Gilpin Co. (Tolland). CSU: Baca Co. (Carrizo Cr.); Denver Co. (Sand Cr.); Gilpin Co. (South Boulder Cr.); Larimer Co. (Spring Cr.); Mesa Co. (Monument Canyon). PERC: Loch Vale, Rocky Mountain National Park. This distinctive species is found throughout the West, and most recently from South Dakota (McCafferty, 1990) and Texas (McCafferty and Davis, 1992).

**Camelobaetidium warreni* (*Traver and Edmunds*)—CSU: Rio Blanco Co., White R., 0.5 mi. upstream from Yellow Cr., IX-9-1975 (larvae); Yuma Co., Chief Cr., IX-27-1991, A. Polonsky (larvae). Species previously known in the genus *Dactylobaetis* have been shown to belong to *Camelobaetidium* (McCafferty and Waltz, 1990). *Camelobaetidium warreni* was previously known only from California. We report this species from the extreme western and eastern parts of Colorado. Traver and Edmunds (1968) stated that they had seen larvae from the Colorado River drainage in Colorado that were unnamed allies of *C. cepheus* Traver and Edmunds. However, they gave no specific site information. *Camelo-*

baetidius cepheus has been known from Idaho and possibly Oregon (Traver and Edmunds, 1968), and the first author has collected it from the Virgin River in southern Utah and also collected and reported the species from South Dakota (McCafferty, 1990). It also probably occurs in Saskatchewan [the *Dactylobaetis* sp. of Lehmkuhl (1976)]. The genus remains difficult to work because the specific limits are little understood. Recently described species from New Mexico and Arizona by Allen and Chao (1978b) may indeed prove to be variants of *C. cepheus* or *C. warreni*. In fact these two species may prove to be synonyms.

**Camelobaetidius* sp. 1 of McCafferty and Davis—CSU: Moffat Co., Yampa R., Echo Park, Dinosaur National Monument, VII-16-1991 (larvae). These larvae apparently are the same species with highly multidenticulate claws that McCafferty and Davis (1992) recently found in Texas. They are quite unlike any other species known in North America, except perhaps for *C. salinus* (Allen and Chao). Like the specimens taken in Texas, the Colorado larvae are immature, and a better series will be necessary before the species can be accurately described.

**Centroptilum bifurcatum* McDunnough—CSU: Jackson Co., North Platte R. 9 mi. SW Walden, VIII-6, VIII-31-1991, B. Kondratieff, R. Durfee (adults and larvae); Jackson Co., Roaring Fork R. at County Rd 5 bridge, VIII-31-1991, B. Kondratieff, R. Durfee (adults and larvae). PERC: Grand Co., Muddy Cr., Hwy 40, Rabbit Ears Pass, VIII-23-1967, R. W. Baumann (adults); Routt Co., Elk R., Rt. 69, VIII-20-1967, N. B. Paul (adults). This species was previously known from Alberta, Idaho, Manitoba, and Utah. It is the only species of *Centroptilum* currently confirmed from Colorado. McCafferty and Waltz (1990) listed six North American species of *Centroptilum*, with *C. selandorum* Edmunds the only other western species. Some of the larval skins we have examined from an extensively reared series from the North Platte River agree well with the recent larval description of this species by Lowen and Flannagan (1991). However, others of the series vary from the dorsal color pattern those authors illustrated. Among the adults there is variation both in thoracic nota coloration and in the shape of the subgenital plate, with a number of males showing a slight emargination like that illustrated by Edmunds (1954a)

in his description of *C. selandorum*. It therefore is possible that the latter name is a junior synonym of *C. bifurcatum*.

Dipheter hageni (Eaton)—Dodds (1923) as *Baetis parvus*: Gilpin Co. (Tolland); Ward and Berner (1980) as *Baetis parvus*: Boulder Co. (St. Vrain Cr.); Ward (1986): Boulder Co. (St. Vrain R. system); Ward and Stanford (1990) as *Baetis hageni*: Delta, Gunnison, Mesa Co. (Gunnison R.). CSU: Grand Co. (Colorado R.); Gunnison Co. (East R.); Jackson Co. (North Platte R., Roaring Fork R.). PERC: Gunnison Co. (Gunnison R.); Saguache Co. (Los Pinos Cr.). This is a distinctive, transcontinental species known from British Columbia to Quebec and south to North Carolina, Indiana, Missouri, and Colorado.

Fallceon quilleri (Dodds)—Dodds (1923) as *Baetis quilleri*: Boulder Co. (South Boulder Cr.). CSU: Denver Co. (Sand Cr.); Jackson Co. (North Platte R.); Larimer Co. (Poudre R.); Mesa Co. (North Thoroughfare Canyon). PERC: Archuleta Co. (Martinez Cr.). This is a widespread species, common in the Southwest. In the West, it is presently not known any further north in the Rocky Mountains than its Colorado records, although it is known from the Black Hills, South Dakota. In Colorado it is known only from relatively low elevations.

**Heterocloeon frivolum* (McDunnough)—CSU: Jackson Co., North Platt R. 9 mi. SW Walden, VIII-31-1991, B. Kondratieff, R. Durfee (adults). Like several other species documented herein, this species is known as an eastern and midwestern species. Like *Barbaetis cestus*, it is an eastern species that has shown up in the North Platte River in Jackson County, indicating a disjunct pattern (on the basis of current distributional information) and suggesting perhaps a historically widespread pattern. It is apparently the most ancestral species of the genus, retaining venation in the hindwings among other traits. Morihara and McCafferty (1979c) transferred the species from *Baetis* on the basis of larval characteristics. The previous most western record of *H. frivolum* was Illinois, and the genus was not reported from west of the Mississippi River. There is some possibility that the adults from Colorado represent a new species closely related to *H. frivolum* or to the eastern species *Acentrella ampla* Traver, the adults of which are symmorph with those of *H. frivolum* according to Morihara and McCafferty (1979c).

**Procloeon album* (*McDunnough*)—CSU: Jackson Co., Roaring Fork R. at County Rd 5 bridge, VIII-31-1991, B. Kondratieff, R. Durfee (adults and larvae). This new state record is based on a single male adult that was reared from a larva. The adult matches well the description of *P. album*. The larval skin possesses the distinctive medially and apically banded tails shown by Lowen and Flannagan (1991), but otherwise appears dark with sparse light markings, quite unlike that figured by Lowen and Flannagan (1991). This mainly northern species is found across North America, being also known from British Columbia, Manitoba, New Brunswick, North Carolina, Ontario, and Quebec.

Procloeon ingens (*McDunnough*)—Traver (1935) as *Cloeon ingens*: Larimer Co. (Pingree Park). Besides Colorado, this species has been known from both western and eastern Canada. It is only one of a number of other possible species of *Procloeon* (esp. *Procloeon conturbatum*) that may eventually be found in Colorado.

Family Ametropodidae: *Ametropus albrighti* Traver—Allen and Edmunds (1976): Moffat Co. (Yampa R.). This species is known from medium sized to large, sandy bottomed rivers from northern New Mexico and the Green River drainage system of Wyoming, Utah, and Colorado.

Family Pseudironidae: **Pseudiron centralis* *McDunnough*—CSU: Otero Co., Arkansas R. at Fowler, VI-12-1974 (larvae). Edmunds et al. (1976) indicated that this species was found sporadically from the southeastern United States to Manitoba, Wyoming, and Utah. Pescador (1985) reiterated this, but neither publication provided any records from Colorado. It may have been presumed that the species occurred in Colorado because it was found in adjacent areas of southwestern Wyoming and northeastern Utah (Edmunds and Musser, 1960). It is here reported from the central-southeastern part of the state not the northwestern part. It is also common in the sandy bottomed rivers of Nebraska. It may eventually be found to occur in the Yampa/Green River drainages of the western plateaus region. McCafferty (1991b) discussed the rather consistent North American distributional patterns of psammophilous, carnivorous mayflies, including *Pseudiron*.

Family Isonychiidae: **Isonychia campestris* *McDunnough*—CSU: Mesa Co., Colorado R. at Grand Junction, VII-28-1989, B. Kondratieff

(adults); Mesa Co., Colorado R. at Fruita, Rt. 340, VII-30-1988, B. Kondratieff and E. Bergey (adults); Mesa Co., Colorado R. at Corn Lake, Clifton, IX-2-90, R. Durfee (larvae); Moffat Co., Dinosaur National Monument, at lights, VII-17-1991, D. Leatherman (adults); Rio Blanco Co., Douglas Cr., Rt. 64, VIII-3-1986, B. Kondratieff (larvae). Kondratieff and Voshell (1984) previously noted that the species was distributed from Alberta to northeastern Utah north to Manitoba.

Isonychia rufa *McDunnough*—Kondratieff and Ward (1987): Yuma Co. (Chief Cr., North Fork Republican R.). CSU: Bent Co. (Arkansas R.); Kit Carson Co.; Larimer Co. (Fort Collins); Otero Co. (Arkansas R.); Weld Co. This species is a midwestern species that apparently has its western range limits in eastern Colorado and the panhandle of Nebraska.

Family Oligoneuriidae: **Lachlania saskatchewanensis* *Ide*—CSU: Moffat Co., Yampa R., Dinosaur National Monument, VII-19-1985, C.D.O.W. (larvae); Otero Co., Arkansas R. at Fowler, VIII-6-1974 (larvae); Rio Blanco Co., White R. Rt. 110.6, IX-3-1990, M. Trammell (larvae); Rio Blanco Co., White R. at Rangely (larvae). Distribution records for *L. saskatchewanensis* have been limited to Saskatchewan. However, with the discovery of larvae of this species in Colorado, a common distribution pattern for certain western species emerges once again. Koss and Edmunds (1970) had recognized the possibility of *L. powelli* Edmunds, known from adjacent areas of eastern Utah, being a junior synonym of *L. saskatchewanensis*. Given the southern range extension of *L. saskatchewanensis* shown here, such a synonymy is perhaps even more likely.

Family Heptageniidae: *Cinygmula mimus* (*Eaton*)—Eaton (1885) as *Cinygma mimus*: El Paso Co. (Manitou). CSU: Boulder Co. (North Boulder Cr.); Grande Co. (Colorado R., North Fork Colorado R.); Gunnison Co. (Cement Cr.); Jackson Co. (Michigan R.); Larimer Co. (Buckhorn Cr.); Rio Grande Co. (Beaver Cr.).

Cinygmula par (*Eaton*)—Dodds (1923) as *Cinygma mimus*?: Boulder and Gilpin Co. (South Boulder Cr.); Elgmork and Saether (1970) as *Cinygmula mimus*: Boulder Co. (North Boulder Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). PERC: Boulder Co. (Fawn Brook); Routt Co. (Fish Cr., Walton Cr.). There is considerable confusion about the identification of

Cinygmula species mainly due to the fact that larvae have not been adequately described and compared. *Cinygmula par* and *C. mimus* seem often to be confused (see previous records above). It remains unclear as to what species the many references to *Cinygmula* sp. that appear in published ecological studies in Colorado actually refer. However, *C. par* is apparently a high altitude species (it was taken by Dodds in headwater areas between 10,500 and 11,650 feet) that has been referred to under various epithets (see also Traver, 1935; Ward and Berner, 1980).

Cinygmula ramaleyi (Dodds)—Dodds (1923) as *Ecdyurus ramaleyi* and *Iron tollandi*: Boulder and Gilpin Co. (South Boulder Cr.); Rader and Ward (1988): Grand Co. (Colorado R.). CSU: Grand Co. (Colorado R., South Fork Ranch Cr., Tonahutu Cr.); Jackson Co. (Michigan R.); Larimer Co. (Poudre R.); Pueblo Co. (spring). PERC: Gunnison Co. (Anthracite Cr.). The male genitalia of this species, while clearly diagnostic, place it near *C. par*. Traver's (1935) key can be misleading, however, because the wings of *C. ramaleyi* may or may not be tinged with amber. This tinge may actually be due to the variable amount of an oily residue on the wing membrane, as becomes apparent where it leeches out in specimens that have been preserved in alcohol for some time (McCafferty, unpubl.).

Heptagenia diabasia (Burks)—Kondratieff and Ward (1987): Yuma Co. (Chief Cr.). CSU: Denver Co. (Sand Cr.); Larimer Co. (Mail Cr., Poudre R., Spring Cr.); Otero Co. (Arkansas R.); Weld Co.; Yuma Co. (Arikaree Cr.). This species has been thought to be a strictly midwestern species (Burks, 1953); however, it not only is found in the eastern plains region of Colorado, but also in the north central area of the state. It also has been collected in the Sand Hills area of Nebraska (McCafferty, unpubl.) and in New Mexico (Kondratieff, unpubl.). In this respect, it is similar in distribution pattern to only a relatively few heptageniid mayflies. Adults of *H. diabasia* and *H. elegantula* are difficult to distinguish, but the larvae of the two are readily identified (Bednarik and Edmunds, 1980).

Heptagenia elegantula Eaton—Eaton (1885) as *Rhithrogena elegantula*: El Paso Co. (Arkansas Canyon); Banks (1914) as *Heptagenia coxalis*; Jefferson Co. (Clear Cr.); Dodds (1923) as *Rhithrogena elegantula*: Boulder and Gilpin Co. (South Boulder Valley); Traver (1935): Larimer Co.

(Fort Collins), Platte Canyon; Peters and Edmunds (1961): Archuleta Co. (San Juan R.); Ward (1975): Boulder Co. (North St. Vrain Cr.); Ward (1976b): Douglas Co. (South Platte R.); Bednarik and Edmunds (1980): Mesa Co. (Colorado R.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). CSU: Larimer Co. (Poudre R.); Mesa Co. (Colorado R.); Moffat Co. (Yampa R.); Rio Blanco Co. (Douglas Cr., White R.). PERC: Gunnison Co. (Iola). Larvae of *H. elegantula* can be difficult to distinguish from *H. solitaria*. See Bednarik and Edmunds (1980) for dorsal abdominal color pattern variations in both species. Larvae tentatively identified as *H. elegantula* in CSU are from Grizzly Creek (Jackson Co.).

Heptagenia solitaria McDunnough—McDunnough (1926): Platte Canyon; Traver (1935): questionable identification, no site specific data; Peters and Edmunds (1961): La Plata Co. (Los Pinos R.); Argyle and Edmunds (1962): Gunnison Co. (Cebolla Cr., Gunnison R., Soap Cr., Steuben Cr., West Elk Cr.), Montrose Co. (Cimarron Cr.); Ward and Stanford (1990): Delta, Gunnison, Mesa Co. (Gunnison R.). CSU: Archuleta Co. (Piedra R.); Garfield Co. (Colorado R.); Jackson Co. (North Platte R.); Larimer Co. (Lone Pine Cr., Poudre R.); Mesa Co. (Dolores R., Plateau Cr.); Moffat Co. (Yampa R.); Montrose Co. (Gunnison R.). This is a common species in the Gunnison River system, and except for Larimer Co. records is found on the western slope. Also, see remarks for *H. elegantula* above.

Iron albertae McDunnough—All previous Colorado records have been as *Epeorus albertae*. Argyle and Edmunds (1962): Gunnison Co. (Beaver Cr., Blue Cr., Curecanti Cr., Gunnison R., Red Cr., Steuben Cr., West Elk Cr.), Montrose Co. (Cimarron Cr.); Ward (1975): Boulder Co. (North St. Vrain Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). CSU: Boulder Co. (Chief Cr.); Grand Co. (Colorado R.); Larimer Co. (Buckhorn Cr., Poudre R., Sheep Cr.); Routt Co. (Elk R., Mad Cr.). Edmunds and Musser (1960) and Ward and Berner (1980) indicated that this Intermountain West species tends to replace other *Iron* species as waters become somewhat warmer at lower elevations.

Iron deceptivus (McDunnough)—Dodds (1923) as *Iron longimanus*: Boulder and Gilpin Co. (South Boulder Valley); Short and Ward (1980) as *Epeorus deceptivus*: Larimer Co. (Joe

Wright Cr.); Ward and Berner (1980) as *Epeorus deceptivus*: Boulder Co. (St. Vrain Cr.). CSU: Chaffee Co. (S. Arkansas R.); Clear Creek Co. West Chicago Cr.); Grand Co. (South Fork of Ranch Cr.); Gunnison Co. (Crystal R., East R.); Jackson Co. (Jack Cr., Michigan R.); Lake Co. (Lake Fork); Larimer Co. (McIntyre Cr., Roaring Fork); Mineral Co.; San Juan Co. (Lime Cr.). PERC: Gunnison Co. (Gunnison R.). This species is evidently restricted to the Intermountain West (Edmunds and Allen, 1964).

Iron longimanus Eaton—Eaton (1881) as Colorado sp.: not site specific; Eaton (1885): not site specific; Dodds (1923) as *Iron* nymph no. 1: Gilpin Co. (South Boulder Cr.); Dodds and Hisaw (1924) as *Iron* sp.: Boulder Co. (South Boulder Cr.); Traver (1935): Larimer Co. (Estes Park), Boulder Co. (South Boulder Valley), South Park, and as *Iron propius*: “probably South Boulder Valley”; Argyle and Edmunds (1962) as *Epeorus longimannus* [sic]: Gunnison Co. (Beaver Cr., East Elk Cr., Gunnison R., Red Cr., Steuben Cr., Soap Cr., West Elk Cr.); Allan (1975) as *E. longimanus*: Gunnison Co. (Cement Cr.); Ward (1976b) as *E. longimanus*: Douglas Co. (South Platte R.); Ward and Berner (1980) as *E. longimanus*: Boulder Co. (St. Vrain Cr.); Rader and Ward (1987a) as *E. longimanus*: Larimer Co. (Cache la Poudre R.); Rader and Ward (1988) as *E. longimanus*: Grand Co. (Colorado R.); Ward and Stanford (1990) as *E. longimanus*: Boulder Co. (North St. Vrain Cr.). CSU: Chaffee Co. (Deer Cr.); Clear Creek Co. (West Chicago Cr.); Delta Co. (Gunnison R.); Grand Co. (St. Louis Cr.); Gunnison Co. (Crystal R., East R., Gunnison R.); Jackson Co. (Michigan R.); Jefferson Co. (South Platte R.); Lake Co. (Lake Fork); La Plata Co. (La Plata R.); Larimer Co. (Glacier Cr., McIntyre Cr., Rist Canyon, Sheep Cr., Youngs Gulch); Pitkin Co. (Maroon Cr.); Saguache Co. (Saguache Cr.); Summit Co. (Blue R.). PERC: Gunnison Co. (Gunnison R.); Routt Co. (Fish Cr., Service Cr., Walton Cr., Yampa R.). Additionally in PERC there are pinned adults from Glacier Basin, Loch Vale, and Oslar. Edmunds and Allen (1964) noted that this was the most widespread of the western species of *Iron* and that it evidently is not found cohabiting with *I. albertae*.

**Ironopsis grandis* (McDunnough)—PERC: Gunnison Co., Gunnison R., Surber Survey 79-104 (larvae); Rocky Mountain National Park,

Glacier Cr. at Glacier Gorge Junction, VIII-24-1967, R. W. Baumann (adults). This species has been known from Alberta, British Columbia, California, Montana, South Dakota, and Oregon. The first author also has seen specimens from Idaho, Washington, and Wyoming. This species was therefore to be expected in Colorado. It is surprising that the distinctive larvae of this species had not been reported before in any of the state ecological studies, and it may be that populations are very isolated, such as those of the Black Hills, South Dakota (McCafferty, 1990).

**Macdunnoa persimplex* (McDunnough)—CSU: Larimer Co., Fort Collins, at lights VII-23-1935, M. T. James, VII-24-1935, R. Swain (adults). The 1935 date of collection of the material, on which this record is based, along with the fact that the species has been known as a midwestern species with Lincoln, Nebraska as its western limit, make this both an unusual and somewhat unexpected addition to the Colorado list. The material was taken at lights and originally identified by McDunnough. The only other western species of this genus is *M. nipawinia* Lehmkuhl, known from Saskatchewan. It remains to be seen whether *M. persimplex* still exists in Colorado.

Nixe criddlei (McDunnough)—Traver (1935) as *Heptagenia criddlei*: Larimer Co. (Fort Collins), South Park; Ward and Berner (1980) as *H. criddlei*: Boulder Co. (St. Vrain Cr.). CSU: Grand Co. (Colorado R., Muddy Cr.); Gunnison Co. (Gunnison R.); Jackson Co. (Michigan R., Roaring Fork R.); Larimer Co. (Buckhorn Cr., Glacier View, Lone Pine Cr., Poudre R., Youngs Gulch); Mesa Co. (Big Cr.); Montrose Co. (Buckeye Reservoir); Routt Co. (Little Rock Cr.). PERC: Grand Co. (Muddy Cr.); Chinerys. It is likely that some of the *Heptagenia* spp. reported from the upper Gunnison R. drainage system by Argyle and Edmunds (1962) are referable to this species.

Nixe simplicioides (McDunnough)—Bednarik and Edmunds (1980) as *Heptagenia simplicioides*: Boulder Co. (St. Vrain Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). CSU: Archuleta Co. (Piedra R.); Larimer Co. (Grizzly Cr.); Larimer Co. (Poudre R.); Routt Co. (Yampa R.); Saguache Co. (Tomichi Cr.). PERC: Grand Co. (Kinney Cr.). The larvae of this western species, which tend to occur in moderate currents below 7,000 feet, were keyed by Traver (1935)

and were eventually described by Bednarik and Edmunds (1980).

Rhithrogena flavianula (McDunnough) — McDunnough (1924) as *Heptagenia flavianula*: Gunnison Co. (Gunnison), Garfield Co. (Glenwood Springs). The above records are the only ones presently available for this species. The fact that the larval stage remains unknown may be the reason for it not being reported again since its original description. The third author has studied the types of *R. flavianula* and determined it is distinct from *R. hageni* Eaton. There are unidentifiable larvae at CSU from the North Platte River that lack dorsal protuberances on the gills, similar to *R. robusta*, but also lack a sclerotized setal line on the gills ventrally. These may eventually prove to be larvae of *R. flavianula*.

Rhithrogena hageni Eaton—Dodds (1923): Boulder and Gilpin Co. (South Boulder Valley); Argyle and Edmunds (1962) as *R. robusta*: Gunnison Co. (Gunnison R.); Allan (1975): Gunnison Co. (Cement Cr.); Ward (1975) as *Rhithrogena doddsi*: Boulder Co. (North St. Vrain Cr.); Ward (1976a) as *R. doddsi*: Douglas Co. (South Platte R.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Rader and Ward (1987a, 1987b): Larimer Co. (Cache la Poudre R.); Ward and Stanford (1990): Delta, Gunnison, Mesa Co. (Gunnison R.). CSU: Jackson Co. (Michigan R.); Jefferson Co. (South Platte R.); Larimer Co. (Buckhorn Cr., Poudre R.). PERC: Archuleta Co. (West Fork San Juan R.); Conejos Co. (Conejos R., Rio San Antonio); Gunnison Co. (Almont, Gunnison R.); La Plata Co. (Lightning Cr.); Mineral Co. (Pass Cr.); Rio Grande Co. (Rio Grande R., Willow Cr.). It is likely that some of the *Rhithrogena* spp. reported from the upper Gunnison River drainage by Argyle and Edmunds (1962) are referable to this species.

Rhithrogena robusta Dodds—Dodds (1923) as *Rhithrogena robusta* Needham: Gilpin Co. (South Boulder Valley, Tolland); Short and Ward (1980): Larimer Co. (Joe Wright Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). CSU: Gunnison Co. (Cement Cr., East R.); Jackson Co. (Michigan R.); Lake Co. (Lake Fork); Larimer Co. (McIntyre Cr.). PERC: Gunnison Co. (Gunnison R.); Chasm Lake. Dodds (1923) first noted that larvae of this species may or may not have pink or red gills. A parallel situation was discussed by Flowers and Hilsenhoff (1975) for the eastern and midwestern species *R. impersonata* McDunnough.

Rhithrogena undulata (Banks)—Peters and Edmunds (1961): Archuleta Co. (San Juan R.); Allan (1975): Gunnison Co. (Cement Cr.). CSU: Garfield Co. (Colorado R.); Larimer Co. (Poudre R.); Moffat Co. (Yampa R.); Montrose Co. (Cedar Cr.); Rio Blanco Co. (White R.). This species appears to be limited to the western slope in Colorado, and it shows considerable color variation throughout its range. It, as well as *R. plana* and *R. vitta* described by Allen and Chao (1978a) from Arizona, will likely prove to be variants of *R. morrisoni* (Banks). *Rhithrogena morrisoni* has one page priority over *R. undulata* (see Banks, 1924) and has been reported from Arizona, California, Nevada, New Mexico, and Utah. In addition, the first author has seen specimens from Idaho and Wyoming.

Family Leptophlebiidae: *Choroterpes albianulata McDunnough—PERC: Moffat Co., Yampa R., 1938 (larvae). In an unpublished Master's thesis submitted to Colorado State University in 1977, E. L. Ames had earlier reported this species in abundance in the Yampa River (Moffat Co. and Routt Co.) and White River (Rio Blanco Co.). Edmunds and Musser (1960) reported this species from the Green River in nearby areas of both Utah and Wyoming. It is now generally known from throughout the Northwest, and McCafferty (1992a) has recently described the larval stage, allowing the present confirmation.

Choroterpes inornata Eaton—Ward and Berner (1980) as *C. inornata* (?): Boulder Co. (St. Vrain Cr.); Ward and Stanford (1990): Mesa Co. (Gunnison R.). CSU: Archuleta Co. (Piedra R.); Delta Co. (Gunnison R.); Jackson Co. (North Platte R., Roaring Fork R.); Larimer Co. (Lone Pine Cr., Poudre R.); Mesa Co. (Colorado R.). PERC: Moffat Co. (Yampa R.). Colorado is evidently the northernmost location of this species, which was originally described from Mexico (Eaton, 1892). Allen (1974) showed *C. inornata* as occurring in southern Colorado on a range map, but provided no specific information. Larvae reported from La Plata Co. by Peters and Edmunds (1961) are probably attributable to this species.

Leptophlebia cupida (Say)—Traver (1935) as *Blasturus gravastellus*: Routt Co. (Hayden). CSU: Jackson Co. (Roaring Fork R.); Larimer Co. (Hewlett Gulch, Poudre R., Shields Pond); Yuma Co. (Arikaree R.). *Blasturus gravastellus* Eaton (1884) was originally described from Montana, and Traver (1935) reported Colorado specimens that matched that concept. There are specimens

in PERC from Idaho and Wyoming also fitting that concept, and Edmunds (1954b) reported it from Utah. A strong possibility exists, however, that *L. gravastella* is a junior synonym of *L. cupida* (S. Burian, pers. comm.). We agree, and because the specimens from Colorado are indistinguishable as either *L. gravastella* or *L. cupida*, we consider them under the latter name.

Leptophlebia nebulosa (Walker) —Traver (1935) as *Blasturus nebulosus* Walker: Routt Co. (Hayden). There is strong possibility that Traver's (1935) record is based on a misidentification of *L. cupida*. This might account for two species being recorded by her from Hayden, Colorado, although the first author has found the two species cohabiting in Michigan springs and Ed Bacon (pers. comm.) has observed the same phenomenon in Arkansas. Larvae taken in Yuma Co. (Arikaree R.) and housed in CSU are most probably *L. nebulosa*. In any case, the retention of this mainly midwestern and eastern species on the Colorado list remains somewhat tentative.

**Neochoroterpes mexicana* (Allen) —CSU: Otero Co., Purgatoire R. at Rt. 109, B. Kondratieff, XI-24-1986 (larvae), VI-25-1987 (adults); Otero Co., Purgatoire R. at Rt. 109 bridge, B. Kondratieff, V-10-1991 (larvae), V-15-1991 (adults); Las Animas Co., Purgatoire R. at Bent Canyon, IX-22-1988, R. Bramblett (adults); Las Animas Co., Purgatoire R. at Pinyon Canyon, VII-12-1989, B. Kondratieff (adults). This species, as *Choroterpes* (subgenus *Neochoroterpes*) *mexicanus*, was previously known only from southern Mexico to northern Texas (Allen, 1974). It represents the northernmost record for the genus. In addition to elevating *Neochoroterpes* to generic status and thus recombining this species, we have emended the specific epithet to agree with the feminine generic nomen.

**Paraleptophlebia bicornuta* (McDunnough) —CSU: Moffat Co., Yampa R., Milner (larvae). This species is one of two leptophlebiids in the Intermountain West that possess tusked mandibles as larvae. Two additional tusked species of *Paraleptophlebia* have been described from California (Day, 1952). *Paraleptophlebia bicornuta* is now known from throughout most of northwestern North America.

Paraleptophlebia debilis (Walker) —Ward and Stanford (1990): Delta, Gunnison, Mesa, Montrose Co. (Gunnison R.). CSU: Grand Co. (Colorado R.); Jackson Co. (Grizzly Cr., North Platte R., Roaring Fork R.); Larimer Co. (Buchhorn

Cr., Lone Pine Cr., Poudre R., Youngs Gulch); Routt Co. (Little Rock Cr.). PERC: Grand Co. (Colorado R.). This species is apparently transcontinental being known from Nova Scotia to California.

Paraleptophlebia heteronea (McDunnough) —Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Rader and Ward (1987b): Larimer Co. (Cache la Poudre R.); Rader and Ward (1989): Grand Co. (Colorado R.). CSU: Grand Co. (St. Louis Cr.); Jackson Co. (Roaring Fork R.); Moffat Co. (Pool Cr.). This species was originally described from Alberta. It is expected to occur generally in the northern mountain states. The previous Colorado records could be attributable to *P. memorialis* (Eaton) because those records were based on larval identifications, and whereas the two species are easy to distinguish as adults, they are very similar morphologically as larvae.

Paraleptophlebia memorialis (Eaton) —Dodds (1923) as *Leptophlebia pallipes*: Gilpin and Boulder Co. (South Boulder Cr.); Argyle and Edmunds (1962) as *Paraleptophlebia pallipes*: Gunnison Co. (East Elk Cr.); Rader and Ward (1988) as *Epeorus memorialis*: Grand Co. (Colorado R.); Ward and Stanford (1990): Delta, Gunnison, Mesa, Montrose Co. (Gunnison R.). CSU: Garfield Co. (East Rifle Cr.); Grand Co. (Colorado R.); Jefferson Co. (Bear Cr.); Mesa Co. (Plateau Cr.). PERC: Archuleta Co. (Devil Cr., West Fork San Juan R.); Gunnison Co. (Gunnison R.); Routt Co. (Fish Cr.). The larvae of this western species can easily be confused with those of *P. heteronea*.

**Paraleptophlebia packi* (Needham) —CSU: Grand Co., Colorado R., .4 km below Lake Granby, IX-10-1983, R. Rader (adults); Jackson Co., North Platte R., Verner State Wildlife Area, 9 mi. SW Walden, B. Kondratieff and R. Durfee, VIII-31-1991 (larvae) IX-8-1991 (adults); Jackson Co., Roaring Fork R., Co. Rd. 5 bridge, B. Kondratieff and R. Durfee, VIII-31-1991 (larvae) IX-6-1991 (adults). This is the second species of tusked *Paraleptophlebia* from Colorado. The species was previously known only from Utah (Needham, 1927).

**Paraleptophlebia temporalis* (McDunnough) —CSU: Teller Co., Rule Cr., N Woodland Park, VIII-2-1987, B. Kondratieff (adults). This species has been previously known from the Pacific Northwest. Lehmkuhl and Anderson (1971) keyed the larva of this species, but that stage remains undescribed.

Paraleptophlebia vaciva (Eaton) —Allan

(1975): Gunnison Co. (Cement Cr.). PERC: Routt Co. (Yampa R.). This species may be more common than that shown by the sparse records from Colorado. It can be easily confused in the larval stage with *P. heteronea* and *P. memorialis*.

Traverella albertana (McDunnough)—Allen (1973): Moffat Co. (Yampa R., Elkhead R., Green R.); Ward et al. (1986): Garfield, Mesa Co. (Colorado R.); Ward and Stanford (1990): Mesa Co. (Gunnison R.). CSU: Delta Co. (Gunnison R.); Mesa Co. (Colorado R.); Moffat Co. (Yampa R.); Montezuma Co. (San Juan R.); Rio Blanco Co. (White R.). PERC: Moffat Co. (Yampa R.-Green R. confluence). This species shows a somewhat common pattern for many western plateaus region species: It inhabits silty/sandy bottomed rivers from Arizona to Saskatchewan. Adults swarm from sunrise to about 0900 h.

Family Polymitarciidae: *Ephoron album* (Say)—Ward and Stanford (1990): Mesa Co. (Gunnison R.). CSU: Larimer Co. (Mail Cr., Poudre R.); Mesa Co. (Colorado R.); Moffat Co. (Yampa R.); Rio Blanco Co. (White R.); Routt Co. (Yampa R.); Yuma Co. (Chief Cr.). This species is known from Ohio and Indiana to Utah and Idaho (Britt, 1962). The larvae have been taken from diverse substrate types in the Midwest (McCafferty, unpubl.), but appear to be more habitat restricted in the West. Edmunds et al. (1956) found larvae associated with lightly compacted clay/sand substrates in irrigation canals in Utah.

Family Ephemeridae: *Ephemera compar* Hagen—Hagen (1875): "Foot Hills." This species evidently has not been seen since it was originally described in 1875. Edmunds and McCafferty (1984) thoroughly discussed its dubious status and presumed geographic distribution in Colorado and made a plea for collectors to search for it. The species appears valid but may now be extinct.

Ephemera simulans Walker—Edmunds and McCafferty (1984): Yampa R. CSU: Moffat Co. (Yampa R.); Rio Blanco Co. (White R.). PERC: Moffat Co. (Yampa R.). Hamilton (1959) cited this species as having been reported from Colorado as did McCafferty (1975). However, no precise collecting data or specimens can be found to verify those records. Edmunds and McCafferty (1984), however, reported seeing numerous individuals of this species from the Yampa River. Such a record certainly agrees with the Colorado

distribution pattern indicated in the additional records cited above and with confirmed records from nearby areas in Wyoming and Utah (see Britt, 1962). Leichti (1981) reported *E. simulans* from Kansas.

Hexagenia limbata Serville—Spieth (1941): Jefferson Co. (Clear Cr.); Kondratieff and Ward (1987): Yuma Co. (Chief Cr.). CSU: Kit Carson Co. (South Republican R.); Larimer Co. (Mail Cr., Spring Cr.). This burrowing species is known from most of North America. In Colorado, it has been taken in eastern streams, but it is known from both streams and lakes in Idaho and Utah (Eaton, 1883; Spieth, 1941).

Family Ephemerellidae: *Attenella margarita* (Needham)—Argyle and Edmunds (1962) as *Ephemerella margarita*: Gunnison Co. (Cebolla Cr., Gunnison R., Tomichi Cr.); Ward and Berner (1980) as *Ephemerella margarita*: Boulder Co. (St. Vrain Cr.); Ward and Stanford (1990): Delta, Gunnison Co. (Gunnison R.). CSU: Archuleta Co. (San Juan R.); Jackson Co. (Grizzly Cr., Michigan R., North Platte R., Roaring Fork R.); Montrose Co. (Gunnison R.), Rio Blanco Co. (White R.); Routt Co. (Elk R., Yampa R.). This species has a somewhat unusual distribution pattern in North America. It is known from populations in the extreme northeastern United States and eastern Canada as well as western populations from British Columbia to New Mexico. It is most common in the western slope/plateaus region of Colorado.

Drunella coloradensis (Dodds)—Prior to 1987 this species was reported as *Ephemerella coloradensis*. Dodds (1923): Boulder and Gilpin Co. (South Boulder Cr.); Traver (1935): Gothic; Allen and Edmunds (1962b): El Paso Co. (Green Mountain Falls), Grand Co. (Swift Cr.); Elgmork and Saether (1970): Boulder Co. (North Boulder Cr.); Allan (1975): Gunnison Co. (Cement Cr.); Short and Ward (1980): Larimer Co. (Joe Wright Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Bushnell et al. (1987): Boulder Co. (Green Lakes drainage). CSU: Chaffee Co. (Hughes Cr.); Clear Creek Co. (West Chicago Cr.); Eagle Co. (Booth Cr.); El Paso Co. (Green Mountain Falls); Garfield Co. (Prince Cr.); Grand Co. (St. Louis Cr., Tonahutu Cr.); Gunnison Co. (East R., South Fork Crystal R.); Jackson Co. (Michigan R.); Larimer Co. (Fall R., Lone Pine Cr.); Mineral Co. (West Willow Cr.); Pitkin Co. (Pine Cr.); Saguache Co. (Sa-

guache Cr.); San Juan Co. (Lime Cr.). PERC: Boulder Co. (Fawn Brook); Clear Creek Co. (Blue Cr.); Gunnison Co. (Gunnison R.); Routt Co. (Walton Cr.); Chasm Falls. This common western species ranges from Arizona to Alaska.

Drunella doddsi (*Needham*)—All reports have been as *Ephemerella doddsi* except for those of Dodds (1923) and Dodds and Hisaw (1925) from Boulder and Gilpin Co. (South Boulder Cr.). Traver (1935): Larimer Co. (Gothic and Estes Park); Allen and Edmunds (1962b): Boulder Co. (Como Cr.), El Paso Co. (Green Mountain Falls); Argyle and Edmunds (1962): Gunnison Co. (East Elk Cr., Gunnison R., West Elk Cr.); Allan (1975): Gunnison Co. (Cement Cr.); Ward (1976b): Douglas Co. (South Platte R.); Pennak (1977): Rio Blanco Co. (White R.), etc.; Short and Ward (1980): Larimer Co. (Joe Wright Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Rader and Ward (1987a, 1987b): Larimer Co. (Cache la Poudre R.). CSU: Chaffee Co. (Deer Cr.); Delta Co. (Gunnison R.); Eagle Co. (Eagle R.); Grand Co. (Colorado R., Tonahutu Cr.); Gunnison Co. (East R., South Fork Crystal R.); Hinsdale Co. (Lake Fork, Gunnison R.); Jackson Co. (Jack Cr., Michigan R.); Lake Co. (Lake Fork); La Plata Co. (La Plata R.); Larimer Co. (Buckhorn Cr.); Pitkin Co. (Pine Cr.); Rio Grande Co. (Pinos Cr.). PERC: Archuleta Co. (West Fork San Juan R.); Gunnison Co. (Gunnison R.); La Plata Co. (La Plata R.); Mineral Co. (Pass Cr.); Rio Grande Co. (Rio Grande). Although Eaton (1884) is often credited with the first Colorado record of this common western mayfly (e.g., Traver, 1935), that particular record is actually from Idaho in the Colorado Territory.

Drunella grandis grandis (*Eaton*)—All records have been as *Ephemerella grandis*. Eaton (1884): not site specific; Traver (1935): Larimer Co. (Estes Park); Allen and Edmunds (1962b): El Paso Co. (Fountain Cr., Green Mountain Falls), Gunnison Co., cited as Grand Co. (Frazier R. [?sic]); Argyle and Edmunds (1962): Gunnison Co. (Beaver Cr., Blue Cr., Curecanti Cr., East Elk Cr., Gunnison R., Soap Cr., Steuben Cr., West Elk Cr.); Ward (1974): Douglas Co. (South Platte R.); Ward (1975): Boulder Co. (North St. Vrain Cr.); Allan (1975): Gunnison Co. (Cement Cr.); Rader and Ward (1987a, 1987b): Larimer Co. (Cache la Poudre R.); Rader and Ward (1989): Grand Co. (Colorado R.). CSU: Archuleta Co. (Rio Blanco); Chaffee Co.

(S. Arkansas R.); Delta Co. (Gunnison R.); Gilpin Co. (South Boulder Cr.); Grand Co. (St. Louis Cr.); Gunnison Co. (East R.); Jackson Co. (Michigan R., Roaring Fork R.); Jefferson Co. (South Platte R.); La Plata Co. (La Plata R.); Larimer Co. (Buckhorn Cr.); Mineral Co. (Creede); Moffat Co. (Yampa R.); Montrose Co. (Gunnison R.); Pitkin Co. (Roaring Fork R.); Pueblo Co. (Rye); Rio Blanco Co. (Piceance Cr., White R.); Routt Co. (Elk R., Mad Cr., Yampa R.); Summit Co. (Blue R.). PERC: Archuleta Co. (Big Navajo R., Rio Blanco, San Juan R., Turkey Cr., West Fork San Juan R.); Gunnison Co. (Gunnison R.); La Plata Co. (La Plata R.); Mineral Co. (Pass Cr.); Montezuma Co. (Mancos R.); Ouray Co. (Uncompahgre R.); Rio Grande Co. (South Fork Rio Grande); Saguache Co. (Tomichi Cr.). *Drunella grandis* was divided into three western subspecies by Allen and Edmunds (1962b), with *D. grandis grandis* typically found in Colorado, Arizona, New Mexico, Utah, and Wyoming. The other subspecies are found further west or north, and no intergrades have as yet been reported from Colorado.

Ephemerella apopsis *McCafferty*—McCafferty (1992b): Chasm Lake. This distinctive species is thus far known only from the male adult type material. It was collected at 11,000 feet elevation in 1947 by C. P. Alexander. For the present, it may be considered endemic to Colorado. There is a remote possibility that it is actually a western color variant of the eastern species *E. needhami* McDunnough (see McCafferty, 1992b).

**Ephemerella aurivillii* (*Bengtsson*)—PERC: Routt Co., Walton Cr., at Hwy 40, 6 mi. W of Rabbit Ears Pass, VIII-23-1967, B. R. Oblad (larvae). This is a northern species that has been known from Labrador to Alaska (McCafferty, 1985). Its southernmost distribution would now include Massachusetts, Colorado, and California. It is common in the Upper Peninsula of Michigan (McCafferty, unpubl.), but otherwise has not been generally known from central areas of the United States. Although the larvae of this species are distinct, there remains a very remote possibility that the larvae from Colorado fitting the description of *E. aurivillii* are the undescribed larvae of *E. apopsis*. Both species as adults possess deeply forked penes and may be related (McCafferty, 1992b).

Ephemerella inermis *Eaton*—Eaton (1884):

Denver Co. (Denver), El Paso Co. (Arkansas Canyon, Colorado Springs); Dodds (1923) as *Ephemerella* nymph No. 2: Boulder and Gilpin Co. (South Boulder Cr.); Peters and Edmunds (1961): Archuleta Co. (Piedra R., San Juan R.); Allen and Edmunds (1965): Arapahoe Co. (South Platte R.), Boulder Co. (Boulder Cr., St. Vrain Cr.), Gunnison Co. (Tomichi Cr.), Larimer Co. (Poudre R.); Argyle and Edmunds (1962): Gunnison Co. (Beaver Cr., Blue Cr., Cebolla Cr., Curecanti Cr., East Elk Cr., Gunnison R., Red Cr., West Elk Cr.), Montrose Co. (Cimarron Cr.); Ward (1974): Douglas Co. (South Platte R.); Allan (1975): Gunnison Co. (Cement Cr.); Ward (1975): Boulder Co. (North St. Vrain Cr.); Ward and Dufford (1979): Larimer Co. (springbrook); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Gray et al. (1983): Rio Blanco Co. (Piceance Cr.); Kondratieff and Ward (1987): Yuma Co. (Chief Cr.); Ward and Stanford (1990): Delta, Mesa Co. (Gunnison R.). CSU: Archuleta Co. (Rio Blanco); El Paso Co. (Green Mountain Falls); Garfield Co. (Colorado R.); Gunnison Co. (Soap Cr.); Jefferson Co. (South Platte R.); Larimer Co. (Lone Pine Cr., Thompson R.); Mesa Co. (Colorado R.); Moffat Co. (Yampa R.); Montezuma Co. (San Juan R.); Montrose Co. (Gunnison R.); Rio Blanco Co. (Black Sulphur Cr.); Routt Co. (Yampa R.). PERC: Archuleta Co. (Big Navajo R., Piedra R., San Juan R., West Fork San Juan R.); La Plata Co. (Animas R., Los Pinos R.); Mineral Co. (Pass Cr.); Montezuma Co. (Mancos R.); Routt Co. (Yampa R.). This evidently is one of the most common ephemereids in Colorado; however, it is easily confused with *E. infrequens* McDunnough, and caution must be taken in distinguishing the larvae of the two species (see Johnson, 1978).

Ephemerella infrequens McDunnough—Allen and Edmunds (1965): El Paso Co. (Green Mountain Falls, Monument Cr.), Gilpin Co. (Tolland), Larimer Co. (Thompson R.), Delta Co. (Surface Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Rader and Ward (1987a, 1987b): Larimer Co. (Cache la Poudre R.); Rader and Ward (1988, 1989): Grand Co. (Colorado R.); Ward and Stanford (1990): Delta, Gunnison Co. (Gunnison R.). CSU: Boulder Co. (Silver Lake Cr.); Delta Co. (Surface Cr.); El Paso Co. (Green Mountain Falls, Monument Cr.); Grand Co. (Colorado R., St. Louis Cr.); Gunnison Co. (East R.); Jackson Co. (Roaring Fork R.); La Plata Co. (La Plata R.); Larimer Co. (Buckhorn

Cr., Hewlett Gulch, Poudre R., Thompson R.); Mesa Co. (Colorado R.); Mineral Co. (Rat Cr., Willow Cr.); Montrose Co. (Gunnison R.); Routt Co. (Elk R.). PERC: Gunnison Co. (Gunnison R.); San Juan Co. (Lime Cr.). This species has been difficult to distinguish from *E. inermis* and according to Johnson (1978), who presented new distinguishing characteristics of the two, many *E. infrequens* individuals have been incorrectly identified as *E. inermis* in the past. The distribution maps of Allen and Edmunds (1965) are not reliable. This places certain previous Colorado records of either species in doubt.

Serratella micheneri (Traver)—All records have been reported as *Ephemerella micheneri*. Peters and Edmunds (1961): Archuleta Co. (Piedra R.), La Plata Co. (Los Pinos R.); Allen and Edmunds (1963a): Larimer Co. (Fort Collins); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.). CSU: Jackson Co. (Grizzly Cr.); Larimer Co. (Buckhorn Cr., Poudre R.); Routt Co. (Yampa R.). This western species is apparently most common in California. It has a U-shaped distribution in the West, being absent in Idaho, Nevada, and Utah, but occurring from Wyoming to New Mexico and Arizona to Washington.

Serratella tibialis (McDunnough)—All reports prior to 1990 have been as *Ephemerella tibialis*. Argyle and Edmunds (1962): Gunnison Co. (Gunnison R., Myers Gulch, Red Cr., West Elk Cr.); Allen and Edmunds (1963a): El Paso Co. (Cascade Cr.), Grande Co. (Glacier Cr.); Ward (1975): Boulder Co. (North St. Vrain Cr.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Ward and Stanford (1990): Gunnison Co. (Gunnison R.). CSU: Eagle Co. (Eagle R.); Grand Co. (Muddy Cr.); Gunnison Co. (East R.); Jackson Co. (Michigan R.); Larimer Co. (Poudre R., Youngs Gulch); Rio Blanco Co. (White R.); Routt Co. (Elk R., Yampa R.). This species is found throughout the West at almost all elevations in cool, moderately flowing waters.

Timpanoga hecuba hecuba (Eaton)—All reports prior to 1990 have been as *Ephemerella hecuba*. Eaton (1884): Manitou (El Paso Co.); Allen and Edmunds (1959): Gunnison Co. (Beaver Cr., Cebolla Cr., Gunnison R., Steuben Cr., West Elk Cr.); Larimer Co. (Big Thompson R., Frazer [sic] R.); Ward and Stanford (1990): Gunnison Co. (Gunnison R.). CSU: Archuleta Co. (San Juan R.); Boulder Co. (Boulder Canyon); Grand Co. (Colorado R.); Jackson Co. (Michigan R.); Larimer Co. (Buckhorn Cr., Pou-

dre R.); Routt Co. (Elk R., Yampa R.). This genus and *Attenella* have been placed in a separate subtribe Timpanogae by Allen (1984). They are distinguished by larvae with gills only on abdominal segments 4–7. All other Colorado ephemeroptera are members of the Ephemerellae (gill on segments 3–7). *Timpanoga hecuba* was divided into two subspecies by Allen and Edmunds (1959), with *T. hecuba pacifica* restricted in distribution to the Pacific coast region, and *T. hecuba hecuba* found variously throughout the Intermountain West.

Family Tricorythidae: Tricorythodes corpulentus Kilgore and Allen—Ward and Stanford (1990): Delta, Mesa Co. (Gunnison R.). Prior to 1990, this species was known only from New Mexico (Kilgore and Allen, 1973). Since the original description of this species was based on a single larval specimen, any subsequent assignment of specimens to it must be considered tentative until it becomes better known.

**Tricorythodes edmundsi* Allen—PERC: Moffat Co., Green R., VI-28-1956, E. Mills (larvae). The species has previously been known from northeastern Utah and Tamaulipas Province, Mexico (Allen, 1967), and most recently, Texas (Lugo-Ortiz and McCafferty, 1993). It is possible that *T. edmundsi* from Colorado and Utah, the type locality, will prove to be distinct from the Mexico and Texas material.

Tricorythodes minutus Traver—Argyle and Edmunds (1962): Gunnison Co. (Cebolla Cr., Gunnison R., West Elk Cr.); Ward (1974): Douglas Co. (South Platte R.); Ward and Berner (1980): Boulder Co. (St. Vrain Cr.); Gray et al. (1983): Rio Blanco Co. (Piceance Cr.); Ward and Stanford (1990): Delta, Gunnison, Mesa Co. (Gunnison R.). CSU: Denver Co. (Sand Cr., South Platte R.); Garfield Co. (Colorado R.); Gunnison Co. (East R.); Jackson Co. (Grizzly Cr., North Platte R., Roaring Fork R.); Jefferson Co. (South Platte R.); Kit Carson Co. (South Fork Republican R.); Larimer Co. (Buckhorn Cr., Mail Cr., Poudre R., Spring Cr.); Mesa Co. (Colorado R.); Moffat Co. (Poole Cr., Yampa R.); Montezuma Co. (Mancos R.); Montrose Co. (Gunnison R.); Rio Grande Co. (Pinos Cr.); Routt Co. (Yampa R.); Weld Co. (South Platte R.); Yuma Co. (Chief Cr.). PERC: Archuleta Co. (West Pagosa Springs); Denver Co. (South Platte R.); Douglas Co. (Deckers Resort); Gunnison Co. (Cebolla Cr.); Montezuma Co. (Chicken Cr.); Routt Co. (Walton Cr.). This widespread species

is one of the most ubiquitous in North America. Nonetheless, it is susceptible to egg mortality at cold temperatures (Newell and Minshall, 1978) and is therefore not often found in cold springs and springbrooks in Colorado (Gray et al., 1983). In the material housed in PERC, collected from Walton Cr. in Routt Co., there are male adults typically small and colored as described for the species by Traver (1935). There are other male adults collected with them that are larger and fit Traver's (1935) description of *T. fallax*. Edmunds et al. (1976) synonymized the two species and intimated that they may represent subspecies. Our Colorado collection suggests either individual variability or two cohabiting species, not subspecies. Any discovery of intergrades would tend to substantiate the synonymy.

Family Caenidae: Brachycercus edmundsi Soldán—Soldán (1986): Grand Co. (Colorado R.). This species was described from the tri-state corner areas of Colorado, Utah, and Wyoming. It is probably closely related to *B. tuberculatus*, although the species taxonomy of this genus remains very dubious.

**Brachycercus prudens (McDunnough)*—CSU: Routt Co., Yampa R. at Hayden, 1975, E. Ames (larvae). This species has previously been known from Saskatchewan and Wyoming in the West and Kansas and Illinois in the Midwest.

**Brachycercus tuberculatus Soldán*—PERC: Moffat Co., Yampa R.—Craig, IV-24-1976, L. Ames (larvae). Soldán (1986) stated that G. F. Edmunds regarded material of *B. tuberculatus* recorded from the Provo River (Wasatch Co., Utah) and in the University of Utah collection to have been mislabeled and in fact much more likely to have come from a collection made by Vladimir Landa in Moffat Co., Colorado (either the Green River or Yampa River at Dinosaur National Park). Since we have seen larvae from the Yampa River (Moffat Co.) and E. L. Ames, in an unpublished Master's thesis submitted to Colorado State University in 1977, reported *Brachycercus* sp. from both the Yampa River and White River (Rio Blanco Co.), we believe that assessment to be correct. The Provo River does not provide a predictive habitat for *Brachycercus*.

**Caenis amica Hagen*—CSU: La Plata Co., Los Pinos R. at Bayfield, Rd. 502, VII-17-1990, B. Kondratieff (larvae); Larimer Co., Fort Collins at light, VIII-1935, R. Swain (adults); Larimer Co., Shields Pond, Fort Collins, black light, VII-5-1991, B. Kondratieff and R. Durfee

(adults); Mesa Co., Colorado R. at Fruita, Rt. 340, VII-30-1988, B. Kondratieff (adults); Saguache Co., Davey Lake, Russell Lakes, V-20-1991, C. Sevin (larvae); Washington Co., VI-9-1991, P. A. Opler (adults). Colorado is one of the few areas in North America from which this ubiquitous species had been previously unreported (Provonsha, 1990).

Caenis bajaensis Allen and Murvosh—Provonsha (1990): Clear Creek Co. (Berthoud Pass). CSU: Larimer Co. (Park Cr.). This mainly Mexican and southwestern species is probably present throughout Colorado in suitable habitats, which include sandy bottomed streams with moderate to slow current. It has been found by McCafferty and Provonsha (unpubl.) throughout much of the Sand Hills area in the panhandle of Nebraska.

**Caenis latipennis* Banks—CSU: Larimer Co., Shields Pond, Fort Collins, black light, VII-5-1991, B. Kondratieff and R. Durfee (adults); Weld Co., black light trap, IX-2-1986, D. Thompson (adults). In a recent revision of North American *Caenis*, Provonsha (1990) commented that *C. latipennis* was one of the most common and widespread species, known from almost every state.

**Caenis punctata* McDunnough—CSU: Larimer Co., Swifts Pond, S of I-25 off Harmony Rd., X-8-1986, S. Kahn (larvae). *Caenis punctata* is widespread in the East and Midwest. Previous to the Colorado record, its westernmost record was eastern Kansas. It should be kept in mind that *C. punctata* larvae are very difficult to distinguish from *C. amica* larvae, and characteristics of the adults of the two species are also similar.

**Caenis tardata* McDunnough—CSU: Jackson Co., Grizzly Cr., Peterson State Wildlife Area off Rt. 14, VII-28-1991, B. Kondratieff, R. Durfee, and B. Painter (larvae). This species has been known from western Canada to the eastern United States. A previous California record given by Day (1956) was shown to be erroneous by Provonsha (1990). The species demonstrates the strong correlation between the mayfly fauna of sandy/silty bottomed rivers in western Colorado and Saskatchewan.

**Caenis youngi* Roemhild—CSU: Jackson Co., N Delaney, Butte Lake, at light, VIII-2-1991, D. E. Ruitter (adults). In western North America, this species has previously been known from Alberta, Montana, and Wyoming. Provonsha (1990) also reported a lake population from the Upper Peninsula of Michigan.

OTHER TAXA POSSIBLY OCCURRING IN COLORADO—Whiting and Lehmkuhl (1987b) described *Acanthomola* (Heptageniidae) from Saskatchewan. McCafferty and Provonsha (1988) indicated that it was possibly the larvae of *Anepeorus rusticans* [reviewed by McCafferty and Provonsha (1985)], which has been known from the Green River in Utah. If *A. rusticans* is not extinct (see McCafferty et al., 1990), it could eventually be found in western Colorado.

Analetris (Analetrididae) was described by Edmunds, in Edmunds and Koss (1972), from sandy bottomed rivers in Sweetwater Co., Wyoming and Daggett Co., Utah. These areas are adjacent to northwestern Colorado. McCafferty (1991b) discussed the inherent difficulty in sampling these fast-swimming larvae.

Baetisca (Baetiscidae) have been taken from as near as Laramie, Wyoming (Edmunds, 1960, 1977). This primary eastern and midwestern genus has also been taken in California (Eaton, 1885) and Washington (Edmunds, 1960).

Baetodes (Baetidae) is known through New Mexico to the southern border of Colorado, as is *Leptohyphes* (family Tricorythidae). Both genera presumably have recent Neotropical centers of dispersal (McCafferty et al., 1992) and may eventually be found in extreme southern Colorado. In addition, *Homoeoneuria* (family Oligoneuriidae) is known from the Rio Grande in New Mexico and the Colorado and Escalante Rivers in Utah (Pescador and Peters, 1980).

Stenonema terminatum (Heptageniidae) is known from Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming as well as from throughout the East and Midwest (Bednarik and McCafferty, 1979), and the first author has collected it extensively in the Sand Hills of western Nebraska. There is little doubt that the genus *Stenonema* will be found in Colorado, most likely from low-lying, small streams.

Tortopus primus (Polymitarcyidae) is known from Nebraska and Kansas (McCafferty, 1975). It may eventually be found in eastern Colorado canals or streams with clay banks (see Scott et al., 1959).

Parameletus (Siphonuridae) is known from Alaska to the northern Rocky Mountains in the United States (Edmunds et al., 1976). In Utah it is known from isolated populations at high altitudes (Edmunds, 1957). An unconfirmed citing of this genus in Colorado was made by James

Ward; however, no voucher specimens exist (Ward, pers. comm.).

Amercaenis (Caenidae) is found in the sandy bottomed rivers and streams of Nebraska and Kansas (Provonsha and McCafferty, 1985) [other published state records are based on misidentifications (Provonsha, pers. comm.)]. It is probable that *Amercaenis* occurs in similar streams in the plains of Colorado. It is more difficult, however, to say whether *Cercobrachys* (Caenidae), one species of which has been described from the Snake River in Idaho (Soldán, 1986) and another unnamed species of which has been taken in Nebraska by the first author, will be found in Colorado.

A reference to *Pentagenia* (Ephemerae) was made by Pearson et al. (1968) as having been reported by N. A. Binns (in an unpublished Master's thesis submitted to Oregon State University in 1965) from the Green River in Wyoming. We do not regard *Pentagenia* as likely to occur in the Intermountain or Pacific West. McCafferty (1975) showed the westernmost records for *Pentagenia* to be Kansas and Texas.

Although more typical of the Pacific West and the Sierra Nevada Mountains, the western genus *Caudatella* (Ephemerae) has also been recorded from Idaho, Montana, and Wyoming (Allen and Edmunds, 1961). Curiously, it has not been recorded from Colorado or Utah, but may eventually be found in northern Colorado. *Dannella* (Ephemerae) is known from the East and Midwest, with western limits in Illinois (Allen and Edmunds, 1962a), and Arkansas (McCafferty and Provonsha, 1978). *Eurylophella* (Ephemerae) has also been regarded as eastern and midwestern, including Missouri (Allen and Edmunds, 1963b), Arkansas (McCafferty and Provonsha, 1978), and Kansas (Liechti, 1982). We would not necessarily predict *Dannella* or *Eurylophella* in Colorado; however, Ward (1975) reported an unnamed larva of *Dannella* from North St. Vrain Creek. While possible, this does not appear likely, and it is possible that specimens were immature larvae of *Attenella* or *Timpanoga*, which would have had a form and gill pattern similar to that of *Dannella* or *Eurylophella*.

FAUNISTICS—Three major physiographic regions of Colorado are inhabited by a diverse array of mayfly species involving numerous faunal elements. The eastern plains region is found

in the eastern two-fifths of the state and is an extension of the great plains of North America. The central mountains region comprises the central third of the state. The western slope/plateaus region is found in the western fourth of the state.

Several Colorado species (e.g., *Drunella grandis*, *Iron longimanus*, and *Rhithrogena hageni*) are generally widespread in mountains throughout the West and are generally found in the central mountains region of Colorado, with most (e.g., *Drunella doddsi* and *Ephemerella inermis*) also common along the western slope. At least one species (*Baetis bicaudatus*) appears to be a strictly alpine and subalpine western species. At least one other mountain species (*Attenella margarita*) demonstrates a bivalent distribution pattern, with another population in extreme northeastern North America. A few species (e.g., *Diphetero hageni* and *Ephemerella aurivillii*) show a widespread northern boreal pattern that extends across the continent and into Alaska; these tend to be mountain species in Colorado but not necessarily in other areas of the continent. A few species that are widespread in the West at all elevations (e.g., *Serratella tibialis*) are found in both the western slope/plateaus and central mountains regions of the state.

Some species occurring in the western slope/plateaus region, in particular the Colorado and Yampa River systems (e.g., *Lachlania saskatchewanensis* and *Traverella albertana*), are typical of the Green River system of northeastern Utah and western Wyoming, a faunal element that often also extends from New Mexico to Saskatchewan in sand/silt bottomed rivers. Certain species (e.g., *Tricorythodes corpulentus*) have southwestern and Mexican affinities and occur in the western plateaus; a few otherwise western slopes/plateaus species (e.g., *Choroterpes inornata* and *Heptagenia solitaria*) also have isolated populations in mid-northern areas of the state.

A number of species (e.g., *Heptagenia diabasia*, *Isonychia rufa*, and *Pseudiron centralis*) are representative of a rather continuous midwestern and eastern North American element that predictably reaches into the eastern plains region of Colorado. A few of these (*Heptagenia diabasia*, *Caenis punctata*, and *Macdunnoa persimplex*) also occur in mid-northern areas of the state. Some eastern and midwestern species have not yet been found in eastern Colorado but curiously have been found disjunctly in western Colorado (e.g., *Acerpenna*

pygmaea, *Barbaetis cestus*, and *Heterocloeon frivolum*).

A final faunal element in Colorado includes those mayfly species that are truly widespread in North America (e.g., *Baetis tricaudatus*, *Caenis amica*, and *Tricorythodes minutus*). These ubiquitous species can be expected in all regions of Colorado.

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