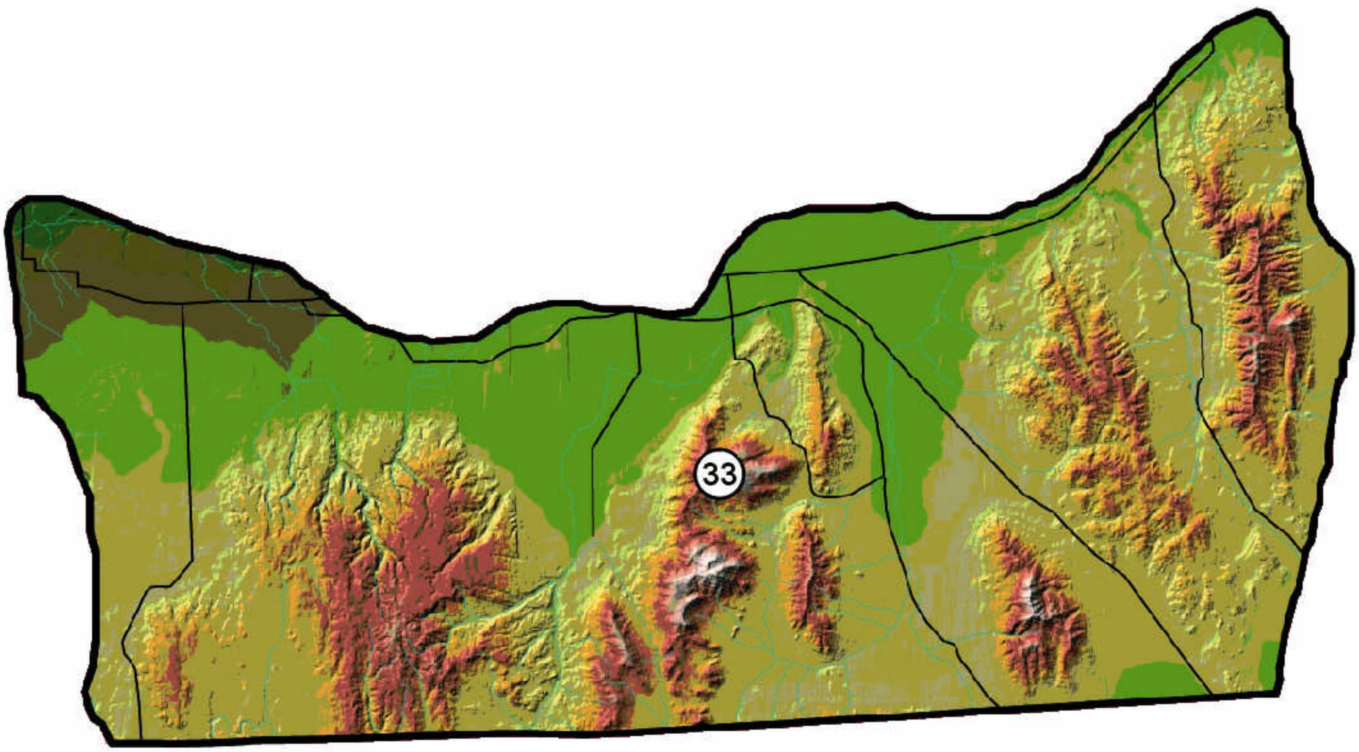
GREAT BASIN

33. Mount Harrison RNA



Mount Harrison Pond

Mount Harrison Research Natural Area

Sawtooth National Forest

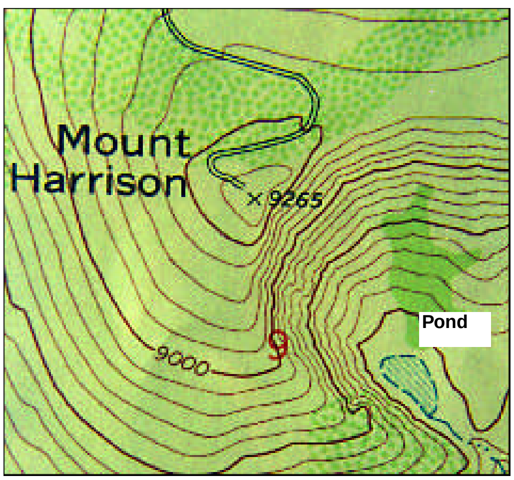
Fred Rabe sampled the single pond in the RNA on August 14, 1998.

Location

Mount Harrison RNA, located in the Albion Mountains, is about 14 miles southwest of Albion, Idaho.

Ecoregion Section: NORTHWESTERN BASIN AND RANGE (342B). Cassia County; USGS Quad: MOUNT HARRISON

From Albion, Idaho travel southeast on State Route 77 for about 4 miles to the intersection with the Howell Canyon Road which becomes FS Road 549. Drive about 9 miles to the summit. From the Forest Service fire lookout, descend approximately 600 feet to the pond below.



USGS Quad: MOUNT HARRISON.

A road goes to the top of Mt Harrison from the Snake River Plain. The summit is 2825 m (9265 ft).

Looking down at pond (arrow) from inside Forest Service fire lookout atop Mount Harrison.

Geology

Mount Harrison is the highest point in the Albion Range of southern Idaho. The steep topography and distribution of geologic formations result in very distinct vegetation patterns (Mancuso and Evenden 1996). Subalpine fir (*Abies lasiocarpa*) occured on quartzite while limber pine (*Pinus albicaulis*) was observed on calcareous substrates. The basin consists of a steep-walled, rocky cirque with a vernal pool at the bottom.

This Precambrian quartzite rock shows streaking or smearing where an allignment of minerals occurs. Mica is present in the rock.

Classification

- Subalpine, small, shallow, cirque pond
- Circumneutral water in quartzite, calcareous basin
- Medium - high production potential
- Inlet: snow melt; Outlet: ephemeral stream

Aquatic physical - chemical factors

Area (hectares): 0.8 (2.1 acres)
Length of shoreline (m): 384 (1260 (ft)
Maximum depth (m): 2 (7)
Elevation (m): 2619 (8590 ft)
Aspect: SE
Percent shallow littoral zone: 100
Dominant bottom substrate: cobble and boulders
Shoreline development: 1.189
Pond edge %: talus rock-90, herbaceous-10
Alkalinity (mg/l): 9
Conductivity (micromhos): 10
pH: 7.3
Inlet: snowmelt
Outlet: ephemeral stream

Spike rush (*Eleocharis* sp.) lines about a third of the pond edge.

View looking northwest at Mt. Harrison Pond. The pond is ephemeral drying up in some years. Surface water had receeded about 6 m (20 ft) by the middle of August. Snow drifts in the basin likely provide an inflow to the pond.

Flagged trees (whitebark pine) reflect windy conditions on the rim of the cirque wall.

An army plane crashed into the basin in 1942 killing a few people. A large tire and other scattered debris still remain from the crash close to the pond.

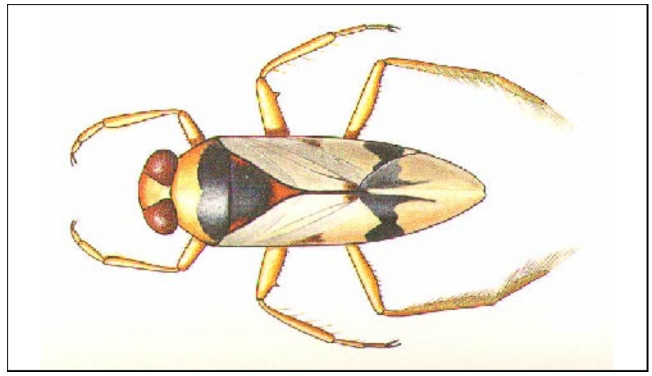
Vegetation

Castilleja christii (Indian paintbrush) is endemic to Mount Harrison and is a candidate for listing. (Mancuso and Evenden 1996). *Cymopterus davisii* is endemic to the Albion Range and is known from only two other sites. *Machaeranthera laetevirens* (aster) is a USFS Sensitive species and known from three other sites in Idaho and Nevada. Mount Harrison RNA is the only documented occurrence for this species in Idaho.

Zooplankton

The only taxa observed in the sample was a species of *Diaptomus* seen below.

Diaptomus sp. is a calanoid copepod.



The backswimmer *Notonecta* is a swimmer and climber. It may utilize the macrophyte, *Eleocharis*, as a substrate. *Notonecta* is a predator which pierces the body of prey sucking out the contents. It is also cannibalistic (Merritt and Cummins 1996). Drawing: McCafferty 1983.

Macroinvertebrates

Trichoptera
- *Clistorina* sp.

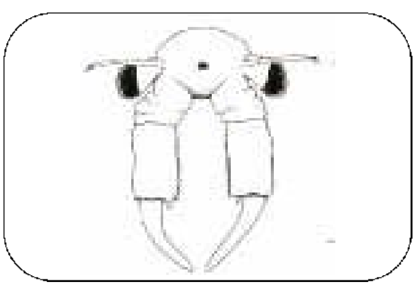
Diptera
- Subfamily Chironominae

Hemiptera
- *Notonecta undulata* -dominant
- *Notonecta kirbiyi*
- *Family* Corixidae

Coleoptera
- *Agabus* sp.

Eubranchiopoda
- *Branchianecta paludosa*

According to Pennak (1989)the fairy shrimp (B*ranchianecta paludosa*) found in the pond is not known in Idaho. This might be its first documented occurrence.



Head area of the fairy shrimp (*Branchianecta paludosa*) Sketch credit: Pennak (1989).

Fairy shrimp and a zooplankton (*Diaptomus* sp.) are often found together in small ephemeral water bodies where no fish exist as was the case in Mt. Harrison pond.

Backswimmers (*Notonecta undulata* and *N. kirbiyi*) were found throughout the pond but were in more dense concentrations in the vicinity of *Eleocharis*, a species of sedge growing in the north end of the pond.

View of stunted coniferous vegetation and steep-walled, rocky cirque with Mount Harrison pond at bottom.

Literature Cited

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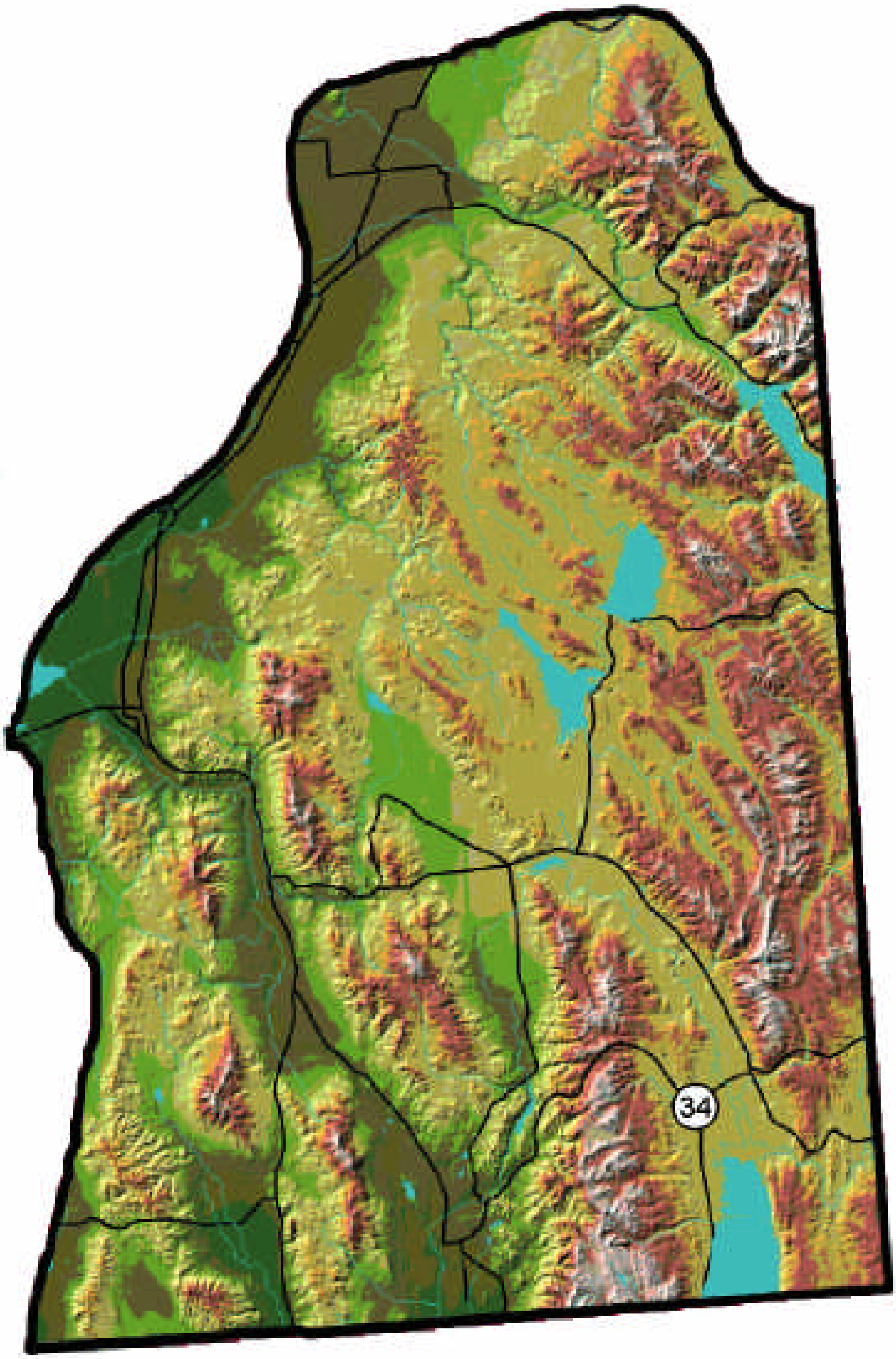
SOUTHEAST IDAHO

34. Bloomington Lake Cirque (proposed Special Interest Area)



Bloomington Lake

Proposed Bloomington Lake Special Interest Area

Caribou National Forest

Fred Rabe sampled the lake in the RNA on August 15, 1998. Limited sampling occurred in Pond 2. Pond 1 was not sampled.

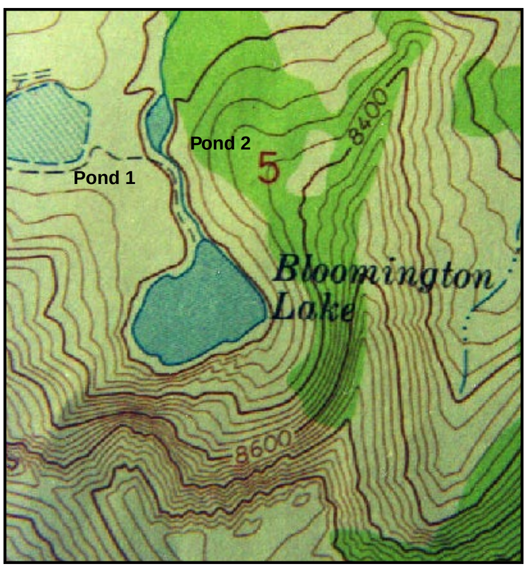
Note the upper dolomite formation over the lower quartzite layer in Bloomington Lake. Observe the littoral zone comprised of soft sediment and some boulder-size rocks.

Location

The lake lies at the head of Bloomington Creek in the Bear River Range east of the town of Bloomington,Idaho (Moseley 1992).

Ecoregion Section: OVERTHRUST MOUNTAIN (M331D), Bear Lake County; USGS Quad: PARIS PEAK.

From Bloomington travel west about 12 miles (no road name or number) to a well marked trailhead. The road can be very dusty and the last few miles are extremely rough. The trail to the lake is about 0.5 miles long.



USGS Quad: PARIS PEAK

Classification

- Subalpine, large, deep, cirque lake
- Low - medium production potential
- Highly alkaline, quartzite-dolomite basin
- Inlet: snow seepage; Outlet: stream

Geology

The headwall above the lake is the steepest in the Idaho portion of the Bear River Range. According to Moseley (1992) two quite different geologic formations occur on the headwall. White Swan Peak Quartzite comprises the lower cliff next to the lake; the upper face is gray Laketown Dolomite. Moseley reports that the two substrates have quite different physical and chemical properties. Lake water chemistries reveal highly alkaline conditions compared to other high lakes studied in the state.

Aquatic physical - chemical factors

Maximum depth (m): 15 (49 ft)
Elevation (m): 2500 (8200 ft)
Aspect: NW
Percent shallow littoral zone:10
Dominant bottom substrate: soft sediment
Lake edge %: cliff-25, herbaceous-5, boulders-5, willows-65
Alkalinity (mg/l):104
Conductivity (micromhos/cm): 195
pH: 8.5
Inlet: snow seepage
Outlet: 1 stream

The headwall retains snow in the chutes and along cliff bases longer than in any other area of the Bear River Range (Moseley 1992). The lake is deep (15 m). About 3 m off shore the depth is 9 m. Even though alkaline conditions exists in the water, the lake was classed as low to medium production potential mainly because of a limited littoral zone and limited sedge growth around the lake perimeter. A few logs and boulders were observed on the light colored soft sediment substrate in the littoral zone.

Vegetation

Rydberg's musineon (*Musineon lineare*) and green spleen-wort (*Asplenium viride*) are two rare plant species that occur in the area (Moseley 1992). Moseley also noticed two rare species that occur at Bloomington Lake, but not in other portions of Idaho's Bear River Range; these species are usually observed at elevations 2000 feet higher than the elevation of Bloomington Lake. Sedges were noted mostly along the west shore of the lake.

Pond 1 is a short distance northwest of Bloomington Lake.

Zooplankton

Bloomington Lake

Cladocera
- *Polyphemus pediculus*
- *Simocephalus* sp.

Copepoda
- *Diaptomus* sp.

Ostracoda

Macroinvertebrates

Bloomington Lake

Ephemeroptera
- *Callibaetis* sp.

Trichoptera
- *Limnephilis* sp.

Diptera
- Subfamily Tanypodinae

Odonata
- *Aeshna californica / multicolor*
- *Coenagrion / Enallagma* sp.

Coleoptera
- *Gyrinus* sp.

Amphipoda
- *Hyallela azteca*

The low gradient outlet of Bloomington Lake has a boulder - rubble substrate. It flows about 10 m into a wet meadow and then into Pond 2 which is surrounded by a profusion of sedges and other herbaceous plants.

Bloomington Pond 2

Diptera
 Subfamily Orthocladiinae
Hemiptera
 Gerris sp.
Odonata
 Family Aeshnidae
Pelecypoda
 Pisidium sp.
Gastropoda
 Physella sp.
Oligochaeta
 Family Lumbriculidae

The whirligig beetle (*Gyrinus*) is somewhat unique in having a ventral pair of eyes that serve for vision in water and a dorsal pair used for aerial vision, an adaptation for optimal sight at the water surface. The beetles swim erratically or dive while emitting defensive secretions when disturbed. McCafferty (1983).

Sampling the lake was difficult because of the limited littoral zone. Density of macroinvertebrates was high possibly due to alkaline water conditions in the basin. The lake and Pond 2 shared very few common species.

Limnephilus sp. was present along the lake margin. It is the most common caddisfly in the western United States. *Limnephilus* constructs a variety of different type cases. The above case is comprised of wood and bark arranged transversely (Wiggins 1996).

A small specimen of dragonfly (Aeshnidae). It appears that different species occur in the pond and lake. They are voracious predators, some reaching a maximum size of 5 cm.

View of Bloomington Lake. Observe the White Swan Peak Quartzite which comprises the base of the steep headwall in the background.

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Moseley, R. K. 1992. The biological and physical features of Bloomington Lake Cirque, Caribou National Forest. Unpublished report on file at Idaho Department of Fish and Game, Conservation Data Center, Boise Idaho.11 p.

McCafferty, W. P. 1981. Aquatic entomology. Boston: Jones and Bartlett Publishers. 448 p.

Wiggins, G. B. 1996. Larvae of the North American caddis-fly genera. Toronto: University of Toronto Press. 457 p.

Summary and Discussion

This section describes characteristics of 27 lakes and 20 ponds sampled in 32 established or proposed Research Natural Areas in Idaho. Five classification elements - elevation, size, depth, production potential and lake origin are addressed followed by a discussion of semi-drainage waters and data describing modifiers (pH, rock type and hydrology). Dominant flora and fauna in the RNAs are identified. The report closes with some projects proposed to carry forward the identification and characterization of new RNAs and thoughts on the future of high lake RNAs.

Classification elements

Four classification elements of the water bodies are summarized in Table 4. Two lakes and two ponds are montane; 20 lakes and 16 ponds are subalpine; and five lakes and two ponds are alpine. Alpine water bodies are located in the Broad Valleys, Sawtooths and Idaho Batholith subregions. Montane sites are in the North Idaho, Idaho Batholith and Western Fringe subregions. Subalpine waters are located in all subregions.

Twenty-one of the lakes are small in size or less than 4 hectares (10 acres) and six are large or more than 4 hectares in size (Table 4). Twenty-one of the lakes are classed as deep or more than 4.5 m (15 ft) and six lakes are shallow or less than 4.5 m in depth. All of the ponds are small and shallow.

Ten lakes and three ponds are classed as having low production potential; 16 lakes and 16 ponds have low-medium, medium and medium-high production potential and; one lake and one pond have a high production potential (Table 4).

Production potential is mostly low in alpine lakes. Factors that contribute to low production are high elevation, small littoral zone, boulder-bedrock substrate and few or scattered sedge mats. Exceptions occur in Upper Smiley Lake and Surprise Lake in the Pioneer Mountains where extensive sedge beds occur together with relatively large littoral zones of cobble and rubble.

Alpine lakes usually have a low production potential compared to subalpine waters.

Table 4. Classification elements associated with high lakes and ponds.

LAKE NAME	TYPE		ELEVATION			SIZE		DEPTH		PRODUCTION POTENTIAL				
	Lake	Pond	Montane	Subalpine	Alpine	Small	Large	Shallow	Deep	Low	Med-Low	Med	Med-High	High
Dome Lake	X		X				X		X			X		
Fish Lake	X		X				X		X					X
Lower Steep Lake	X			X		X		X	X		X			
Chilcoot Lake	X			X		X		X				X		
Fiddle Lake	X			X		X		X				X		
Steamboat Lake	X			X		X		X					X	
Snowy Top Lake	X			X		X			X	X				
Lower Bacon Lake	X			X		X			X	X				
Upper Steep Lake	X			X		X			X	X				
Square Mountain Creek Lake	X			X		X			X	X				
Belvidere Lake 4	X			X		X			X	X				
Quad Lake	X			X		X			X	X				
Echo Lake	X			X		X			X	X				
Graves Peak Lake	X			X		X			X		X			
Salmon Mountain Lake	X			X		X			X		X			
Cache Creek Lake 1	X			X		X			X			X		
He Devil Lake	X			X		X			X			X		
Belvidere Lake 7	X			X		X			X				X	
Master Sergeant Lake	X			X		X			X				X	
Lava Butte Lake	X			X			X		X	X				
Bloomington Lake	X			X			X		X		X			
Florence Lake	X			X			X		X			X		
Belvidere Lake 3	X				X	X		X			X			
Upper Smiley Lake	X				X	X		X				X		
Upper Merriam Lake	X				X	X			X	X				
Upper Surprise Valley Lake	X				X	X			X			X		
Mystery Lake	X				X		X		X	X				
Pond Peak Pond		X	X			X		X				X		
Three Ponds-West		X	X			X		X					X	
Salmon Mountain Pond 1		X		X		X		X		X				
Belvidere Pond 1		X		X		X		X		X				
Tech Sergeant Pond		X		X		X		X		X				
Grave Peak Pond 2		X		X		X		X			X			
Belvidere Pond 5b		X		X		X		X			X			
Lava Butte Pond SW		X		X		X		X			X			
Allan Mountain Pond 1		X		X		X		X				X		
Belvidere Pond 6		X		X		X		X				X		
Lava Butte Pond SE		X		X		X		X				X		
Theriault Pond		X		X		X		X					X	
Grave Peak Pond 1		X		X		X		X					X	
Belvidere Pond 2		X		X		X		X					X	
Belvidere Pond 5a		X		X		X		X					X	
Lower Surprise Valley Pond		X		X		X		X					X	
Mount Harrison Pond		X		X		X		X					X	
Cache Creek Pond		X		X		X		X						X
Middle Smiley Pond		X			X	X		X				X		
Lower Smiley Pond		X			X	X		X				X		

Montane lakes have medium-high to high production potential. Fish Lake (high production) has a low elevation, large littoral zone with a mix of small rock and sediments comprising the bottom substrate, high shoreline development, extensive sedge mats and a relatively high alkalinity. Subalpine lakes varied from low to medium-high production and subalpine ponds from low to high production potential (Table 4).

In comparing subalpine lakes with forest lakes located near the base of Mount Rainier, Larson et al. (1994), observed that lower elevation forest lakes had larger watersheds, larger surface areas, deeper waters and more nutrients than subalpine lakes. This was true for the two montane lakes in this study compared to most subalpine waters.

Lake origin

Thirty-four water bodies were characterized as having a cirque origin formed near a mountain headwall. Fourteen lakes/ponds were classed as cirque-scour occupying basins carved in less resistant rock formed down valley from the headwall. It was often difficult to differentiate between cirque and cirque-scour types due to variation in the extent and flow patterns of glaciers.

Paternoster lakes and ponds form a chain of at least three water bodies connected by a stream in a glaciated valley. Two sets of paternoster lakes were observed in this study. For example, in the Graves Peak watershed, a small pond is linked to a large lake by a steep gradient stream merging into a cascade-pool type stream. The outlet to the lake becomes a steep cascade that flows into a lower pond. A pond further down stream is connected by a steep gradient stream.

The two montane lakes in the study are formed by an end moraine in extended valleys. Upland lakes and ponds form in depressions scoured by ice caps on gently rolling or upland valleys. This type might represent early Wisconsin ice cap glaciation or an even older pre-Wisconsin period (Rabe and Breckenridge 1985). Three Ponds RNA is a montane site modified by the presence of beaver activities that control water levels in the ponds.

Semidrainage systems

Semidrainage waterbodies are not connected with definite drainage systems or the drainage is poorly defined (Pennak 1989). Pennak studied semidrainage ponds in Colorado and described most as being located in grassy meadows with highly organic, peaty soils and no surface outlets or having poorly defined outlets. Maximum depths range from 1 to 4 m, and water levels remain somewhat constant. Most semidrainage waterbodies in the Idaho study conform to the above meadow description; however Lava Butte SW is a semidrainage pond set in a rocky basin with limited organic growth.

Pennak describes most semidrainage waters at midmountain (montane) elevations. However subalpine semidrainage waterbodies include Allan Mountain ponds, Steamboat Lake, Mt. Harrison Pond, Lava Butte Ponds, Quad Lake, Baldy Pond 3, Surprise Pond and Soldier Lake Pond 1. Most semidrainage waters in this study are cirque-scour in origin but some semidrainage ponds such as Pond Peak RNA and Lava Butte RNA are cirque in origin.

Since semidrainage waters are for the most part closed systems, their basins fill with fine organic sediment that supports rooted plants such as burr reed (*Sparganium angustifolium*) one of the most common aquatic macrophytes observed in this study. Also amphibians, leeches, aquatic earthworms, dragonflies, and snails are apt to occur in these meadow waters more than in rocky drainage basins.

Theriault Pond is a small, shallow, montane waterbody having a substrate comprised of soft organic sediments and encircled by an extensive sedge meadow. In addition a large population of spotted frogs (*Rana pretiosa*) occupies this site. It is not a closed system since a relatively deep outlet stream exits the pond. However further downstream the outlet diminishes in size so that later in the year it might be described as ephemeral. Cache Creek pond has some of the same characteristics described above but also has a well defined outlet stream. Topographic maps are not often accurate in showing or not showing outlets.

Cache Creek Pond, a shallow, subalpine waterbody having an organic substrate, is surrounded by an extensive sedge meadow.

Modifiers

All of the waterbodies in this study are circumneutral (pH 5.5-7.4) except Steep Lakes which are alkaline (pH 7.5-8.4) and Upper Merriam Lake and Bloomington Lake which is highly alkaline (pH > 8.4).

Medium soft water (13-30 mg/l) most commonly occurs in Precambrian Belt and volcanic rock basins compared to soft water lakes (0-12 mg/l) mostly in granitic basins. Bloomington Lake in a quartzite-dolomite basin is a hardwater lake with an alkalinity of 104 mg/l. Merriam Lake basin pools and lake are hardwater with alkalinities of 41-105 mg/l. They occur in limestone, dolomite, sandstone, quartzite basins. Steep Lakes in Precambrian Belt rock are also classed as hardwater with alkalinities of 50 mg/l.

Surface and subsurface seepage commonly form inlets into alpine lakes such as Mystery Lake which is close to the headwall. Such small flows are often difficult to distinguish and usually do not appear on maps. Examples of multiple inlets into subalpine large deep lakes were observed at Fenn Lake with four inlet streams and Fish Lake with 27 stream inlets and nine seep inlets. A cascade of water was observed to flow into Graves Peak Pond 2 from the lake above, part of the paternoster pattern. Outlet streams are either riffle-pool, meandering glide or cascade-pool type streams. Riffle-pool and meandering glide streams are the most common types observed.

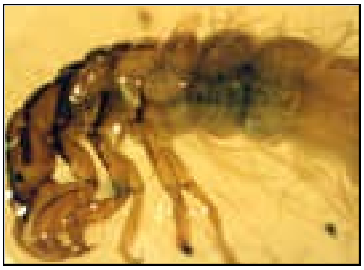
Inlets and outlets often differ in size, substrate, temperature and biological composition. Inlet streams are usually small in width and depth and have small size substrate, commonly small gravel. Inlets are usually several degrees cooler than outlet streams. Outlet streams have more coarse particulate organic matter and dense filamentous algae often covers the rocks late in the season. When this occurred, fewer macroinvertebrates were present in the stream channel.

Biota

The most common aquatic plants associated with standing water are quillwort (*Isoetes* sp.) and bur-reed (*Sparganium*) *Fontinalis* is a moss prevalent in streams. Twenty-three different sedges and rushes were identified. *Juncus mertenisana* is the rush most frequently collected and *Carex aquatilus* and *C. scopulorum* are the most common sedges.

Fourteen zooplankton taxa were identified. The composition of microcrustacean communities varies from one lake to the next, similar to what Larson et al. (1994) report. The copepods *Diaptomus* and Cyclopoidea and the cladocerans *Chydorus*, *Polyphemus pediculus* and *Simocephalus* are dominant. *Diaptomus* is thought to be absent in many lakes due to selective fish predation.

There are 16 different mayflies (Ephemeroptera) collected. Dominant forms are listed in Table 5. Other common mayflies sampled are *Ameletus* and *Nixe*. Twelve different Plecoptera (stoneflies) are recorded but only from streams since they do not ordinarily occur in lakes. Thirty-three caddisfly (Trichoptera) taxa are identified. Dominant mayflies, stoneflies and caddisflies are listed in Table 5.



Trichoptera (caddisflies) are the most diverse group of macroinvertebrates collected.

Table 5. Dominant Ephemeroptera, Plecoptera and Trichoptera from lakes, ponds and streams

Ephemeroptera	Plecoptera	Trichoptera
Baetis bicaudatus *Callibaetis* sp. *Siphlonurus* sp. *Paraleptophlebia* sp.	*Sweltsa* sp. *Yoraperla brevis* *Isoperla* sp. *Zapada* sp.	*Asynarchus* sp. *Psychoglypha* sp. *Limnephilis* sp. *Dicosmoecus* sp.

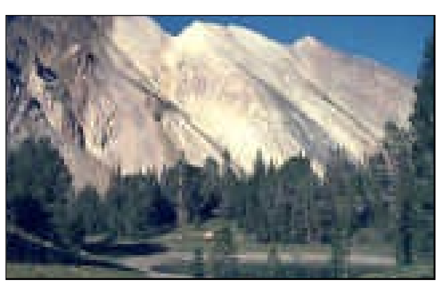
Insect representatives from the Orders Coleoptera, Hemiptera, Diptera, Megaloptera and Odonata are also present. Macroinvertebrates other than insects common in the water bodies are freshwater clams (*Pisidium*), freshwater shrimp (*Gammarus lacustris, Hyallela azteca*), flatworms (*Polycelius*), and fairy shrimp (Anostraca).

The spotted frog (*Rana pretiosa*), long-toed salamander (*Ambystoma macrodactylum*) and Coeur d'Alene salamander (*Plethodon idahoenus*) are the amphibians observed. Cutthroat trout (*Salmo clarki*), brook trout (*Salvelinus fontinalis*) and golden trout (*Salmo aguabonita*) are identified from the lakes.

Recommendations

The classification system presents elements and modifiers (Tables 1 and 3) that can be observed, measured and analyzed. This approach has two primary benefits. First, it sets up uniform methods and target parameters for future research. Second, the system can be applied to gap analysis to identify missing or under-represented natural area types. These gaps may not exist on the landscape or may simply not be reported in the inventory. Future research efforts can focus on covering the gaps and bringing more natural areas into the RNA system.

Of the 52 lakes and ponds assessed in this study, only five were classed as alpine, and lakes in only three RNAs were identified as highly alkaline. Our surveys have identified a series of alpine lakes and ponds located in sedimentary rock basins adjacent to waters in granitic basins in the White Cloud Mountains of central Idaho. Highly alkaline alpine lakes in argillaceous quartzite, dolomite and conglomerates at elevations above 9000 feet are common here (Wissmar and Rabe 1967). Such lakes would provide an excellent opportunity for research comparing the composition and density of macroinvertebrate and plant communities in soft and hard water lakes.



Pond in the White Cloud Mountains.

There is also a need to establish more upland and moraine lakes as RNAs. Both of these geomorphic types occur at slightly lower elevations and are not recognized as high lakes. However since they demonstrate such significant differences in limnological characteristics, a greater effort should be made to identify and inventory these systems.

High lake ecosystems provide an important early warning system for environmental problems expected to grow in number, such as the threat of acid rain and eutrophication. Natural perturbations can also be monitored, as when ash from Mount St. Helens fell on the Steep Lakes, where we had previously gathered baseline data (Crumb 1977).

It is important to increase public awareness of the opportunities that RNAs offer for studying natural systems. Educators and research groups can use these RNA lakes and ponds to give students valuable experience in making scientific observations and collecting samples. Such learning opportunities are exciting for those who enjoy and appreciate nature and can open up a new perspective for those who have never been introduced to these prized natural systems. At the same time, the research produces more information about high lake ecosystems and heightens our awareness and appreciation of Idaho's natural treasures.

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Glossary

Terms that are in bold italics and other words describing high mountain lakes are included in the glossary. The glossary was adapted in part from Horn and Goldman (1994), Hutchinson (1967, Merritt and Cummins (1996, and Reid (1964).

Alkalinity— Ability of lake water to neutralize acid expressed in terms of calcium carbonate as mg/l.

Alpine lake — Lake located above tree line.

Aspect — Direction the outlet of a lake is facing.

Bathymetric — Related to depth measurement of lakes.

Belt Rock — Formations of sedimentary rocks laid down in Idaho, eastern Washington and western Montana during the latter part of Precambrian time, 850-1450 million years ago.

Benthos— Invertebrates living on the bottom of lakes and streams.

Cascade-pool type—Steep gradient stream with a series of cascades and pools.

Circumneutral — Water having a pH of between 5.5 and 7.4.

Cirque — A glacially formed depression containing a lake at the upper end of a mountain valley.

Cirque-scour — Basin scoured out down-valley by alpine glaciers, usually in less resistant rock.

Conductivity— Measure of water to carry an electrical current, varies both with the number and type of ions the solution contains. It is expressed as micromhos/cm.

CPOM — Coarse particulate organic matter comprised of wood litter, leaves and needles in water bodies.

Dystrophic — Brownish in color with much dissolved humic matter.

Ecoregion — Ecosystems of regional extent or ecosystems described at the macroscopic scale (McNab and Avers 1994; Bailey 1993).

Geomorphic form — Lake origin related to glacial processes.

Granite — Common intrusive igneous rock compound predominantly of quartz and felsic minerals with crystals large enough to distinguish with the unaided eye.

Hard water — Waters that contain bound carbon dioxide in excess of 30-35 mg/l. Common in regions where the substrate contains easily dissolved minerals.

Krummholz —Stunted trees characteristic of timberline.

Lake — Large inland body of water. This study used a curve plotting maximum depth in meters against area in hectares used to designate waters as lakes or ponds.

Lentic — Standing bodies of water such as lakes and ponds.

Littoral —Shallow zone. In this study lake waters less than 3 meters (9.8 feet) in depth.

Macrophyte — Macroscopic plant in an aquatic environment.

Macroinvertebrate — Invertebrates visible with the unaided eye. Aquatic insects, flatworms, freshwater clams, freshwater shrimp, fairy shrimp and snails are examples of macroinvertebrates collected in lakes and streams.

Massif — Large mountain mass or compact group of connected mountains forming an independent portion of a range.

Meandering glide —Low gradient stream having a sinous channel.

Modifiers— Lake characteristics (pH, rock type ,hydrology) that provide supplementary information to classifying high mountain lakes.

Montane — a mountain zone lower than alpine and subalpine zones. Upland and moraine type lakes are commonly found in this zone.

Moraine — A deposit of glacial till. One of the geomorphic lake types in this study characterized as being formed by morainal dams.

Paternoster — Variety of cirque-scour lakes that form a linear chain of at least three lakes connected by a stream in a glacial valley.

Phytomacrofauna — Macroinvertebrates associated with aquatic plants.

Pond — Small shallow body of water in a depression. A curve plotting maximum depth in meters against area in hectares is used for designating waters as lakes or ponds.

Production potential — Production of lake based on seven physical, chemical and biotic parameters. Lakes are classified as poor, medium-poor, medium, medium-high and high production.

Quartzite — Metamorphic rock formed by recrystallization of quartz sandstone.

Reference area —Pristine or unaltered site used as a contro to compare with locales changed by human disturbance or natural events.

Riffle-pool — Stream type with series of alternating stretches of fast and slow water in the channel located on a terrain of moderate gradient.

RNA — Research Natural Area. Tracts of land and water set aside by the U.S. Forest Service for the purpose of research, biotic diversity, education and reference areas.

Rock glacier —Mass of poorly sorted angular boulders and other material cemented by interstitial ice, as observed in Mystery Lake.

Scree — An accumulation of rocky debris lying on a slope or at the base of a hill or cliff; talus

Sedge — Any of various plants of the family Cyperaceae resembling grasses but having solid stems.

Sedimentary rock — A deposit of sediment hardened into rock. Most sedimentary rocks are layered or stratified.

Seep — Slow movement of water, sometimes derived from melting snow through porous material.

Semidrainage lake — Small, shallow, soft bottomed lakes lacking a permanent outlet and not being connected with a definite drainage system, most commonly located in a meadow. Macroinvertebrate community is usually different compared to that in a seepage lake.

Shoreline development — Amount of shoreline relative to size of lake. The more convoluted or irregular the shoreline, the more “edge” or shoreline development of the lake. Lakes with more edge or contact with shore have higher production potential than those more round.

Soft water lake — Having a low pH. Concentratrion of bound carbon dioxide as carbonate is low usually less than 10 mg/l.

Subalpine lake — Located on a high upland slope but not above tree line.

Subregion — An area clssified as similar geology, terrain, climate and plant cover. There are ten subregions in the state of Idaho, seven of which contain high mountain lake Research Natural Areas.

Talus — A sloping mass of rock accumulated at base of a cliff or hill.

Upland lake — Form in depressions scoured by ice caps on gently rolling or upland valleys.

Volcanic rock — Finely crystalline or glassy igneous rock resulting from volcanic action at or near the earth's surface, either ejected explosively or extruded as lava, e.g. basalt.

Zooplankton — Microscopic crustaceans and rotifers occupying the water column of a lake.

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Appendix A: Vascular and Nonvascular Plant Species of High Mountain Lake RNAs in Idaho

The emphasis here is on aquatic and semi-aquatic plants, however some terrestrial species in describing an RNA are also listed. Vascular plant nomenclature follows Hitchcock and Cromquist (1973). Common names are developed by the Northern Region, U.S. Department of Agriculture, Forest Service (U. S. Department of Agriculture, Forest Service 1992). Moss nomenclature follows Anderson and others (1990).

Pteridophytes

Isoetaceae

Isoetes lacustris L.	Lake quillwort

Dry Opteridacea

Althyrium filix-femina (L.) Roth ex Mertens	Ladyfern

Gymnosperms

Cupressaceae

Thuja plicata Donn.	Western redcedar

Pinaeceae

Abies grandis (Dougl.) Forbs	Grand fir
Abies lasiocarpa (Hook) Nutt.	Subalpine fir
Larix lyalli Parl.	Subalpine larch
Picea contorta Dougl.	Lodgepole pine
Picea engelmannii Parry	Engelmann spruce
Pinus albicaulis Engelm.	Whitebark pine
Pinus flexilis James	Limber pine
Tsuga heterophylla (Raf.) Sarg.	Western hemlock
Tsuga mertensiana (Bong.) Carr.	Mountain hemlock

Angiosperms

Betulaceae

Alnus sinuata (Regel) Rydb.	Sitka alder
Betula papyrifera Marsh.	Paper birch

Boraginaceae

Romanzoffia sitchensis Bong	Mistmaiden

Cyperacea

Carex aquatalis Wahl.	Water sedge
Carex canescens L.	Gray sedge
Carex dioica L.	Yellow-bog sedge

Carex geyeri Boott	Elk sedge
Carex illota Bailey	Small-headed sedge
Carex lasiocarpa Ehrh.	Slender sedge
Carex lenticularis Michx.	Lens sedge
Carex limosa L.	Mud sedge
Carex mertensii Prescott	Merten sedge
Carex microptera Mack.	Small-winged sedge
Carex multicostata Mack.	Many-ribbed sedge
Carex nigricans C. A. Meyer	Black alpine sedge
Carex oderi Retz.	Green sedge
Carex parryana Dewey	Parry sedge
Carex prionophylla Holm	Firethread sedge
Carex raynoldsii Dewey	Raynold sedge
Carex rossii Boott	Ross sedge
Carex scopulorum Holm	Holm Rocky Mountain sedge
Carex utriculata Boott	Beaked sedge
Carex vesicaria L.	Inflated sedge
Eleocharis pauciflora (Lightf.) Link	Few-flowered spike rush
Compositae	
Arnica alpina (L.) Olin	Alpine arnica
Machaeranthera laetevirens Ness	Aster
Crassulaceae	
Sedum borschii	Stonecrop
Ericaceae	
Gaultheria humifusa (Grah.) Rydb.	Wintergreen
Kalmia microphylla (Hook.) Heller	Laurel
Ledum glandulosum Nutt.	Labrador- tea
Menziesis ferrusginea Smith	Fool’s huckleberry
Rhododendron albiflorum Hook	White rhododendron
Vaccinium scoparium Leiberg	Grouse whortleberry
Vaccinium spp.	Huckleberry
Gramineae	
Deschampsia cespitosa (L.) Beauv.	Hairgrass
Hippuridaceae	
Myriophyllum sp. L.	Water-milfoil
Hydrocharitaceae	
Vallisneria americana Michx.	Tapegrass
Juncaceae	
Juncus drummondii E. Meyer	Drummond’s rush
Juncus ensifolius Wikst.	Dagger-leaf rush
Juncus filiformis L.	Thread rush

Juncus mertensianus Bong	Rush
Juncus nevadensis Wats	Nevada rush
Juncus parryi Engelm.	Rush
Juncus torreyi Cov.	Rush
Menyanthaceae	
Meyanthes trifokiata L.	Bogbean
Nymphaeaceae	
Nuphar polysepalum Engelm.	Yellow water- lily
Umbelliferae	
Cymopterus sp. Raf.	Cymopterus
Musineon lineare Raf.	Rydberg's musineon
Poaceae	
Callamagrostis canadensis (Michx) Beauv.	Bluejoint reedgrass
Festuca viridula Vasey	Green fescue
Potamogetonaceae	
Potomegeton crispus L.	Curly pondweed
Potomegeton natans L.	Floating-leaved pondweed
Primulaceae	
Douglasia idahoensis Henderson	
Ranunculaceae	
Calltha leptosepala DC.	Marshmarigold
Saxifragaceae	
Saxifraga oppositifolia L.	Purple saxifrage
Salicaceae	
Salix artica Pall.	Arctic willow
Salix commutata Bebb	Undergreen willow
Saoix drummondiana Barratt	Drummond willow
Salix planifolia Pursh	Planeleaf willow
Scrophulariaceae	
Castilleja christii Rydb.	Indian paintbrush
Sparganiaceae	
Sparganium angustifolium Michx.	Bur-reed

Mosses

Polytrichum juniperinum Hedw
Aulacomnium sp.
Sphagnum spp.

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Hitchcock, C. L.; Cromquist, A. 1973. Flora of the Pacific Northwest. Seattle, WA: University of Washington Press. 730 p.

Appendix B: Zooplankton Species of High Mountain Lake RNAs in Idaho

Microcrustacean zooplankton consisting of cladocerans and copepods are listed below. Common names of these taxa do not occur. Ostracods are found in the samples but not identified beyond the Class Ostracoda. Brooks (1963) is used to identify cladocerans and Wilson and Yeatman (1963) to identify copepods. Harpacticoid copepod specimens are not identified beyond the Order Harpacticoida.

Cladocera

Polyphemidae
Polyphemus pediculus (Linne)

Holopedidae
Holopedium gibberum Zaddach

Chydoridae
Alona sp. Baird
Chydorus sphaericus (O. F. Muller)
Chydorus spp. Stebbing
Graptoleberis sp. Sars
Pleuroxus sp. Baird

Daphnidae
Ceriodaphnia spp. Dana
Daphnia rosea Sars
Daphnia schodleri Sars
Daphnia spp. Straus
Scapholeberis sp. Schodler
Simocephalus sp. Schodler

Bosminidae
Bosmina longirostris (O. F. Miller)
Bosmina spp. Sars

Copepoda

Diaptomidae
Diaptomus arapahoensis Dodds
Diaptomus lintoni S. A. Forbes
Diaptomus shoshone S. A. Forbes
Diaptomus spp.

Cyclopidae
Macrocyclops albidus Claus
Cyclops venustoides Coker
Orthocyclops modestus E. B. Forbes
Cyclopidae spp.

Harpacticoida

Ostracoda

Literature Cited

Brooks, J. L. 1963. Cladocera 1963. In: Fresh water biology. New York: Wiley Press. 1248 p.

Wilson, M. S.; Yeatman, H. C. 1963. Free-living Copepoda. In: Fresh water biology. New York: Wiley Press. 1248 p.

Appendix C: Macroinvertebrate taxa of High Mountain Lake RNAs in Idaho

Immature aquatic insects were identified from Merritt and Cummins (1996), Wiggins (1996) and Stewart and Stark (1993). Pennak (1989) was used to identify macroinvertebrates other than aquatic insects. The invertebrates were collected from both lakes and streams.

ARTHROPODA

INSECTA

Ephemeroptera

Heptageniidae
Cingma sp.
Cinygmula sp.
Epeorus albertae (McDunnough)
Epeorus deceitivus (McDunnough)
Nixe sp.

Ephemerillidae
Ephemerella infrequens Eaton
Seratella tibialis McDunnough

Ameletidae
Ameletus similor Eaton
Ameletus sp.

Caenidae
Caenis sp.

Leptophlebiidae
Paraleptophlebia debilis (McDunnough)
Paraleptophlebia memorialis (McDunnough)

Siphlonuridae
Siphlonurus columbianus
Siphlonurus sp.

Baetidae
Baetis bicaudatus Dodds
Baetis tricaudatus Dodds
Callibaetis sp.

Centroptilum sp.

Plecoptera

Peltoperlidae
Yoraperla brevis (Banks)

Nemouridae
Amphinemura sp.
Nemoura sp.
Visoka sp.
Zapada sp.

Perlidae
Acroneuria sp.

Perlodidae
Cultus sp.
Isoperla sp.
Setvena bradleyi (Smith)

Chloroperlidae
Alloperla sp.
Sweltsa sp.

Trichoptera

Glossosomatidae
Glossosoma sp.
Protoptila sp.

Limnephilidae
Asynarchuis sp.
Chyranda sp.
Clistorina sp.
Desmona sp.
Ecclisocosmoecus sp.
Ecclisomyia sp.
Ecosmoecus sp.
Grammotaulius sp.
Hesperophylax sp.
Homophylax sp.
Lenarchus sp.
Limnephilus sp.

Onocosmoecus sp.

Hydropsychidae
Arctopsyche sp.
Parapsyche sp.

Philopotamidae
Dolophilodes sp.

Polycentropoidae
Polycentropus sp.

Apataniidae
Allomyia sp.

Brachycentridae
Brachycentrus sp.

Uenoidae
Neothremma sp.

Odontoceridae

Megaloptera

Sialidae
Sialis sp.

Coleoptera

Dytiscidae
Agabus sp.
Coptoptomus sp.
Hydroporus sp.
Hydrovatus sp.
Hygrotus sp.
Ilybius / Agabus sp.
Neoscutopteris sp.
Rhantus sp.
Uvarus sp.

Gyrinidae
Gyrinus sp.
Limnogonus sp.

Hemiptera

Notonectidae
Notonecta kirbyi Hungerford
Notoecta undulata Say

Corixidae

Diptera

Ceratopogonidae
Bezzia sp.

Stratiomyidae
Stratiomyia sp.

Culicidae

Psychodidae

Simulidae
Prosimulium sp.

Chironomidae
Ablabesmyia sp.
Chironominae
Corynorena sp.
Cryptolabis sp.
Diamesa sp.
Dolichopesa sp.
Hydrobaenus sp.
Microspectra sp.
Nanocladius sp.
Orthocladiinae
Pagastea sp.
Pentaneura sp.
Polypedilum sp.
Procladius sp.
Pseudodiamesa sp.
Tanypodinae
Tventenia sp.

Odonata

Cordulegastridae

Libelluidae

Aeshnidae
Aeshna sp.

Coenagrionidae
Ischnura sp.
Ischnura / Enallagma

CRUSTACEA

Gammaridae
Gammarus lacustris Sars

Talitridae
Hyallela azteca Saussure

Branchinectidae
Branchinecta coloradensis Packard
Branchinecta paludosa (O. F. Muller)

PLATYHELMINTHES

Dendrocoelidae
Polycelis coronata Kenk
Procotyla sp.

ANNELIDA

Oligochaeta

Lumbriculidae

Tubificidae

Hirudinea

Glossiphoniidae
Helobdella stagnalis (Linnaeus)
Glossiphonia complanata (Linnaeus)

MOLLUSCA

Sphaeridae
Pisidium sp.

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Merritt, R. W.; Cummins, K. W. 1996. Aquatic insects of North America. Third edition. Dubuque: Kendall Hunt Publishing. 862 p.

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