
12 Habitat differences between northern and southern populations of mayflies of the western United States

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*Several Rocky Mountain species of mayflies usually occur in prime trout rivers and lakes in the northern Rocky Mountain States, and the same species are found only in habitats not occupied by trout in southern Wyoming, Utah, Colorado and in some other states. Four or five species have similar patterns. The best known example is the widely distributed *Ephemera simulans*. Other species with variable but similar patterns are *Rhithrogena undulata*, *Hexagenia limbata*, *Ephoron album*, and possibly *Baetis punctiventris*. The evidence suggests that the mayfly populations are physiologically different between northern and southern waterbodies of the Rocky Mountain area of the United States.*

Several mayfly species show remarkable differences in habitat and association with other aquatic insect and fish species between northern and southern populations within the Rocky Mountain area of the United States. The northern populations are found in rivers or lakes of northern Idaho, Montana and northwestern Wyoming. The southern limits of the northern populations also generally mark the southern occurrence of such boreal genera as *Cinygma*, *Caudatella* and *Ironodes*. Furthermore, many mayfly species and at least one subspecies have their southern boundaries in the same general area. The northern populations usually co-occur with rainbow and brown trout, often in highly productive prime ("blue ribbon") trout waters.

The southern mayfly populations are primarily occupants of rivers in southern Wyoming, Utah and Colorado that usually have no trout, although prime trout waters are in the area and south to Arizona and New Mexico. The mayfly fauna of the interior drainage Great Basin areas of Utah and Nevada is depauperate as compared to the Green River-Colorado River and Platte River drainages, but two of the species with this pattern enter the Great Basin. Most of the species with different north and south habitats occur widely in the United States.

The species are discussed in the sequence in which the data most clearly delineate that habitats are distinctly different for northern and southern populations of each species.

Ephemera simulans (Ephemeridae) is a mayfly whose emergence is of major interest to trout fishermen in prime trout waters of the northern region. In Montana, some of the important *E. simulans* trout rivers or streams are the Big Hole, Odell Creek, Madison River, Clarks Fork of the Columbia River and the Yellowstone River. Wyoming *Ephemera* waters are Crawfish Creek, near the south border of Yellowstone Park, Wyoming as well as the Firehole River and Madison River of Yellowstone Park. In Idaho it also occurs in prime trout streams in the Henrys Fork of the Snake River and in Silver Creek south of Ketchum, Idaho. Although *Ephemera simulans* occurs in sandy pockets of rocky streams, it is more abundant in the slower areas of rivers where sandy deposits predominate. It is also considered an important species in some trout inhabiting lakes in northern Idaho.

Ephemera simulans is a widespread species and is also considered to be of importance in trout streams in the eastern and midwestern area of the United States, but, in the east, *Ephemera guttulata* and *E. varia* appear to be more important. The widely accepted fisherman's name of *E. simulans* is the brown drake.

The southern populations of *Ephemera simulans* occupy similar river substrates but the water is silted and much warmer, trout are generally totally absent and the associated aquatic insects are almost entirely different species. Table 1 lists the fish species associated with *Ephemera simulans* in the Green River of Wyoming and Utah. Only two fish species are shared in the trout water rivers and the warmer southern *E. simulans* river habitats (the whitefish, *Prosopium williamsoni* and the sculpin, *Cottus bairdi*) and they are much more abundant in trout streams. *Ephemera simulans* is common in the Blacks Fork River of southern Wyoming, the Green River of southern Wyoming (it is abundant at the city of Green River, Wyoming) and the Uintah River of Utah and the Yampa River of Colorado. Both of the last named rivers are tributaries of the Green River. *Ephemera simulans* is absent from the closed interior Great Basin drainages of Utah and Nevada.

Ephemera simulans has one generation per year and emerges in late June and early July in both trout waters and the southern silted rivers of Wyoming, Utah and Colorado.

Rhithrogena undulata (Heptageniidae) is another species that is of importance in trout streams in northern Idaho, Montana and northwestern Wyoming. Arbona (1980) states that emergences are "frequent, predictable, and dense" and that to the fly fisher "they rank above those of any other mayfly that thrives in the faster water sections of western trout streams and rivers." They are reported as important in such well-known western trout rivers as the Beaverhead, Big Hole and Madison rivers in Montana, Henrys Fork of the Snake River in northern Idaho and the Roaring Fork and Colorado rivers of Colorado.

Table 1. Fish of the Green River, Wyoming-Utah, occurring with *Ephemera simulans*, *Ephoron album*, *Rhithrogena undulata* and *Hexagenia limbata*.

Salmonidae	
Mountain Whitefish [†]	<i>Prosopium williamsoni</i> (2 only)
Catostomidae	
Flannelmouth Sucker	<i>Catostomus latipinnis</i>
Humpback Sucker	<i>Xyrauchen texanus</i>
Bluehead Sucker	<i>Pantosteus delphinus</i>
Cyprinidae	
Carp	<i>Cyprinus carpio</i>
Colorado Roundtailed Chub	<i>Gila robusta</i>
Bonytail	<i>Gila elegans</i>
Humpback Chub	<i>Gila cypha</i>
Speckled Dace	<i>Rhinichthys osculus</i>
Fathead Minnow*	<i>Pimephales promelas</i>
Redside Shiner*	<i>Richardsonius balteatus</i>
Ictaluridae	
Channel Catfish*	<i>Ictalurus punctatus</i>
Cottidae	
Colorado Mottled Sculpin [†]	<i>Cottus bairdi</i>

* Introduced species

† Usually with trout

I know of *R. undulata* in Colorado only in such non-trout rivers as the Green and Yampa rivers. In Utah, they are abundant in fast-running silted waters that are too warm for trout populations in most of the moderate to large rivers. *Rhithrogena undulata* extends south into Arizona and New Mexico. In southern Wyoming and Utah it is the only *Rhithrogena* of fast silted rivers, and combined with its small size it is easy to recognize in the field. Arbona (1980) calls it the small western red quill. Mating swarms gather over white water and light rocks or white water rapids. Dr. W.L. Peters and I were able to control the diameter of the columns of swarming males in Yellowstone Park by varying the width of white cloth swarm markers.

Hexagenia limbata (Ephemeridae) is found from the east coast to the west coast of North America. It ranges from the Northwest Territories of Canada to the state of Jalisco in Mexico. In the northernmost part of its range it certainly is found in lakes that have various species of trout as well as kokanee, salmon and northern pike (e.g., Couer d'Alene, Priest, Haden, Pend O'Reille lakes in northern Idaho) and some lakes in Canada. In Stark Lake in Northwest Territories, Canada, *Hexagenia limbata* shares the habitat of lake trout in early summer, but as the water warms lake trout are no longer found in shallow bays and the only game fish present when *H. limbata* emerges are northern pike. Details are unknown to me in Idaho lakes. Arbona (1980) suggests that it is found only in certain lakes and rivers in the west and therefore it is not of major interest to fly fishermen. It is probably an inhabitant of non-trout waters and trout waters in the northern part of its range. It is certainly of major importance to trout fly fishers in the northern part of the midwestern United States (e.g., Minnesota, Michigan and Wisconsin). In North America as a whole, the ecological range of *H. limbata* is very broad. It occurs in lakes from shallows to near the bottom of the thermocline. It is often abundant in rivers and in some places it occurs in wet mud that is only intermittently flooded by rivers. In some habitats it is extremely abundant. The length of the life cycle varies greatly. Development may take two years in some lake basins and three years in others. It emerges from canals in Utah that are dry in winter within 17 weeks after water enters the canals. Similar short development times can occur in laboratory rearing. *Hexagenia limbata* is a major food item of many species of fish over its range and the larvae are collected and sold for bait for winter ice fishing.

Although *H. limbata* is found in lakes and rivers in much of its range, it is known to me in southern Wyoming, Idaho and in Utah only from rivers. It is recorded in the Great Basin in Utah only as far south as Utah Lake, but it may not be in the lake at present and the Utah Lake record may be from a nearby river. The species is known to fisherman by several common names, including giant mayfly, sandfly, fishfly, Canadian Soldier and the misleading name Michigan Caddis.

Southern populations were found in the Green River of southern Wyoming and in Utah south to the junction of the Green and White rivers. It has been eliminated from much of this area by Flaming Gorge Reservoir and a long stretch of cool tail waters. It is still abundant at Green River (city), Wyoming. It is found in such Green River tributaries as the Blacks Fork of southern Wyoming and the Uintah River of Utah. It occurs in the Bear River near Randolph, Utah and in the Jordan River and associated canals in the vicinity of Salt Lake City. It is found in southern Idaho in the Snake River and many canals downstream from Twin Falls. At night nearly mature to mature larvae drift (even near the surface) in substantial numbers. I know of no records from Nevada.

Ephoron album (Polymitarcyidae) is found in warmer trout waters. According to Arbona (1980: 107) concentrated emergences occur in Montana in "big, often

unwadable rivers like the Missouri, Jefferson and Yellowstone (below its junction with the Musselshell)." It is considered of little importance to western fly fisherman by Arbona (1980) but Caucci and Nastasi (1986) state that *Ephoron* is common on stretches of "top trout" waters throughout the country.

In non-trout waters of southern Wyoming, *Ephoron* is present in the Blacks Fork and it was found in the Green River for a long distance, but much of this area has been subsequently modified by the building of Flaming Gorge dam and the resulting cooler tail waters, which extend for many miles below the dam. In southern Idaho, it is found in the Snake River and many canals. In the Great Basin, it is present in the Bear River, the Jordan River and many canals as far south as Utah Lake. In one fairly fast flowing and moderately silted portion of the Jordan River in Utah, planted rainbow trout and *Ephoron album* coexist. In Nevada, it is found in the Humboldt River. In the Salt Lake Valley of Utah, *Ephoron* occurs even in small irrigation ditches less than 0.5 m wide and 0.3 m deep if water flows continuously from May until autumn emergence in late August and September.

Ephoron album is called the white fly, the white drake or the trailer by fishermen.

Baetis punctiventris (Baetidae) is uncertain as an example of the same variable pattern. Recently McCafferty and Waltz (1991) have synonymized *Pseudocloeon punctiventris* McDunnough, *P. anoka* (a well-known trout stream emerger in the Michigan area) and *P. edmundsi* Jensen of Idaho and Oregon and placed them all in *Baetis*. In the Henrys Fork of the Snake River in Idaho, an emergence of importance to trout fishermen has been listed by entomological trout fly fisher authors under the name *P. edmundsi*. Some colour photographs of adults and larvae of this Henrys Fork mayfly show it to be a distinctly greenish or olive insect while Pobst (1990) has a colour photograph of a brownish adult. To my knowledge, specimens from the Henrys Fork have not been examined by any professional mayfly specialist. The population originally named as *Pseudocloeon edmundsi* is brown and occurs in the warm silted non-trout waters of the Snake River on the Idaho-Oregon border, near Ontario, Oregon, while the population from the northern midwest originally named *Pseudocloeon anoka* is an important inhabitant of trout streams and rivers.

Rainbow trout and the introduced brown trout have been planted so widely from populations drawn from so many different geographic regions and habitats that it appears virtually impossible that the finding of single species of mayflies as trout-water and non-trout-water populations is caused by regional habitat differences in trout. Rather, it must be that the mayflies are physiologically different in the northern and southern populations of the species that have been discussed. That this should occur in four or five distantly related species is quite remarkable.

Perhaps the most likely explanation of the southern populations being adapted to the warmer waters is that in desert and semi-desert areas silt enters habitats

similar to those that northern populations occur in and the silt raises the water temperature. Presumably a small number of the many cool adapted species have adapted to the warmer silted habitats.

There is also a small number of wide-ranging species of mayflies that inhabit both trout habitats and warm water fish habitats in the Rocky Mountains only a few km apart. Examples that are particularly striking are *Baetis tricaudatus*, *Tricorythodes minutus*, *Caenis amica* and *Ephemerella inermis*. The last named may be two or more cryptic species; the warm water populations of *Ephemerella inermis* have a single generation a year with emergence principally in June, and the populations in trout streams have almost continuous emergence of overlapping generations from June through September. *Caenis amica* has a short emergence in September in one of Utah's prime trout lakes, while populations in marshes near Great Salt Lake have a long summer and autumn emergence period with all sizes of larvae present at any one time. Two other western species that may fit the broad local diversity pattern are *Heptagenia elegantula* and *Nixe simplicioides*. However, both species are primarily found in non-trout waters in Utah and southern Idaho. They may be species that are intermediate between the two groups. A few other species need additional study to determine the nature of their habitat variation in the Rocky Mountain states.

References

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