

Large Valley River



Missouri River in the Wild and Scenic Area



Yellowstone River near Miles City, MT

Aquatic Ecological System Type A001 and A002

View key to subtypes

Community Description

Summary:

This ecosystem is found widely throughout the mainstem Missouri River system (7th order and larger) of the midwestern and western United States. These large, warm-water rivers have low to moderate gradient with origins in the intermontane basins of Montana. Throughout the range, river elevation is below 900m and characterized by long deep runs and pools with depths >2m, numerous mid-stream islands, side channels and interspaced riffles. Substrate characteristics are typically cobble in the riffles, sand and gravel dominated runs and pools, with gravel and/or finer-textured side channels.

Fish Community:

The members of this community consist of the Large, Medium and Large Mainstem Warmwater River Assemblages. The community indicator species are characterized by main channel species shovelnose sturgeon, pallid sturgeon, freshwater drum, paddlefish, burbot, sturgeon chub, sicklefin chub, and blue sucker. The Missouri mainstem contains one more species than the Yellowstone, the shortnose gar, that has only been recorded downstream from Fort Peck dam. Large Valley River fish communities include the side-channel communities occurring at the margins of the main current or in the quiet side-channels; these include emerald shiner, channel catfish, mooneye, sauger, flathead chub, carp, white sucker, shorthead redhorse and sand shiner. The shallow riffle habitat areas are inhabited by longnose sucker, longnose dace, flathead chub with mountain sucker in the Yellowstone River.

Macroinvertebrate Community:

This community consists of members of the Transitional Prairie River, Large Prairie River and Filtering Collector Assemblages in the riffles, with Large River Slow Current and Medium River Side-Channel Assemblages in the slow current areas and side channels, and the uncommon sand-dwelling mayfly community group in the vast sandbar areas. The community indicator species are characterized by main channel riverine dragonfly species (*Stylurus* and *Ophiogomphus*), mayflies (*Neochoroterpes oklahoma*, *Choroterpes*, *Camelobatidius*, *Fallceon quilleri*, *Acentrella insignificans*, *Ephoron*

album, and *Travarella albertana*), caddisflies (*Leucotrichia pictipes*, *Neotrichia*, *Psychomyia*, *Hydropsyche morosa* group, and *Cheumatopsyche*), and mussels - fatmucket (*Lampsilus siliquiodea*), black sandshell (*Ligumia recta*) (Missouri main stem only), and the side-channel mussel, giant floater (*Pyganodon grandis*).

Range:

The Large Valley River type occurs in the Missouri River downstream from Great Falls and below Fort Peck Reservoir and the Yellowstone River downstream from Billings. Additionally, the lower Powder River during spring run-off has occurrences of the Large Valley River fish assemblage.

Management:

Large dams and reservoirs have had the most significant negative impact on this community. Dams create barriers to the long distance spawning runs many fish in this community need, and reservoirs have submerged considerable spawning habitat. Inter-dam reaches (below Great Falls to Fort Peck Reservoir and between Fort Peck and Lake Sacagawea ND) maintain some of their pre-development channel morphology, but they are affected by altered water temperatures, unnatural water level fluctuations, and changes in sediment and nutrient transport.

Global Rank: GU

State Rank: S3

Global/State Rank Comments:

The number of occurrences in the state is fairly well known, and angler harvest is regulated for one member of this group, the paddlefish. Despite this, the Large Valley River type is at risk, and contains one of the most endangered fish in the US, the pallid sturgeon (G1S1, USFWS federally endangered). Other fish in this community are Montana Species of Concern: sturgeon chub (S2), sicklefin chub (S1), and blue sucker (S2S3). It also contains the globally rare sand-dwelling mayfly group, which is currently unranked in Montana. The occurrence of numerous threatened, rare and declining species, and consistent threats to the habitats required for spawning and rearing warrants a state rank of S3.

Large Prairie River



Powder River (A003) riffle habitat near Moorehead, MT



Powder River (A003) gravel run habitat near Broadus, MT



Marias River (A004) riffle habitat near Loma, MT

Aquatic Ecological System Type A003 and A004

View key to subtypes

Community Description

Summary:

This ecosystem consists of mainstem prairie tributaries to the Missouri and Yellowstone Rivers: the Milk, Marias, Little Missouri, Lower Tongue, Bighorn and Powder Rivers. These large (5th order and larger, >200 river miles long, 35m average wetted width) warm-water rivers have low to moderate gradients. These low elevation (below 1000m) rivers are characterized by long deep runs, pools (1-2m deep) and interspaced riffles. Substrate characteristics are typically cobble riffles (when present) to sand and gravel dominated runs and pools, with variably textured side channels. Large woody debris and undercut banks in the lower parts of these rivers provide substantial fish habitat. During spring and early summer, lower sections of these rivers offer many miles of spawning/nursery habitat for sauger, walleye, channel catfish, and the characteristic fishes of the Yellowstone and Missouri: pallid sturgeon, shovelnose sturgeon, and blue sucker.

Fish Community:

The members of this community consist of the Large, Medium Warmwater River and Creek Chub Assemblages. The community indicator species are characterized by mainly native species, channel catfish, stonecat, mooneye, sauger, flathead chub, plains minnow, sand shiner, white sucker, shorthead redhorse, emerald shiner and some introduced species, including walleye, northern pike, black bullhead and spottail shiner (Milk and Marias Rivers). The shallow riffle habitats are inhabited by longnose sucker, longnose dace and flathead chub with mountain sucker included in the Yellowstone drainages. The state

threatened sturgeon chub has good populations in the gravel run habitats of the Powder River, but not in any other A003 or A004 river of MT.

Macroinvertebrate Community:

This community consists of members of the Large Prairie River and Filtering Collector Assemblages in the riffles, and the Large River Slow Current and Medium River Side-Channel Assemblages in the slow current and side-channels areas, and the special sand-dwelling mayfly community group in the vast sandbar areas of the Powder River. The community indicator species are characterized by main channel riverine dragonfly species (*Stylurus* and *Ophiogomphus*), mayflies (*Neochoroterpes oklahoma*, *Choroterpes*, *Camelobatidius*, *Fallceon quilleri*, *Acentrella insignificans*, *Ephoron album*, and *Travarella albertana*), caddisflies (*Ichthytrichia*, *Psychomyia*, *Hydropsyche morosa* group, and *Cheumatopsyche*), side-channel Hemiptera, Corixidae (*Ambrysus mormon*) and the freshwater mussels - fatmucket (*Lampsilus siliquioidea*) and giant floater (*Pyganodon grandis*).

Range:

Large Prairie River types occur throughout the Great Plains region of North America within the Missouri River Drainage, with notable rivers such as the Niobrara and Platte (NB), Kansas River (KS), Belle Fourche and James Rivers (ND and SD). The Northern Glaciated Plains Ecoregion has the lower Milk and Marias River watersheds below Fresno and Tiber Dams, respectively, to their confluence with the Missouri River. Within the Northwestern Great Plains Ecoregion, Montana has the Lower Bighorn River from Hardin to the Yellowstone, the Powder River from the Wyoming border to the Yellowstone and a 100-mile stretch of the Little Missouri from the Wyoming to the North Dakota border. This section of the Little Missouri is more typical of a Medium Prairie River, but transitions into a Large Prairie River type further downstream in North Dakota.

Management:

Large dams and reservoirs have had the most significant negative impact on this community. Fresno and Tiber Dams have substantially altered the downstream hydrology of the Milk and Marias Rivers (Jones 2003). The Milk River becomes increasingly incised below Fresno Dam, and in many segments is not able to access the floodplain. The Milk and Marias Rivers also suffer from degrading channels, where their streambeds are deepening without renewed influx of sediments trapped behind the dams. In the lower Bighorn River, the Yellowtail dam has effectively turned 40 miles of a large prairie river into a trout river, and it only resembles its true nature of a prairie river downstream of Hardin for the last 42 river miles. Anywhere dams occur, the downstream reaches are affected by altered water temperatures, unnatural water level fluctuations, and changes in sediment and nutrient transport. Other threats to these large prairie rivers include water diversions and irrigation for agriculture in the adjacent floodplains.

Global Rank: G4

State Rank: S2

Global/State Rank Comments:

The number of quality occurrences in the state makes this type rare, and it is at risk across its range (Dodds et al. 2004). Within Montana, it contains sturgeon chub (S2, Species of Concern), and provides suitable spawning/rearing for two other Species of Concern, sauger (S2) and blue sucker (S2S3). It also contains the globally rare sand-dwelling mayfly group, which is currently unranked in Montana. The occurrence of many threatened, rare and declining species, and present or future threats (eg. sedimentation, water diversions, coal bed methane) to the habitats required for successful spawning and rearing warrants a state rank of an S2.

Medium Prairie River



Frenchman Creek (B006) riffle habitat in the BLM badlands



Battle Creek (B006) run/pool habitat north of Chinook, MT



Little Powder River (B005) run/pool habitat near Broadus, MT

Aquatic Ecological System Type B005, B006 and B008

View key to subtypes

Community Description

Summary:

This ecosystem is found widely throughout the Great Plains region of Montana, including many occurrences in the Northern Glaciated and the Northwestern Great Plains Ecoregions. Often these are direct tributaries to the Missouri and Yellowstone rivers, but can have connectivity to other Large Prairie Rivers first, such as the Little Powder River to the Powder or Battle Creek to the Milk River. These are larger (4th and 5th order rivers, >100 river miles long, average wetted width of 15m), perennial warm-water, unconfined valley bottom rivers, but are considered wadeable in most reaches by the summer months. In the low to mid-elevation (750-1200m) channels with low gradient they contain long runs and continuous pools (1-1.5 m), and in the moderate gradient sections they contain frequently interspaced riffles maintaining connectivity throughout the year, although riffles may be absent in incised and degraded channel sections. Substrate characteristics are typically cobble/pebble riffles (when present) to gravel dominated runs and silted pools. Large woody debris, deep pools and undercut banks in the lower reaches of these rivers provide substantial fish habitat. During spring and early summer, lower sections of these rivers offer spawning and nursery habitat for sauger, walleye, channel catfish and other Large Warmwater Assemblage fishes.

Fish Community:

The members of the resident fish community consist of the Large, Medium Warmwater, Sunfish, Creek Chub and Core Prairie Stream Assemblages. The community indicator species include fewer species of the Large River assemblage, except at the confluence areas, and are characterized predominately by the native minnow and sucker species of the Medium Warmwater Assemblage: fathead minnow, lake chub, flathead chub, plains silvery minnow, western silvery minnow, white sucker, and shorthead redhorse. In the deeper runs and pools, river carpsucker and channel catfish occur, as well as the introduced species, walleye, northern pike, black bullhead, carp and green sunfish. The riffle areas are inhabited by longnose dace, flathead chub and if there are large cobbles, stonecat. The prairie rivers of the Northern Glaciated Ecoregion (B006 and B008) are more likely to contain introduced northern pike, black bullhead and yellow perch, while the Northwestern Great Plains rivers (B005) will more likely have introduced green sunfish, crappie, yellow bullhead and rarely, smallmouth and rock bass.

Macroinvertebrate Community:

This community consists of members of the Large Prairie River, Prairie Stream and Filtering Collector Assemblages in the riffles, as well as Prairie Stream, Large Prairie River Slow Current and Medium Prairie River Side-Channel Assemblages in other habitats. The community indicator species are characterized by main channel riverine dragonfly species (*Ophiogomphus*), damselfly genera (*Calopteryx* and *Heterarina*), mayflies (*Leucrocuta*, *Stenonema terminatum*, *Isonychia*, *Fallceon quilleri*, *Ephoron album*, *Tricorythodes* and *Caenis latipennis*), caddisflies (*Hydropsyche morosa* group, *Cheumatopsyche* and *Polycentropus*), numerous Corixidae, and mussels - fatmucket (*Lampsilus siliquioda*) and the side-channel mussel, giant floater (*Pyganodon grandis*).

Range:

The Medium Prairie River type occurs throughout the Great Plains region of North America within the Missouri River Drainages. In the Montana Glaciated Plains Ecoregion, Redwater River, Frenchman, Rock, Battle, Lodge, Poplar, Wolf, Big Muddy and Beaver Creeks are examples. In the Northwestern Great Plains, examples include the Tongue, O' Fallon, Mizpah, Pumpkin, Rosebud, Little Beaver and Beaver Creeks.

Management:

Small dams, water diversions, stock ponds and introduced gamefish species have had the most significant negative impact on this community (Winston et al. 1991). Anywhere dams occur, the downstream reaches are affected by altered water temperatures, introduced fish, unnatural water level fluctuations, and changes in sediment and nutrient transport.

Global Rank: GU**State Rank:** S4**Global/State Rank Comments:**

Good quality occurrences in Montana are common, but the native fish community suffers from fish introductions and homogenization. This community contains creek chub (a potential Species of Concern) in the far eastern Montana drainages. Within the Northern Glaciated Ecoregion of Montana, the community contains pearl dace (S2, Species of Concern), and three Potential Species of Concern: Iowa darter, plains minnow and stonecat. The occurrence of at-risk or potentially declining fish and macroinvertebrate species may cause long-term concerns for this ecosystem and indicate a rank of S4.

Great Plains Prairie Stream



Otter Creek (C005) run/pool habitat near Ashland, MT



Rotten Grass Creek (C005) moderately degraded Great Plains stream



*Hanging Woman Creek (C005)
(Great Plains stream with vegetated pools)*

Aquatic Ecological System Type C005

View key to subtypes

Community Description

Summary:

This ecosystem is found throughout the drainages of the Northwestern Great Plains Ecoregion of Montana. Habitats are small to medium (3rd-4th order, <100 river miles long, average wetted width of 5m) perennial warm-water streams, or upstream reaches above Medium Prairie Rivers. In the low elevation (750-1000m) areas, these are low gradient, meandering streams with a typical stream morphology consisting of long runs and continuous standing pools (1-1.5 m depth). In the moderate gradient sections they may contain infrequently spaced riffles that may maintain wetted connectivity throughout the year. Riffle habitats may be absent in incised and degraded channel sections. Substrate characteristics are typically cobble/pebble riffles (when present) to silted runs and deeply silted pools.

Side-channel vegetation, undercut banks and woody debris in the lower reaches of these streams provide the most diverse fish habitat.

Fish Community:

The members of the resident fish community are dominated by the Core Prairie Stream Assemblage and occasionally members of the Medium Warmwater and Creek Chub Assemblages. A fairly clear Great Plains stream in far eastern Montana with weedy pools may contain brook stickleback, northern redbelly dace or brassy minnow, but for the typical turbid Great Plains stream, the community indicator species include fathead minnow, lake chub, flathead chub, white sucker, creek chub, and introduced species like black bullhead, carp and green sunfish. If the stream has gravel substrate in the riffle areas there will likely be longnose dace and if there are large cobbles or large woody debris, stonecat as well. A severely impaired C005 community will be dominated by green sunfish and other members of the Sunfish Assemblage including plains killifish, black bullhead and fathead minnow.

Macroinvertebrate Community:

This community consists of members of the Large Prairie River and Prairie Stream Assemblages in the riffle/run habitats with the Large River Slow Current Assemblage in the slow current areas, side-channels and vegetated pools. The community indicator species are characterized by the crustaceans (*Hyaella* and *Gammarus*), damselfly genera (*Coenagrion/Enallagma* spp., and *Enallagma civile*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Sigara grosslineata*, *Trichocorixa*, *Trichocorixa nais*, and *Corisella*), snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and caddisflies in the cobble riffles (*Hydropsyche morosa* group and *Cheumatopsyche*), and riffle beetles (*Dubiraphia* and *Microcylloepus*). The giant floater mussel (*Pyganodon grandis*) is common in the small Northern Glaciated Ecoregion streams, but is rarely encountered in the Powder River Basin streams.

Range:

The Great Plains Prairie Stream type occurs throughout the Great Plains region of North America within the Missouri River Drainage. In the Northwestern Great Plains of Montana, we have a diversity of this type including the Otter, Sarpy, Armells, Beauvais, Big and Little Porcupine, Cabin, Cedar, Sweeny, Sandstone and Hanging Woman Creeks.

Management:

Small dams, water diversions, stock ponds and introduced gamefish species have had the most significant negative impact on this community (Winston et al. 1991). Other threats include cattle intrusions to the riparian areas causing bank erosion and subsequent sedimentation and siltation. Anywhere dams occur, even small stock pond earthen dams, the downstream reaches are affected by altered water temperatures, unnatural water level fluctuations, and changes in sediment and nutrient transport.

Global Rank: G5

State Rank: S5

Global/State Rank Comments:

The number of quality occurrences in the state is common, but this native community suffers from fish introductions and community homogenization (in the far eastern Montana drainages). This community contains creek chub, plains minnow and Iowa darter, which are potential Species of Concern for Montana.

Northern Glaciated Prairie Stream



Battle Creek riffle/run upstream reach (C006) of a small Northern Glaciated Prairie stream



Cottonwood Creek (C006) severely incised Northern Glaciated Prairie stream



Whitewar Creek reference condition (C006) Northern Glaciated Prairie stream

Aquatic Ecological System Type C006 and C008

View key to subtypes

Community Description

Summary:

This ecosystem is distributed widely throughout the Northern Glaciated Plains and Northwestern Great Plains Ecoregions. Habitats are small to medium (3rd-4th order, 30-100 river miles long, average wetted width of 6m), perennial cool/warm-water streams. In low elevation (800-1000m) areas, these are meandering streams with long runs and wide continuous pools (0.5-1.5 m in depth), connected by narrow (average wetted width ~2m) infrequently spaced riffles that may maintain connectivity throughout the year, although riffles may be absent in incised and degraded channel sections. Substrate characteristics are typically cobble/pebble riffles (when present) to pebble/gravel runs and deeply silted pools. Side-channel vegetation, undercut banks and vegetated deep pools provide the most diverse fish habitat. Woody debris is largely absent from the typical C006 and C008 stream.

Fish Community:

The members of the resident fish community are dominated by the Core Prairie Stream and the Brook Stickleback Assemblages and in clear non-degraded streams, the Northern Redbelly Dace Assemblage. Without aquatic macrophytes in the pools or runs, brook stickleback or northern redbelly dace will be rare. A typical Northern Glaciated Prairie Stream community will have fathead minnow, lake chub (not as

common), brook stickleback, northern redbelly dace, pearl dace, and brassy minnow in the vegetated pools and white sucker, longnose dace and potentially plains minnow, stonecat and Iowa darter in the cobble/pebble riffle and gravelly run sections. Unfortunately, northern pike has been widely introduced as a gamefish in the northern regions of Montana, and small prairie streams containing reproducing populations of these predators will quickly lose their water column species, such as northern redbelly dace, pearl dace, Iowa darter, plains minnow, and brassy minnow. A fish community with the introduced pike will usually degrade to fathead minnow and white sucker.

Macroinvertebrate Community:

This community consists of the Large Prairie River and Prairie Stream Assemblages in the riffles, and the Medium River Side-Channel and Prairie Pool Assemblages in the slow current areas, side channels and vegetated pools. The community indicator species are characterized by the crustaceans (*Hyaella* and *Gammarus*), damselfly genera (*Coenagrion/Enallagma* spp. and *Enallagma civile*), many genera and species of the water boatman (Corixidae: *Sigara grosslineata*, *Trichocorixa*, *Trichocorixa nais*, and *Corisella*), snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), in the cobble riffles, caddisflies (*Hydropsyche morosa* group, and *Cheumatopsyche*), and riffle beetles (*Dubiraphia* and *Microcylloepus*). The giant floater mussel (*Pyganodon grandis*) can be found in the gravel to silted side-channels since two of its host fish species are members of the Brook Stickleback Assemblage.

Range:

The Northern Glaciated Prairie Stream type occurs throughout the north-central glaciated region of North America within the Missouri and Mississippi River Drainages. Within Montana this community exists in a multitude of streams such as Woody Island Coulee, upper Battle, upper Whitewater, Snake, People's, Stinky, Big and Little Warm, Assiniboine, Willow, Little Cottonwood, Porcupine and Little Porcupine Creeks and the West Fork Poplar River.

Management:

Small stock ponds, dams, water diversions and introduced gamefish species have had the most significant negative impact on this community. Anywhere dams occur, the downstream reaches are affected by altered water temperatures, introduced fish, unnatural water level fluctuations, and changes in sediment and nutrient transport. Other threats include cattle intrusions with the resulting riparian degradation and bank trampling.

Global Rank: G5

State Rank: S3

Global/State Rank Comments:

The number of quality occurrences in the state is unknown, but probably only ~50% of original streams represent quality occurrences mainly due to game fish introductions, especially northern pike. The unimpaired stream community contains northern redbelly dace and the Montana Species of Concern northern redbelly/finescale hybrid dace (S3), pearl dace (S2), and the potential Species of Concern, Iowa darter and brassy minnow. The occurrence of numerous rare, threatened or declining fish and macroinvertebrate species, and consistent (e.g. water diversions, northern pike populations) or future threats (natural gas wells) warrants a state rank of an S3.

Great Plains Intermittent Stream



Deer Creek (D005) an intermittent Great Plains stream near Decker, MT



Tooley Creek (E005) a reference condition Great Plains intermittent fishless pool near Otter, MT

Aquatic Ecological System Types D005 and E005 View key to subtypes

Community Description

Summary:

This community is widely distributed throughout the coulees, small streams (1st to 3rd order) and headwaters of Medium Prairie Rivers (B005) and Great Plains Prairie Streams (C005) within the Northwestern Great Plains Ecoregion. These are small, warm-water, low to moderate gradient and elevation (900-1200m) intermittent streams. Stream sections in the moderate gradient reaches (riffles/runs) are the first to lose flowing water connections and become interrupted pools (D005). Once these systems lose their connectivity to fish recruitment pools of downstream reaches (this may be due to climatic factors over many years such as drought) they become fishless isolated pools (E005). Throughout their range, these clear to turbid streams are characterized by short to long (~2-25m) pools that are sometimes vegetated with silted gravel to cobble substrates. The fishless pool community type provides substantial amphibian breeding and rearing habitat in otherwise harsh, dry upland conditions, so *Bufo* spp. (toads) and *Rana pipiens* (northern leopard frog) tadpoles and adults are usually present.

Fish Community:

The resident fish community is dominated by the Lake Chub or the Core Prairie Stream Assemblage (2 potential members). If connectivity to downstream reaches exists on an annual basis lake chub or fathead minnow will be the dominant species with the occasional pioneering white sucker. If there is vegetation in the pools brook stickleback may be present, but often it is just a single fish species in the pool. The only introduced fish species reported from a D005 stream was black bullhead.

Macroinvertebrate Community:

This community consists of the Prairie Stream and Pool Assemblages, occurring in the cobble and vegetative pool areas respectively. The reference community indicator species are characterized by the crustaceans (*Hyalella* and *Gammarus*), damselfly genera (*Coenagrion/Enallagma* sp. *Enallagma civile*, and *Ishnura*), many genera and species of the water boatman (Corixidae: *Sigara alternate*, *Sigara grosslineata*, *Trichocorixa*, *Trichocorixa nais*, and *Corisella*), snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases the clinger habitat species are lost, such as the damselflies and many of the water boatman taxa. The truly intermittent fishless pools (E005) may be only in existence for a few months. If these pools are dry for more than a year and then rehydrate, invertebrates with resting egg stages dominate the pools, including the crustaceans (*Ostracoda*, *Cladocera*, and *Copepoda*), fairy shrimp (*Branchinecta* and *Eubbranchipus*), clam shrimp (*Caenestheriella*), and tadpole shrimp (*Lepidurus*).

Range:

The Great Plains Intermittent Stream type occurs throughout the Northwestern Great Plains Ecoregion of North America within the Missouri and Mississippi River Drainages. Within Montana, this community exists in a multitude of streams and coulees with a few notable examples including the Ranch, Rough, Deer, Tooley, Little Bear, Little Pumpkin, Buffalo, Home and Taylor Creeks.

Management:

Small stock ponds, dams, and cattle intrusions have had the most significant negative impact on this community. Anywhere stock ponds and dams occur the downstream reaches are affected by altered water temperatures and flow, and changes in sediment and nutrient transport (Winston et al. 1991). The spring flows backed up behind stock pond dams could have potentially filled numerous E005 pools, and possibly connected these pools for a brief period to downstream fish populations for recolonization. Therefore, unless there is sufficient outflow streams and coulees below stock ponds usually do not develop this community type. Another threat to this community is cattle intrusions, which cause trampling of stream banks with the subsequent siltation and nutrient inputs into the pools. This siltation and nutrient loading may eliminate aquatic macrophytes and cause blue-green algae blooms.

Global Rank: G5**State Rank:** S5**Global/State Rank Comments:**

The number of quality occurrences in the state is unknown, but probably numerous, although this is a difficult type to quantify given the past years of drought in the state. Intermittent pools containing the *Ostracoda* group could be inventoried for unique crustaceans, such as fairy or tadpole shrimp.

Northern Glaciated Intermittent Stream



Little Sandy Creek (D006) a reference condition Northern Glaciated Intermittent prairie stream



Murray Coulee (D006) slightly impaired Northern Glaciated Intermittent prairie stream



Cowen Coulee (E006) impaired Northern Glaciated Intermittent Stream fishless pool

Aquatic Ecological System Types D006 and E006

View key to subtypes

Community Description

Summary:

This ecosystem is found widely throughout the coulees, small streams (1st to 3rd order, average wetted width of 3m) and headwaters of Medium Prairie Rivers (B006) and Northern Glaciated Prairie Streams (C006, C008) within the Northern Glaciated Ecoregion. These small, cool to warm-water, low gradient and elevation (900-1200m) streams have origins in the alluvium and sedimentary geology of this region. Throughout their range these clear (typical) to turbid streams are characterized by usually vegetated long

pools separated from each other by narrowed riffle areas usually dry by early-summer forming isolated pools or a “string of pearls”. Once these systems lose their connectivity to the fish recruitment pools of downstream reaches (may be due to climatic factors such as drought), or never had fish potential, they become the fishless isolated pool ecosystem type (E006). The substrate can be gravel to cobbles in the shallow pools to silted gravel deeper pools with rooted vegetation. These pools, on average, remain filled longer and are cooler and wider than their Great Plains counterparts.

Fish Community:

The resident fish community is dominated by the Brook Stickleback and Core Prairie Stream Assemblages. In the largest clear non-degraded pools members of the Northern Redbelly Dace Assemblage may occur. A reference-condition Northern Glaciated Intermittent Stream type will have fathead minnow, brook stickleback, lake chub (not as common), brassy minnow and northern redbelly dace in order of dominance. Without aquatic macrophytes in the pools, brook stickleback or northern redbelly dace will be rare. Typically this community will be co-dominated by fathead minnow and brook stickleback only, and just fathead minnow in truly degraded or non-vegetated systems. The E006 type will be fishless.

Macroinvertebrate Community:

This community consists of members of the Prairie Stream and Pool Assemblages, occurring in cobbles and in the vegetative pool areas respectively. The reference community indicator species are characterized by the crustaceans (*Hyalella* and *Gammarus*), damselfly genera (*Coenagrion/Enallagma* sp. *Enallagma civile*, and *Ishnura*), many genera and species of the water boatman (Corixidae: *Sigara alternata*, *Sigara grosslineata*, *Trichocorixa*, *Trichocorixa nais*, and *Corisella*), snails (*Physella*, *Gyraulus*, and *Stagnicola*), mayflies (*Caenis* and *Callibaetis*), and beetles (*Haliphus*, *Oreodytes*, *Laccophilus*, *Hydroporus* and *Hygrotus*). As the complexity of the pool habitat decreases, the clinger habitat species, such as the damselflies and many of the water boatman taxa, will be lost. The truly intermittent fishless pool ecosystems (E005) may only exist for a few months. If these pools are dry for more than a year and then rehydrate, many invertebrates with resting egg stages dominate the pools, including crustaceans (*Ostracoda*, *Cladocera*, and *Copepoda*), fairy shrimp (*Branchinecta* and *Eubranchipus*) the clam shrimp (*Caenestheriella*), and the tadpole shrimp (*Lepidurus*).

Range:

The Northern Glaciated Intermittent Stream Ecosystem occurs throughout the glaciated Great Plains regions of northern North America. Within Montana, this community exists in a multitude of streams and coulees mostly situated north of the Missouri River, with examples including the Little Sandy, Murray Coulee, Cowen Coulee, Rattlesnake, Little Sage, Coberg, E. Fork Battle, Black, Snow and Hell Coulee, Bitter, Buggy, and E. Fork Porcupine Creeks.

Global Rank: G5

State Rank: S5

Global/State Rank Comments:

The number of quality occurrences in the state is unknown, but probably fairly common. This is a difficult community type to quantify given the past years of drought in the state and the tenuous nature of this aquatic system.

Great Plains Perennial Spring



Cow Creek (S005) reference spring example within the Custer National Forest



Charcoal Spring (S005) a slightly impaired example within the Custer National Forest

Aquatic Ecological System Type S005

View key to subtypes

Community Description

Summary:

This ecosystem is found in the moderate elevation (1000-1600m), upland hill areas of the Northwestern Great Plains Ecoregion. It occurs in small (0.2-2m in width) perennial fishless headwater springs with low to moderate gradient flowing through sedimentary geology. Benthic habitats are typically long riffle/run reaches dominated by shale cobbles and gravel with some woody debris.

Environment:

Throughout its Montana range, it occurs in seeps and springs within the Custer National Forest, Wolf Mountains and the higher elevation ponderosa pine forests of the Powder River Basin. Surface topography is sometimes undulating or hummocky and the gradient is moderate. Disturbance by cattle is widespread, as these springs often represent the only water source.

Fish Community:

This is a fishless system.

Macroinvertebrate Community:

The reference condition ecological system (S005) indicator macroinvertebrates include the midges (*Odontomesa*, *Radotanypus*, *Heleniella*, and *Pseudodiamesa*), diptera (*Tipula*, *Dicranota*, *Ormosia*, and *Pedicia*), snails (*Hydrobiidae* and *Physa*), the mayfly (*Baetis tricaudatus*), the caddisfly (*Hesperophylax designatus*), the water mite and leech (*Hydrachna* and *Glossophona complanata*), beetles (*Oreodytes*, *Optioservus* and *Hydroporus*), and the damselfly larva *Argia*. Sediment impaired and cattle degraded springs will quickly lose the mayfly, caddisfly, and dipteran species (above), and form a community dominated by tolerant midges, biting dipteran larvae (*Ceratopogonidae*) and air breathing beetles.

Range:

The Great Plains Perennial Spring type has been recorded in the Custer National Forest, Wolf Mountains and the higher elevation ponderosa pine forests of the Powder River Basin.

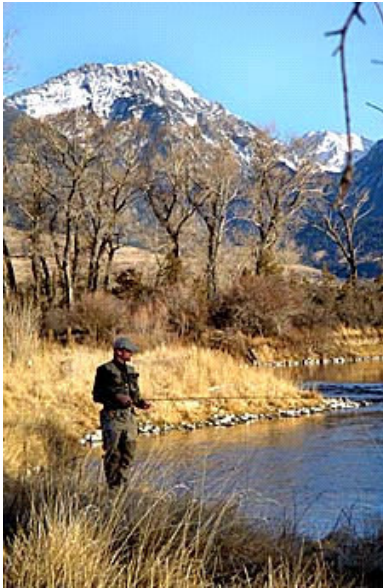
Management:

Soils adjacent to the springs are often waterlogged and are easily trampled and hummocked by livestock, causing severe streambed degradation, sedimentation and siltation downstream. Stock tanks and fencing can help preserve these ecosystems.

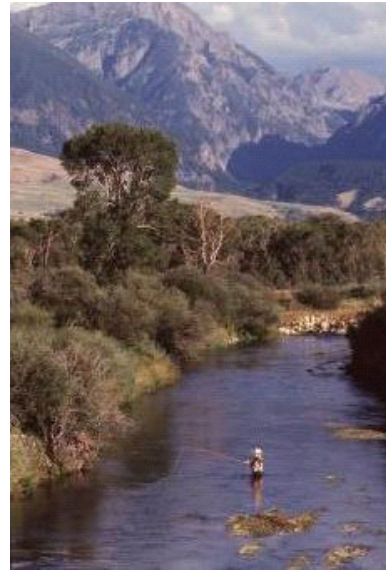
Global Rank: GU**State Rank:** S4**Global Rank Comments:**

The number of occurrences is unknown. In Montana, this ecosystem is reported from 25 site visits within the Custer National Forest Ashland District, but only three of these sites contained a quality, fully functional S005 community (Stagliano 2004). In a similar ecological type, the caddisfly *Hesperophylax designatus* was also found to be an indicator species of perennial springs in the Glass Mountains of the Great Basin (UT) in a 1994 survey (Myers 1995). Therefore, this ecosystem may be widespread, but because of the limited occurrence of high integrity sites in Montana, long-term monitoring and restoration of degraded sites may be recommended.

Spring Creek



Armstrong Spring Creek (S002) within the Paradise Valley. Photo taken by Yellowstone Flyfishers, Inc.



DePuy's Spring Creek (S002) within the Paradise Valley. Photo taken by DePuys Spring Creek, LLC.



Big Spring Creek aquatic vegetation (S002) near Lewistown, MT

Aquatic Ecological System Type S001, S002, and S003 **View key to subtypes**

Community Description

Summary:

This ecosystem is found in the Montana Foothills and Valleys Ecoregion. Elevation is 1200-2000m. These small to medium (average wetted width from 2-15m, average summer temperature <15°C) rivers have moderated permanent flow with strong seasonal variabilities. Waters are mineral-rich and circumneutral to alkaline with pH of 7.0-8.2; clarity is often high. These factors contribute to lush growth of submerged aquatic vegetation, which may include watercress, *Potamogeton* spp., and *Myriophyllum* spp. These streams represent groundwater discharge input, therefore they do not experience severe flooding or drastic temperature shifts and have more constant flow. The substrate of these streams is

usually cobble riffles, gravel/sand runs and pools, with extensive beds of aquatic vegetation, and, unless they are degraded by cattle, flow silt-free and clear.

Fish Community:

Fish are from the Traditional Trout Stream Assemblage. The community historically had native species including westslope cutthroat, mottled sculpin, longnose dace, mountain whitefish, with Yellowstone cutthroat trout and mountain sucker in the Yellowstone drainages. However, the introduced brook, brown and rainbow trout tend to dominate and become the focal species of these systems.

Macroinvertebrate Community:

The Spring Creek type has abundant macroinvertebrate populations, but a relatively limited diversity. This unique low-diversity community consists of a combination of members from the Medium Coolwater Transitional, the Traditional Trout Stream, and the Foothills Transitional Assemblages. The community is dominated by the mayflies (*Tricorythodes* and *Ephemerella* spp. (usually *Ephemerella inermis* and *E. infrequens*)), the amphipod crustacean (*Gammarus*), and many Chironomidae. Other community indicator species include *Baetis tricaudatus*, caddisfly species (*Hydropsyche*, *Amiocentrus aspilis*, *Cheumatopsyche*, and *Brachycentrus occidentalis*), beetles (*Optioservus* spp.), and snails (*Gyraulus*, *Physella*, *Stagnicola* and Hydrobiidae).

Range:

The Spring Creek type has been identified in the foothills of many Montana drainages, particularly some of the more famous trout fishing sites: Armstrong's, Depuy's, Nelson's Spring Creeks of the Yellowstone, and Thompson, Ben Hart (tributary to the E. Gallatin), O'Dell, Warm Spring and Big Spring Creeks of the Missouri drainage.

Management:

Livestock use around the riparian areas is common and can have strong local effects resulting in sedimentation and streams becoming wider or shallower. High-density cattle usage can cause severe degradation, sedimentation and siltation on the riffle habitats and gravel spawning areas downstream.

Global Rank: GU

State Rank: SU

Global Rank Comments:

The number of occurrences is fairly well known and many spring creeks fall within private property. Very few spring creeks have had extensive biological inventories due to private land issues, but the potential of discovering new snail species is high (D. Gustafson, pers. comm.). Due to the constant temperatures, these streams can act as fish refuges during the summer and winter months with trout spawning areas on the gravel bottoms.

Intermountain Transitional River

Mainstem Intermountain Transitional River



Big Hole River (B001) an Intermountain Transitional River



Gallatin River (B002) an Intermountain Transitional River



Smith River (B003) an Intermountain Transitional River



Musselshell River (B004) a dewatered representative of the Intermountain Transitional River

Aquatic Ecological System Type B001, B002, B003, B004 and B007

View key to subtypes

Community Description

Summary:

This well-known cool to cold-water ecosystem occurs throughout the upper Missouri and Yellowstone River Drainages and includes some of the most famous trout rivers in the country. Habitats occur in moderate elevation (1200-2000m), medium-sized streams (4th-5th order, wetted width from 15 to 30m, average summer temperature <20°C) with moderate gradient and a permanent flow. There is strong seasonal variability due to melting snow pack from higher elevation mountainous areas. These rivers represent the ecotonal area from high-elevation steep-gradient mountain streams to the eastern prairie rivers. They are typically direct tributaries of the Missouri and Yellowstone Rivers except the Mainstem Transitional subtype, which describes portions of the Yellowstone and Missouri River. These are classic freestone trout rivers with boulder/cobble riffles, cobble/gravel runs and pools, and silt on the margins or in the deepest pools. Deep runs and pools with undercut banks and large woody debris provide the best fish habitats, while the riffles harbor the most diverse macroinvertebrate communities. These are clear running rivers except during spring run-off or where cattle intrusions, bank erosion or stream incisement

has caused sedimentation and silt deposits in the main channel areas. Over 50% of the sites in this ecosystem type were classified as impaired by sediments or de-watering by the MT DEQ.

Fish Community:

The members of this community are dominated by the Traditional Trout Stream Assemblage. The fish community historically had native species including westslope cutthroat, mountain whitefish, mottled sculpin, longnose sucker, longnose dace, with Yellowstone cutthroat trout and mountain sucker in the Yellowstone drainages. However, introduced brown and rainbow trout tend to dominate and become the focal species of these systems. One member of the Large Mainstem River Assemblage occurring frequently in deeper coldwater habitats of this system is burbot, a potential Species of Concern in the state. Additionally, white sucker, walleye, northern pike and carp may be found at the warmer lower end of this transitional gradient. The shallow gravel runs of these rivers provide spawning habitat for downstream populations of brown trout during their fall migration, and rainbow trout and sucker species in the spring. The Big Hole Assemblage is unique and found only in the Big Hole River drainage. It includes the indicator species fluvial arctic grayling (candidate for federal threatened status) and redbside shiner.

Macroinvertebrate Community:

This diverse community consists of the Medium Coolwater Transitional, Traditional Trout Stream, Medium Mountain Stream and Foothills Transitional Assemblages. The community indicator species are characterized by main channel fast current stonefly and caddisfly species (*Pteronarcys californica*, *Hesperoperla pacifica*, *Brachycentrus americanus*, *Arctopsyche grandis*, *Hydropsyche*, *Glossosoma*, and *Lepidostoma*) and the tipulids (*Hexatoma* and *Antocha*). Mayflies are diverse and contain many genera including *Baetis*, *Ephemerella*, *Serratella*, *Rhithrogena*, *Drunella* and *Epeorus*. As these transitional rivers proceed downstream and begin to warm (>17 °C) or are degraded or dewatered, they will quickly lose the Traditional Trout Stream and Medium Mountain Stream Assemblages and shift to the mayfly, caddisfly, beetle and dipteran species that form the Medium Coolwater Transitional and Foothills Transitional Assemblages with indicator species *Hydropsyche*, *Optioservus*, *Baetis tricaudatus*, *Brachycentrus occidentalis*, *Helicopsyche borealis*, *Corynoneura*, *Prosimulium*, *Amiocentrus aspilis*, *Lara*, *Phaenopsectra*, *Plauditus*, and *Narpus*. Populations of western pearlshell mussel have been reported from this river ecosystem, although it may be in decline.

Range:

The Intermountain Transitional River ecosystem occurs in the rivers that dominate trout fishing throughout central and southwest Montana; these include the Smith, Jefferson, Madison, Gallatin, Beaverhead, Big Hole, Dearborn, Sun and the mainstem Missouri from Three Forks to Cascade. In the Yellowstone drainage they include the mainstem Yellowstone River from Gardiner to Big Timber, Clarks Fork of the Yellowstone, and the lower Boulder, Stillwater, and Shields Rivers. The Middle Missouri/Musselshell drainages contain the Judith and Musselshell Rivers.

Management:

Livestock use around the riparian areas of this ecosystem is common and can have strong local effects resulting in sedimentation, a shift of the macroinvertebrate communities from a Traditional Trout Stream Assemblage to the Medium Coolwater Transitional Assemblage, and a shift in fish communities from native cutthroat trout to coolwater introduced species, such as brook trout. High-density cattle usage can cause severe degradation, bank erosion, sedimentation and siltation on the riffle habitats and gravel spawning areas downstream. Water diversions lower in the foothills for agriculture may be an issue for this ecosystem since these streams usually flow onto private lands as foothills grade into the valleys and decrease in elevation and gradient.

Global Rank: G5

State Rank: S4

Global Rank Comments:

The number of quality occurrences is unknown, but probably common. In Montana, this community is reported from ~75 sites within the Foothills and Valleys Ecoregion.

Headwaters Foothills River
Small Foothills River
Small Transitional Foothills River



Pryor Creek (D001) a Headwater Foothills River with a beaver dam in the Custer National Forest



Sweetgrass Creek (C002) a Small Transitional Foothills River near Big Timber, MT



Bear Creek (C001) a Small Transitional Foothills River with slight sediment impairment near Belfry, MT

Aquatic Ecological System Type C001, C002, C003, C004 and D001
View key to subtypes

Community Description

Summary:

This ecosystem is found in the moderate elevation (1200-2000m), upland foothill streams of the Foothills and Valleys or Middle Rockies and Isolated Mountain Ranges Ecoregions as they decrease in elevation and gradient. The smallest sub-type, the Headwaters Foothills River, is a 1st or 2nd order stream tributary to the Small Transitional Foothills and the Small Foothills River Systems, which are small-medium-sized

(2nd-4th order, average wetted width of 5m), moderately flowing rivers with permanent flow of strong seasonal variability due to melting snow pack from higher elevation mountainous areas. These streams represent the transitional areas from high gradient mountain stream to intermontane or prairie rivers. Small Foothills Rivers are tributaries to Intermountain Rivers and maintain average summer temperatures (<20°C) suitable for cool-coldwater fish species. In contrast, Small Transitional Foothills Rivers typically enter prairie rivers in the eastern part of the state and lose the ability to maintain cool water fish species at the lower elevations. The surrounding landscape is transitional as well with coniferous forests giving way to sage steppe with woody riparian areas. Beaver pond complexes are often characteristic habitats on these streams. Beavers find suitable conditions and dam building materials as the foothills stream gradient decreases. These ponds provide substantial trout habitat, but can warm beyond the tolerance of cutthroat trout. The native cutthroats will usually be pushed to the upstream reaches by the more aggressive brook trout. The substrate of these streams is usually boulder/cobble riffles, gravel/sand runs and pools, and silt bottoms in beaver ponds with large woody debris.

Fish Community:

The fish of this community are Coolwater Transitional and Traditional Trout Stream Assemblages. Indicator species of the Headwaters Foothills and Small Foothills Rivers include the native species westslope or Yellowstone cutthroat trout, mountain whitefish and mottled sculpin. However, the introduced brook trout and rainbow trout tend to dominate and become the focal species. As Small Foothills and Transitional Foothills Rivers proceed down gradient, inclusions of the longnose sucker, longnose dace and mountain sucker (Yellowstone drainages) into community occur. Additional fish species (carp, white sucker, lake chub and fathead minnow of the Core Prairie Stream Assemblage) may be found at the warmer lower end of the Small Transitional Foothills Rivers in the prairie regions. The shallow riffle areas of the larger foothills rivers entering Intermountain Rivers may provide spawning habitat for downstream populations of brown trout during their fall migration, and suckers, dace and rainbow trout in the spring.

Macroinvertebrate Community:

Reference condition Headwaters and Small Foothills Rivers are dominated by the Traditional Trout Stream Assemblage, with some members of the Medium Coolwater Transitional and Foothills Transitional Assemblages. The community indicator species are characterized by main channel, fast current mayfly, stonefly and caddisfly species (*Pteronarcys californica*, *Hesperoperla pacifica*, *Brachycentrus americanus*, *Rhithrogena*, *Arctopsyche grandis*, and *Lepidostoma* spp.), and the tipulid, *Antocha*. As Small Foothills Rivers proceed downstream and begin to warm (>17 °C) or are sediment impaired, degraded or dewatered, they will quickly lose the Traditional Trout Stream Assemblage and shift to the mayfly, caddisfly, beetle and dipteran species that form the Medium Coolwater Transitional Assemblage with indicator species *Hydropsyche*, *Optioservus*, *Baetis tricaudatus*, *Brachycentrus occidentalis*, *Helicopsyche borealis*, *Corynoneura*, *Constempellina*, *Prosimulium*, *Amiocentrus aspilis*, *Lara*, *Phaenopsectra*, *Plauditus*, and *Narpus*. Lower, warmer stretches of Small Transitional Foothills Rivers will begin to pick up species of the Transitional Prairie River Assemblage. Populations of western pearlshell mussel have been reported from this river ecosystem, although the populations may be in decline.

Range:

This type has been identified in the Custer National Forest (Beartooth District), Pryor Mountains, and foothills of the Belts, Judiths and other isolated mountain ranges. Many BLM managed lands contain this community where the National Forest lands transition to the foothills and valleys. The Middle Missouri/Musselshell drainages contain the most representatives of this community type in the database.

Management:

Livestock use around the riparian areas of this ecosystem is common and can have strong local effects resulting in sedimentation, a shift of the macroinvertebrate communities from a Traditional Trout Stream Assemblage to the Medium Coolwater Transitional Assemblage, and a shift in fish communities from native cutthroat trout to introduced species, such as brook trout. High-density cattle usage can cause severe degradation, bank erosion, sedimentation and siltation on the riffle habitats and gravel spawning areas downstream. Water diversions lower in the foothills for agriculture may be an issue since these streams usually flow onto private lands as foothills grade into the valleys and decrease in elevation and gradient.

Global Rank: GU**State Rank:** S4**Global Rank Comments:**

The number of occurrences is unknown, but probably abundant. In Montana, the community is reported from over 200 sites within the Foothills and Valleys Ecoregions and in the transitional zones of most mountain ranges in the state.

Mountain Stream



Tenderfoot Creek (D002) a Mountain Stream in the Belt Mountains



Boulder River (D004) a Mountain Stream in the Beartooth Mountains



LeMarche Creek (D004) a Mountain Stream tributary to the Big Hole in the Anaconda-Pintlar Mountains

Aquatic Ecological System Type D002, D003, D004 and E010 View key to subtypes

Community Description

Summary:

This ecosystem is found in the mountainous, moderate-high elevation (1600-2500m), forested, moderately confined-channel streams of the Middle Rockies and Isolated Ranges Ecoregion. These small-medium (2nd-3rd order, average wetted width of 7m, average summer temperature <15°C) moderately flowing streams have permanent flow with strong seasonal variability due to melting snow pack from higher elevation mountainous areas. They are often within National Forest Service boundaries. These streams represent the transitional areas from the alpine stream communities to foothills and intermontane rivers and provide substantial habitat for Montana's native cutthroat trout populations, which thrive in the cold water temperatures and complex in-stream habitats. The geomorphology of these streams is usually a step-pool configuration with substrate dominated by boulders, cobbles and gravel in the short pools. Large woody debris from the surrounding hillslopes can provide significant channel material and additional substrate to these streams.

Fish Community:

The fish community is the Traditional Trout Stream Assemblage, specifically the Small Trout Stream Assemblage, which contains westslope cutthroat trout and mottled sculpin in high quality Missouri drainage streams, and the Yellowstone Mountain Stream Assemblage, which includes Yellowstone cutthroat trout, golden trout (introduced) and sculpin. Unfortunately, the introduced brook and rainbow trout have pushed many native cutthroat trout populations to the brink through aggressive competition (brook trout) and hybridization (rainbow trout). Mottled sculpin usually persist in all of these types, but single species assemblages of westslope and Yellowstone cutthroat trout occur in many streams that have sufficient downstream barriers to prevent the dispersal of the sculpin upstream. Interestingly, these downstream barriers have allowed the persistence of high quality, intact small mountain stream communities by impeding the colonization of introduced species into the pure cutthroat trout areas.

Macroinvertebrate Community:

This diverse community of coldwater stenotherms consists of the Mountain Stream and Medium Mountain Stream Assemblages. The community indicator species are characterized by intolerant, main channel, fast current mayfly, stonefly and caddisfly species (*Baetis bicaudatus*, *Caudetella* spp., *Drunella* spp., *Epeorus* spp, *Cinygmula*, *Zapada* spp. *Megarcys*, *Doroneuria*, *Sweltsa*, *Paraperla*, *Micrasema*, *Neothremma*, *Parapsyche*, *Neophylax* spp., and numerous *Rhyacophila* spp. groups) and the cold-water dipterans (*Rhabdomastix*, *Bibliocephala*, and *Glutops*). As mountain streams proceed downstream and begin to warm (>15 °C), a dominance shift occurs to the Medium Mountain Stream Assemblage. Populations of western pearlshell mussel have been reported from this stream type and this ecosystem may be their stronghold in the state east of the continental divide.

Range:

In Montana, the Mountain Stream type is reported from over 100 sites within the Middle Rockies and Isolated Ranges Ecoregions. These include streams in many of Montana's mountain ranges, including the Beartooths, Absorokas, Elkhorns, Big Belts, Little Belts, Crazy's, Gallatin-Madison-Bridgers, Anaconda-Pintlers, Pioneers and the Big Snowy Mountains. These ecosystems typically fall within the boundaries of National Forest Service lands and wilderness areas.

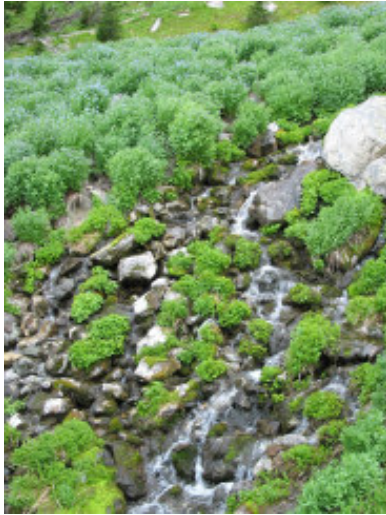
Management:

Due to the confined valley nature of these streams, the largest management issue involves keeping the riparian zone intact. Disturbances in the riparian zone (e.g. logging) can have severe water quality impacts from bank erosion, sedimentation, increased stream temperatures, silt deposits and loss of large woody debris. Livestock use around the riparian areas can have strong local effects resulting in sedimentation and stream widening at cattle crossings.

Global Rank: G5**State Rank:** SU**Global Rank Comments:**

The number of occurrences is unknown, but probably abundant. These stream ecosystems are widespread across the mountain ranges of North America and are usually afforded some measure of protection due to National Park or Forest Service land ownership.

Alpine Stream



E. Fork Pintlar Creek (E001) a fishless Alpine Stream in the Anaconda-Pintlar Mountains



Hellroaring Creek (E001) a steep Alpine Stream in the Beartooth Mountains

Aquatic Ecological System Type D011, E001, E002 and E003

View key to subtypes

Community Description

Summary:

This ecosystem is found in the high elevation (>2500m) mountainous streams of the Middle Rockies and Isolated Ranges Ecoregions. These small (1st and 2nd order, average wetted width of 2m, average summer temperature <10°C) moderately flowing streams have permanent flow with variability due to melting snow pack. These streams can be directly snow pack or glacier-fed or flow from alpine lakes formed in mountain cirques. The geomorphology of these coldwater streams can vary from a high gradient, step-pool configuration with substrate dominated by boulders and cobbles with gravel in the short pools to a low gradient lake outflow dominated by cobbles and gravel.

Fish Community:

The smallest alpine creeks are steep, shallow and fishless. If fish are present in the drainage or have access to the streams from a lake outlet, they will typically be members of a single species assemblage dominated by westslope or Yellowstone cutthroat trout depending on the drainage, or the introduced golden or brook trout. This assemblage is dictated by the fishstocking history of the high mountain lakes in the area. Native species management plans are in place by management agencies, but high mountain lakes are often still stocked with introduced species. Sufficient downstream barriers (waterfalls, boulder step-drops) usually exist to prevent the dispersal of mottled sculpin into this system and impede the colonization of introduced species (brook trout) into the pure cutthroat trout areas.

Macroinvertebrate Community:

This diverse community of coldwater stenotherms consists primarily of the Mountain Stream and Medium Mountain Stream Assemblages. The community indicator species are characterized by intolerant, shredder, and scraper mayfly, stonefly and caddisfly species (*Drunella spinifera*, *Epeorus grandis*, *Yoraperla*, *Soliperla*, *Zapada frigida*, many *Leuctridae* and *Capniidae* species, *Oligophlebodes*, and

numerous predatory *Rhyacophila* spp. groups) and the cold-water dipterans (Thaumalidae, *Bibliocephala*, and *Glutops*). As the alpine mountain streams proceed downstream, begin to lose elevation/gradient and warm (>10 °C), a dominance shift occurs to the Medium Mountain Stream Assemblage.

Range:

In Montana, the Alpine Stream community is described from ~20 sites within the Middle Rockies and Isolated Ranges Ecoregion. These include streams in many of Montana's mountain ranges, including the Beartooths, Absarokas, Elkhorns, Big Belts, Little Belts, Crazy's, Gallatin-Madison-Bridgers, Anaconda-Pintlers, Pioneers and the Big Snowy Mountains. These ecosystems typically fall within the boundaries of National Forest Service lands and wilderness areas.

Management:

Due to the high altitude nature of these streams anthropogenic disturbances are usually minimal, but may include high impact recreational use (e.g. stock use, campsites, stream crossings). This type may be threatened by global warming. The communities inhabiting these streams are glacial relicts taking refuge from the last ice age and are confined to these high elevations due to temperature requirements. If these cold-water dependent communities experience increased unsuitable temperatures from snow pack and glacier reductions they have nowhere to go. Due to the inherent inaccessibility of these systems few have been inventoried, but some may contain Species of Concern, like the western glacier stonefly (G2S1) from the glacier-fed streams of Glacier Park.

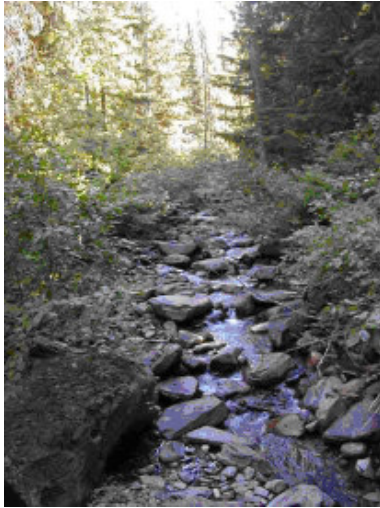
Global Rank: G5

State Rank: S4

Global Rank Comments:

The number of occurrences is unknown, but probably abundant. These stream ecosystems occur in the alpine zones of high mountain ranges across western North America. A state rank of S4 is warranted because the alpine systems in Montana contain unique and intolerant fauna with many Species of Concern. Inventory and long-term monitoring of these poorly understood ecosystems is recommended.

Mountain Spring



Step-pool boulder spring



Cobble/gravel spring

Aquatic Ecological System Type S003

View key to subtypes

Community Description

Summary:

Mountain Springs are found in the moderate to high elevation (1600-2500m) steep-forested slopes of the Middle Rockies and Isolated Mountain Ranges Ecoregion. These moderately confined, single-thread channel streams are 1st order spring rivulets with an average wetted width up to 0.5m and average summer temperature <12°C. Although there is strong seasonal variability due to melting snow pack, permanent groundwater-based flow contributes year-round to headwater foothills and mountain streams. These systems are often within National Forest Service boundaries. The geomorphology of these streams is usually Rosgen A-2 with a step-pool configuration. Substrate ranges from boulder and cobbles to gravel in the short pools. Large woody debris from the surrounding hillslopes can provide significant channel material and additional substrate to these streams.

Fish Community:

The typical Mountain Spring is fishless, although pioneering members of the Headwater Trout Stream Assemblage, specifically Westslope and Yellowstone Cutthroat Trout, may migrate up these small tributaries. Unfortunately, the introduced brook trout may also migrate up and aggressively compete with the native cutthroats in this limited habitat.

Macroinvertebrate Community:

This community of coldwater stenotherms typically consists of the shredder and predator functional groups of the Mountain Stream assemblage. The community indicator species include intolerant, moderate current mayflies (*Baetis bicaudatus*, *Ameletus*, *Caudetella spp.*, and *Drunella spinifera*), stoneflies (*Yoraperla*, *Zapada colombiana*, *Despaxia augusta*, Leuctridae, and *Megarctys*), caddisflies (*Neothremma alicia*, *Parapsyche*, *Cryptochia*, *Lepidostoma*, and *Neophylax splendans*), cold-water dipterans (*Bibiocephala*, and *Glutops*), and the non-insect turbellarian *Polycelis*.

Range:

In Montana, the Mountain Spring type is only represented from 10 sites within the Middle Rockies and Isolated Mountain Ranges Ecoregion. However, these small and usually unnamed streams are numerous, but under sampled. They originate in all of Montana's Upper Missouri River mountain ranges including the Absaroka-Beartooth, Big Snowy, Elkhorn, Big Belt, Little Belt, Crazy, Gallatin-Madison-Bridger, Anaconda-Pintler, Pioneer and Tendoy Ranges. These ecosystems typically fall within the boundaries of National Forest Service lands and wilderness areas.

Management:

Due to the confined valley nature of these streams, the largest management issue involves keeping the riparian zone intact. Disturbances within the riparian zone (e.g. logging) can have severe water quality impacts including bank erosion, sedimentation, increased stream temperatures, silt deposits and loss of large woody debris. Grazing and livestock use in the riparian areas occurs, even on National Forest Lands, and can have strong local effects of sedimentation and stream widening at cattle crossings.

Global Rank: G5**State Rank:** S5**Global Rank Comments:**

The number of viable occurrences is unknown, but probably abundant. These stream ecosystems are abundant across the mountain ranges of Western North America and are usually afforded some measure of protection due to National Park or Forest Service land ownership.

Significant indicator species ($p < 0.05$) of the macroinvertebrate community groups.

SPA group common name. OIV = Observed Indicator Value of that taxon.

Taxon	Group	OIV	Average	Std Dev	p-value
Medium Coolwater Transitional Assemblage					
<i>Hydropsyche</i> spp.	1	34.4	9.8	2.86	0.001
<i>Optioservus</i> spp.	1	52.1	10.4	3.25	0.001
<i>Baetis tricaudatus</i>	1	46.4	10.3	2.52	0.001
<i>Brachycentrus occidentalis</i>	1	34.1	8.7	3.59	0.001
<i>Eukiefferiella</i> spp.	1	30.2	8.2	2.93	0.001
<i>Skwala</i>	1	22.5	7.6	3.44	0.005
<i>Parametriocnemus</i>	1	19.4	7.4	2.86	0.008
<i>Hydroptila</i> spp.	1	17.1	7.5	2.77	0.012
<i>Tvetenia</i> spp.	1	16.9	7.6	3.25	0.021
<i>Zaitzevia parvula</i>	1	17.6	7.7	3.65	0.026
<i>Oecetis</i> spp.	1	14.5	6.8	3.03	0.027
<i>Wormaldia</i> spp.	1	12.4	4.8	2.85	0.031
<i>Attenella margarita</i>	1	6.3	3.1	1.86	0.051
<i>Malenka</i> spp.	1	10.8	5.3	3.17	0.053
Transitional Prairie River Assemblage					
<i>Cricotopus</i> spp.	3	40.6	11.8	3.83	0.001
<i>Rheotanytarsus</i>	3	31.7	8.8	3.6	0.002
<i>Tricorythodes</i>	3	26.5	10	3.47	0.003
<i>Cricotopus trifascia</i> group	3	31.5	7.9	3.79	0.003
<i>Naididae</i>	3	24.2	7.3	3.61	0.004
<i>Oecetis avara</i> group	3	19	5.5	3.53	0.009
<i>Monodiamesa</i> spp.	3	14.1	4.8	3.04	0.015
<i>Camelobatidius</i>	3	15.5	5.3	3.16	0.015
<i>Stenelmis</i> spp.	3	21.4	7.8	4.3	0.016
<i>Leucotrichia pictipes</i>	3	13.9	4.6	2.91	0.017
<i>Neotrichia</i> spp.	3	13.9	5	3.19	0.022
<i>Psychomyia</i> spp.	3	11.2	4.7	2.93	0.039
<i>Fallceon quilleri</i>	3	13.7	6.8	3.34	0.041
<i>Acentrella insignificans</i>	3	15	7.1	3.62	0.043
<i>Ephoron album</i>	3	13.7	6.1	3.61	0.044
<i>Travarella albertana</i>	3	10.1	5.3	3.08	0.051
Traditional Trout Stream Assemblage					
<i>Antocha</i>	4	32.3	7.1	2.95	0.001
<i>Brachycentrus americanus</i>	4	56.2	9.2	3.74	0.001
<i>Lepidostoma</i>	4	47	9.4	3.97	0.001
<i>Ephemerella inermis</i>	4	57.6	7.9	3.4	0.001
<i>Glossosoma</i> spp.	4	70.5	8.1	3.59	0.001

<i>Pteronarcys californica</i>	4	24.4	4.5	3.13	0.001
<i>Hesperoperla pacifica</i>	4	25.1	6.9	2.92	0.002
<i>Biocephala</i> spp.	4	22.7	3.9	2.46	0.002
<i>Hexatoma</i>	4	21	7.9	2.92	0.007
<i>Chelifera</i> spp.	4	15	5.7	2.79	0.019
<i>Atherix</i> spp.	4	17.9	7.2	3.6	0.02
<i>Lymnaeidae</i>	4	11.9	5	2.84	0.029
<i>Prodiamesa</i>	4	10.1	4.1	2.78	0.036
<i>Cricotopus Nostoccladius</i>	4	13.7	5.9	3.48	0.037
<i>Diura</i>	4	9.1	4.1	2.45	0.051

Prairie Stream Assemblage

<i>Caenis latipennis</i>	9	66.5	7.7	3.37	0.001
<i>Ceratopogon</i> spp.	9	37.1	8.5	3.94	0.001
<i>Coenagrion</i>	9	52.3	6.3	3.37	0.001
<i>Labrundinia</i>	9	26.2	3.9	2.51	0.001
<i>Dubiraphia</i>	9	21.1	3.8	2.48	0.002
<i>Enallagma civile</i>	9	17.6	3.8	2.35	0.003
<i>Physella</i>	9	27.7	11.1	3.52	0.005
<i>Enallagma</i> spp.	9	16.6	3.9	2.42	0.005
<i>Sigara alternata</i>	9	16.4	4.5	3.16	0.011
<i>Psectrocladius</i>	9	13.5	4.6	2.95	0.024
<i>Sigara grosslineata</i>	9	11.8	4.2	2.89	0.029
<i>Trichocorixa</i>	9	9.1	3.9	2.36	0.046

Large Prairie River Assemblage

<i>Cheumatopsyche</i>	11	54.7	9.9	3.18	0.001
<i>Chironomidae</i>	11	23.3	5.9	3.37	0.003
<i>Neochoroterpes oklahoma</i>	11	16.6	4.2	2.7	0.005
<i>Choroterpes</i>	11	23.5	7.3	4.14	0.009
<i>Ambrysus mormom</i>	11	19.9	7.1	3.72	0.011
<i>Hemerodromia</i>	11	18.4	6.1	3.69	0.015
<i>Microcyloopus</i>	11	13.6	5.5	3.08	0.026
<i>Hydropsyche morosa</i> group	11	12.2	5.8	3.16	0.044
<i>Hydrochus</i>	11	8.8	4.1	2.77	0.048

Prairie Pool Assemblage

<i>Hyaella</i>	12	62.2	9.5	3.24	0.001
<i>Coenagrion/Enallagma</i>	12	32.7	4.8	2.67	0.001
<i>Gammarus</i> spp.	12	27.8	7	3.79	0.004
<i>Callibaetis</i>	12	30.4	7.4	4.02	0.005
<i>Glyptotendipes</i>	12	18.7	6	3.37	0.005
<i>Trichocorixa nais</i>	12	15	3.9	2.58	0.005
<i>Gyraulus</i>	12	22.4	7.2	3.79	0.008
<i>Endochironomus</i>	12	18.5	5.8	3.7	0.008
<i>Halipus</i>	12	17	5.7	3.03	0.009
<i>Paratanytarsus</i> spp.	12	20.2	5.6	3.54	0.011

<i>Mystacides</i> spp.	12	13.2	4.2	2.76	0.015
<i>Molanna</i>	12	10	4	2.64	0.033
<i>Hygrotus</i>	12	9.8	4.1	2.72	0.044
<i>Caenis</i> spp.	12	9.1	4.1	2.63	0.049
<i>Erpobdella</i>	12	11.1	5.3	3.07	0.05
<i>Corisella</i>	12	9.4	4.2	2.87	0.05
<i>Stagnicola</i>	12	12	5.4	3.6	0.051
Filtering-Collector Assemblage					
<i>Simulium</i> spp.	37	67.6	13.2	3.78	0.001
<i>Isonychia</i> spp.	37	21.4	6.6	3.87	0.01
<i>Stylurus</i> spp.	37	10.7	4	2.6	0.02
<i>Eukiefferella claripennis</i> group	37	12.1	4.7	3.07	0.029
<i>Pseudocloeon</i>	37	9.4	4.4	2.85	0.049
<i>Hydropsyche confusa</i>	37	10.8	5	3.32	0.05
Large River Slow Current Assemblage					
<i>Tanytarsus</i> spp.	38	49.5	10.8	4.68	0.001
<i>Dicrotendipes</i>	38	24.5	8.1	3.34	0.002
<i>Cladotanytarsus</i>	38	32.5	10.1	5.04	0.005
<i>Hexagenia limbata</i>	38	30	5.3	2.92	0.005
<i>Ablabesmyia</i> spp.	38	17.4	6.1	2.74	0.006
<i>Polycentropus</i>	38	16.4	5.4	3.23	0.011
<i>Chironomus</i> spp.	38	19.3	7.3	3.75	0.016
<i>Paratanytarsus</i>	38	16.1	7.2	3.23	0.02
<i>Sigara</i> spp.	38	17.8	6.8	3.98	0.021
<i>Culicoides</i> spp.	38	12.3	5	3.35	0.037
<i>Pseudocloeon</i> spp.	38	14.9	7.5	3.78	0.049
<i>Gomphidae</i>	38	9.7	4.5	2.94	0.051
<i>Ithytrichia</i>	38	10.6	5	3.15	0.052
Medium Warm River Side-Channel Assemblage					
<i>Corixidae</i>	40	71.1	8.4	3.26	0.001
<i>Cryptotendipes</i>	40	21.7	6.2	3.45	0.004
<i>Placobdella</i>	40	14.3	4.3	2.61	0.004
<i>Tubifex</i>	40	16.4	4.3	2.68	0.007
<i>Procladius</i>	40	20.4	6.9	3.31	0.008
<i>Cryptochironomus</i>	40	15.7	6.7	2.46	0.009
<i>Stempelinella</i>	40	18.8	5.5	3.36	0.013
<i>Tanypus</i>	40	14.5	6.2	3.54	0.041
<i>Centroptilum</i>	40	11	4.8	2.84	0.047
<i>Gompus</i> spp.	40	9.4	4.2	2.85	0.052
<i>Palmarcorixa gilletti</i>	40	11.6	5.4	3.44	0.053
<i>Probezzia</i>	40	11.1	5.5	3.61	0.053
Mountain Stream Assemblage					
<i>Enchytriidae</i>	58	27.6	5.6	2.72	0.001
<i>Rhithrogena</i>	58	42.8	8.7	3.2	0.001
<i>Drunella doddsi</i>	58	34.8	7.2	2.96	0.001

<i>Cinygmula</i>	58	59.9	7.2	3.32	0.001
<i>Epeorus longimanus</i>	58	47.2	7.1	3.68	0.001
<i>Rhyacophila betteni</i>	58	29.4	5.2	2.74	0.001
<i>Drunella coloradensis</i>	58	26.5	6.2	2.83	0.001
<i>Megarcys</i>	58	75.6	6.1	2.94	0.001
<i>Zapada oregonensis</i>	58	51.3	5.8	3.29	0.001
<i>Baetis bicaudatus</i>	58	38.1	6.4	3.47	0.001
<i>Epeorus grandis</i>	58	76.7	6.5	3.57	0.001
<i>Parapsyche elsis</i>	58	37.9	4.9	2.99	0.001
<i>Zapada columbiana</i>	58	32.9	5.6	3.09	0.001
<i>Rhyaphila siberica</i> group	58	21.5	4.3	2.76	0.001
<i>Rhyacophila hylineata</i> group	58	34.8	6.3	3.28	0.002
<i>Epeorus albertae</i>	58	26	5.5	3.4	0.002
<i>Epeorus deceptivus</i>	58	26.6	5.5	3.46	0.003
<i>Zapada cinctipes</i>	58	24.2	7.4	3.47	0.004
<i>Ameletus</i>	58	25.9	7.3	3.5	0.004
<i>Rhyacophila verrula</i>	58	13.3	3.9	2.5	0.011
<i>Rhyacophila iranda</i> group	58	12.8	4	2.77	0.013
<i>Doroneuria</i>	58	23.5	8.6	4.72	0.019
<i>Rhabdomastix</i>	58	12.5	4.1	2.68	0.026
<i>Apatania</i>	58	12.5	5.5	3.25	0.04
<i>Rhyacophila albertae</i>	58	11.5	5	3.08	0.049

Medium Mountain Stream Assemblage

<i>Tvetenia bavarica</i> group	90	46.6	6.2	2.99	0.001
<i>Orthocladius</i> spp.	90	37	10.6	3.22	0.001
<i>Heterlimnius</i>	90	46.7	7.3	3.07	0.001
<i>Sweltsa</i>	90	43.7	7.3	3.07	0.001
<i>Psychoglypha</i>	90	22.6	5.3	3.02	0.001
<i>Eukiefferella gracei</i> group	90	29.6	6.3	3.3	0.001
<i>Rhyacophila brunnea</i> group	90	25.3	7.2	2.72	0.002
<i>Glutops</i>	90	24.5	4.8	2.97	0.002
<i>Micropsectra</i> spp.	90	25.8	9.3	3.25	0.003
<i>Polycelis cornuta</i>	90	23.8	5.2	3.23	0.003
<i>Pisidium</i>	90	20.8	7.5	3.11	0.004
<i>Serretella tibialis</i>	90	24.9	5.8	3.11	0.004
<i>Rhyacophila narvae</i>	90	22	4.8	3.16	0.004
<i>Micrasema</i> spp.	90	29	8.7	4.54	0.005
<i>Pseudodiamesa</i>	90	15.7	4.1	2.49	0.006
<i>Pagastia</i> spp.	90	23.4	9.7	3.65	0.007
<i>Yoraperla</i>	90	16.9	4.7	2.81	0.007
<i>Ostracoda</i>	90	20.2	6.7	3.37	0.008
<i>Drunella grandis</i>	90	17	6.4	3.1	0.01
<i>Perlodidae</i>	90	13.2	4.6	2.64	0.015
<i>Brillia</i>	90	22.2	8.6	4.58	0.017

<i>Visokia cataractae</i>	90	12.7	4.5	2.65	0.019
<i>Turbellaria</i>	90	17.8	7.7	3.22	0.02
<i>Caudatella hystrix</i>	90	18.9	6.2	3.89	0.023
<i>Leuctridae</i>	90	11.1	3.9	2.6	0.028
<i>Neothremma</i>	90	14.3	5	3.27	0.028
<i>Cleptelmis</i>	90	13.9	5.4	3.21	0.029
<i>Clinocera</i> spp.	90	11.5	4.5	2.53	0.029
<i>Limnophora</i>	90	12.5	5	3.48	0.037
<i>Eukiefferella devonica</i>	90	14.4	6.5	3.49	0.042
<i>Caudatella</i> spp.	90	8.8	3.9	2.46	0.046
<i>Neophylax rickeri</i>	90	9.8	4.6	3.29	0.051

Small Foothills Transitional Assemblage

<i>Narpus concolor</i>	105	92.2	5.6	2.94	0.001
<i>Helicopsyche borealis</i>	105	51.5	8.2	3.93	0.001
<i>Corynoneura</i> spp.	105	41.4	8.2	4.16	0.001
<i>Constempellina</i> spp.	105	60.2	5.2	2.78	0.001
<i>Nanocladius</i> spp.	105	79.9	7.5	4.3	0.001
<i>Prosimulium</i>	105	64.5	5.4	3.15	0.001
<i>Amiocentrus aspp.ilis</i>	105	32.5	8.2	4.58	0.001
<i>Lara</i>	105	32.5	4.4	2.75	0.001
<i>Phaenopsectra</i>	105	32.7	6.4	3.6	0.001
<i>Plautitus punctiventris</i>	105	78.9	5.5	2.85	0.001
<i>Erioptera</i>	105	38.5	4.3	2.61	0.001
<i>Diamesa</i> spp.	105	52	6.7	3.19	0.001
<i>Ptychoptera</i>	105	22.9	4.8	3.2	0.001
<i>Protanydarus</i>	105	36	4.8	3.24	0.001
<i>Diplocladius</i> spp.	105	97.3	4.9	3.13	0.001
<i>Setvena</i>	105	61.5	5.1	3.25	0.001
<i>Paraperla</i>	105	32	3.9	2.55	0.001
<i>Agraylia</i>	105	46.5	4.6	3.2	0.001
<i>Blepharicera</i>	105	21.8	3.7	2.24	0.001
<i>Ephemerella infrequens</i>	105	37.3	4.9	3.21	0.001
<i>Acentrella edmundsi</i>	105	36.5	4	2.68	0.001
<i>Nemotaulius</i>	105	35.5	3.9	2.55	0.001
<i>Tipulidae</i>	105	16.4	4	2.55	0.002
<i>Ordobrevia nubifera</i>	105	27.4	5.2	2.96	0.002
<i>Acricotopus</i>	105	21.2	4.1	2.79	0.002
<i>Leucrocota</i>	105	24	6.2	3.52	0.004
<i>Helichus</i>	105	18	4	2.61	0.004
<i>Culoptila</i>	105	20.4	5.7	3.39	0.005
<i>Rhyacophila</i> spp.	105	21.4	4.3	2.96	0.005
<i>Parakiefferiella</i>	105	18.7	6.3	3.3	0.007
<i>Pteronocella badia</i>	105	18.2	5.2	3.04	0.009
<i>Epeorus</i>	105	17.2	5.3	3.36	0.01

<i>Hydroptila</i> spp.	105	14.4	4	2.7	0.011
<i>Nilothauma</i>	105	13.8	3.9	2.59	0.012
<i>Paraleptophlebia</i>	105	12.5	4	2.31	0.021
<i>Ammicola</i>	105	11.7	4	2.74	0.023
<i>Cascadoperla</i>	105	12.5	4	2.37	0.025
<i>Nectopsyche</i>	105	12.6	5.1	2.65	0.026
<i>Pseudosmittia</i>	105	9.6	4	2.46	0.034
<i>Chimarra</i>	105	12.5	4.1	2.5	0.035
<i>Glossoma</i>	105	12.5	4.1	2.5	0.035
<i>Procloeon</i>	105	10.1	4.8	2.82	0.051
