BIOLOGICAL ASSESSMENT OF SITES ON THE GALLATIN RIVER, GALLATIN COUNTY, MONTANA: MACROINVERTEBRATE ASSEMBLAGES

A REPORT TO
THE GALLATIN RIVER TASK FORCE

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Introduction

With increased development in the watershed, the integrity of the Gallatin River and its tributaries may be threatened by impacts to channel structure and riparian zones as well as by degradation of water quality. Monitoring and assessment of biological assemblages can help to detect whether impacts and degradation are in fact occurring. For the past several years, the Blue Water Task Force (BWTF) has sampled benthic macroinvertebrates for monitoring and assessment of the waters of the Gallatin River drainage. The taxonomic and functional composition of benthic macroinvertebrate assemblages are known to respond to the effects of stressors that may be associated with accelerating human influences. Such stressors may include pollutants, sediment, thermal impacts and hydrologic alterations, and changes to the natural morphology of river channels and riparian zones.

In September 2016, 1 replicate sample of macroinvertebrates was collected at each of 4 sites on the South Fork Gallatin River in Big Sky, Montana. This report begins by describing the methods for processing and identifying these 4 samples. Data resulting from that work were translated into a multimetric index, and scores were calculated. Scores were used to assign impairment classes to the sites. Narrative interpretations of the ecological condition of the macroinvertebrate assemblages are also reported. These narratives use the taxonomic and functional composition, tolerance and sensitivity characteristics, and habits of the benthic invertebrates to describe probable water quality and habitat influences on the assemblages. Narrative interpretations maximize the information available in the data: they do not rely solely on a single cumulative index score which may mask the effects of stressors on the biota.

Methods

Sample processing

Four macroinvertebrate samples, collected at 4 sites on the South Fork Gallatin River in September 2016, were delivered to Rhithron's laboratory facility in Missoula, Montana. All samples arrived in good condition. Table 1 gives site names, identifiers, and other metadata for the samples.

Table 1. Sites on the South Fork Gallatin River, and sample information.

Site identifier	Site name	Date sampled	Latitude (°North)	Longitude
West Fork	**West Fork**	9/7/2016	45.265826	-111.257027
Ousel	**Ousel**	9/7/2016	45.265826	-111.257027
American Bank	**American Bank**	9/7/2016	45.26564	-111.288551
South Fork	**South Fork**	9/7/2016	45.266534	-111.280014

Subsamples of a minimum of 300 organisms were obtained using methods consistent with Montana Department of Environmental Quality (MDEQ) standard procedures (MDEQ 2006): Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 6 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly selected. Grid contents were examined under stereoscopic microscopes using 10x – 30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 70% ethanol for subsequent identification. Grid selection, examination, and

sorting continued until at least 300 organisms were sorted. The final grid was completely sorted of all organisms. If a sample contained fewer than 300 organisms, it was entirely sorted.

Organisms were individually examined using 10x – 80x dissecting scopes (Leica S8E) and identified to the lowest practical level consistent with MDEQ (MDEQ 2006) data requirements, using appropriate taxonomic references and keys.

Identification, counts, life stages, and information about the condition of specimens were recorded electronically. To obtain accuracy in richness measures, organisms that could not be identified to the target level specified in MDEQ protocols were designated as "not unique" if other specimens from the same group could be taken to target levels. Organisms designated as "unique" were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 70% ethanol in labeled vials, and archived at the Rhithron laboratory. Midges were morphotyped using 10x – 80x dissecting microscopes (Leica S8E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were archived at the Rhithron laboratory along with the other identified invertebrates.

Quality control procedures

Quality control (QC) procedures for initial sample processing and subsampling involved checking sorting efficiency. Sorting efficiency was conducted on 1 samples (25.0% of the samples) by an independent observer who microscopically re-examined 25% of sorted substrate from this sample. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_1 + n_2} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, n_1 is the total number of specimens in the first sort, n_2 is the total number of specimens expected in the second sort, based on the results of the re-sorted 25%.

Quality assurance procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. One sample (25.0% of samples) was randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating the Percent Taxonomic Disagreement (PTD), the Percent Difference in Enumeration (PDE) (Stribling et al. 2003), and a Bray-Curtis similarity statistic (Bray and Curtis 1957) for the selected sample. Rhithron's internal minimum data quality standards require less than 10% PTD, less than 5% PDE, and 95% similarity as measured by the Bray-Curtis statistic.

Data analysis

Taxa and counts for each sample were entered into Rhithron's database application (RAILIS v.2.1). Life stages, "unique" designations, and the condition of specimens were also entered. Bioassessment metrics were calculated by the database application and a multimetric index developed for montane ecoregions of Montana (MVFP: Bollman 1998) was calculated and scored.

Narrative interpretations describing metric and taxonomic signals for water quality (including the presence of possible metals contamination), thermal condition, sediment deposition and habitat indicators were completed for each site. These interpretations of the taxonomic and functional composition of invertebrate assemblages are based on demonstrated associations between assemblage

components and habitat and water quality variables gleaned from the published literature, the writer's own research and professional judgment, and those of other expert sources (e.g. Wisseman 1998). Often canonical procedures are used for stressor identification; however, the substantial data required for such procedures (e.g., surveys of habitat, historical and current data related to water quality, land use, point and non-point source influences, soils, hydrology, geology) were not readily available for this study. Instead, attributes of invertebrate taxa that are well-substantiated in diverse literature, published and unpublished research, and that are generally accepted by regional aquatic ecologists, are combined into descriptions of probable water quality and instream and reach-scale habitat conditions. The approach to this analysis uses some assemblage attributes that are interpreted as evidence of water quality and other attributes that are interpreted as evidence of habitat integrity. To arrive at impairment hypotheses, attributes are considered individually, so information is maximized by not relying on a single cumulative score, which may mask stress on the biota.

Mayfly taxa richness, the Hilsenhoff Biotic Index (HBI) value (Hilsenhoff 1987), the richness and abundance of hemoglobin-bearing taxa and the richness of sensitive taxa are often used as indicators of water quality. Mayfly taxa richness has been demonstrated to be significantly correlated with chemical measures of dissolved oxygen, pH, and conductivity (e.g. Bollman 1998, Fore et al. 1996, Wisseman 1996). The HBI has a long history of use and validation (Cairns and Pratt 1993, Smith and Tran 2010, Johnson and Ringler 2014). The index uses the relative abundance of taxa and the tolerance values associated with them to calculate a score representative of the tolerance of a benthic invertebrate assemblage. Higher HBI scores indicate more tolerant assemblages. In one study, the HBI was demonstrated to be significantly associated with conductivity, pH, water temperature, sediment deposition, and the presence of filamentous algae (Bollman 1998). Nutrient enrichment often results in large crops of filamentous algae (Watson 1988). Thus in these samples, when macroinvertebrates associated or dependent on filamentous algae (e.g. LeSage and Harrison 1980, Anderson 1976) are abundant, the presence of filamentous algae and nutrient enrichment are also suspected. In addition, low oxygen concentrations are often a result of nutrient enrichment in situations where enrichment has encouraged excessive plant growth; nocturnal respiration by these plants creates hypoxic conditions. Hemoglobin-bearing taxa are very tolerant of environments with low oxygen concentrations, because the hemoglobin in their circulating fluids enables them to carry more oxygen than organisms without it. Finally, sensitive taxa exhibit intolerance to a wide range of stressors (e.g. Wisseman 1996, Hellawell 1986, Barbour et al. 1999), including nutrient enrichment, acidification, thermal stress, sediment deposition, habitat disruption, and other causes of degraded ecosystem health. These taxa are expected to be present in predictable numbers in well-functioning streams.

In addition to the above characteristics, the absence of invertebrate groups known to be sensitive to metals and the Metals Tolerance Index (MTI, McGuire 1998) are considered signals of possible metals contamination. In the present approach, the absence of these groups in environs where they are typically expected to occur is considered a signal of possible metals contamination, especially when these signals are combined with a measure of overall assemblage tolerance of metals. The MTI ranks taxa according to their sensitivity to metals. Weighting taxa by their abundance in a sample, assemblage tolerance is estimated by averaging the tolerance of all sampled individuals. Higher values for the MTI indicate assemblages with greater tolerance to metals contamination.

Thermal characteristics of the sampled site are predicted by the richness and abundance of cold stenotherm taxa (Clark 1997), which require low water temperatures, and by calculation of the predicted temperature preference of the macroinvertebrate assemblage (Brandt 2001). Hemoglobin-bearing taxa are also indicators of warm water temperatures (Walshe 1947), because dissolved oxygen

is directly associated with water temperature (colder water can hold more dissolved oxygen); oxygen concentrations can also vary with the degree of nutrient enrichment. Increased temperatures and high nutrient concentrations can, alone or in concert, create conditions favorable to hypoxic sediments, habitats preferred by hemoglobin-bearers.

Stress from sediment is evaluated by caddisfly richness and by "clinger" richness (Kleindl 1995, Bollman 1998, Karr and Chu 1999, Wagenhoff et al. 2012, Leitner et al. 2015). The Fine Sediment Biotic Index (FSBI) (Relyea et al. 2001) is also used. Similar to the HBI, tolerance values are assigned to taxa based on the substrate particle sizes with which the taxa are most frequently associated. Scores are determined by weighting these tolerance values by the relative abundance of taxa in a sample. Higher values of the FSBI indicate assemblages with greater fine sediment sensitivity. However, it appears that FSBI values may be influenced by the presence of other deposited material, such as large organic material, including leaves and woody debris.

Functional characteristics of the macroinvertebrate assemblages may also reveal the condition of instream and streamside habitats. Alterations from predicted patterns of the functional characteristics may be interpreted as evidence of water quality or habitat disruption. Predicted patterns are based on the morphology and behaviors associated with feeding, and are interpreted in terms of the River Continuum Concept (Vannote et al. 1980) in the narratives. For example, the abundance of stonefly predators is likely to be related to the diversity of invertebrate prey species, and thus the complexity of instream habitats. Sites with fewer than expected stonefly species are likely to have reduced habitat complexity. Also, the absence of long-lived species (those that take 2 years to mature in the stream) is likely related to catastrophes like periodic scour, thermal stress or toxic pollutants that could interrupt long life cycles. In addition, shredders and the microbes they depend on are sensitive to modifications of the riparian zone vegetation (Plafkin et al. 1989).

Results

Quality control procedures

Sorting efficiency and all 3 quality control parameters for taxonomy and enumeration fell well within internal and industry quality standards (Table 2).

Table 2. Results of quality control procedures for subsampling and taxonomy. South Fork Gallatin River, September, 2016.

RAI sample identifier	Site name	Sorting efficiency	PDE	PTD	Bray-Curtis similarity for taxonomy and enumeration
BWTF16GR001	West Fork				
BWTF16GR002	Ousel	98.8%	0.0%	2.5%	97.5%
BWTF16GR003	American Bank				
BWTF16GR004	South Fork				

Bioassessment

Table 3 summarizes values and scores for metrics in the MVFP bioassessment index (Bollman 1998), which was used to evaluate the aquatic invertebrate assemblages. The West Fork site was considered slightly impaired, whereas the other 3 sites were non-impaired.

Narrative descriptions of aquatic invertebrate assemblages

West Fork

Water quality

Only 1 mayfly taxon, the ephemerellid *Drunella grandis* (3.6%), was collected at this site. The HBI value (6.07) was high for a montane stream because organisms with high biotic index values were abundant (e.g., the annelid*, Nais* sp. (29.5%) the dominant organism in the sample; the chironomid midge *Eukiefferiella gracei* Gr. (10.6%)). Only 2 sensitive taxa (*D. grandis* and the dipteran *Potthastia longimanus* Gr. (3.0%)) were recorded, although both were relatively common. Hemoglobin-bearing taxa were rare (0.3%), but organisms tolerant of pollution were abundant (7.6%). In addition, collectors composed almost 75% of the assemblage. Most of these data suggest that water quality is impaired through nutrient enrichment. The MTI value of 4.26 was lower than the HBI, thus there were no data to suggest metals contamination in this reach.

Thermal condition

No cold stenotherm taxa were recorded from this site. The lack of cold stenotherm taxa and a calculated temperature preference of the assemblage of 15.1 °C suggest that water temperature was elevated above expectations. In fact, this was the highest calculated temperature preference of any site sampled in 2016.

Sediment deposition

Caddisflies were represented by only 4 taxa none of which were very common. Only 10 “clinger” taxa were found in this sample. These results suggest that the deposition of fine sediment could limit macroinvertebrate colonization in this reach. The FSBI (5.47) also indicated a moderately sediment-tolerant assemblage.

Habitat diversity and integrity

Taxa richness (30) was lower than expected; in fact it was the lowest of any site surveyed in 2016. Thus, instream habitats may have been monotonous or disrupted. In addition, only 1 individual in 1 stonefly taxon (Nemouridae) was collected suggesting that channel morphology, streambanks, and riparian function may be disturbed in this reach. Four long-lived taxa were found in this sample; however, only the elmid *Optioservus* sp. (1.7%) was common and represented by more than 2 individuals. This suggests that some instability (e.g., scour, toxic inputs or thermal extremes) occurs in this reach. Collector-gatherers (71.9%) dominated the functional mix. Predators (17.9%) were also well represented; however, all other functional groups composed only small percentages of the assemblage. The low percentage of shredders (1.7%) suggests a scarcity of large particulate organic matter entering the stream from the riparian zone or perhaps swift water flow impedes the retention of such material. The low relative abundance of scrapers (2.0%) suggests only a small contribution of algal autochthonous production to the overall energy flow in this reach. Consequently, the importance of fine particulate organic matter deposited on the substrate to the energy flow of the system cannot be overstated.

Table 3. Bioassessment index (MVFP: Bollman 1998) and individual metrics and scores for samples collected at sites on the West Fork Gallatin River, September 2016.

METRICS	SITES			
	West Fork	Ousel	American Bank	South Fork
METRIC VALUES				
Ephemeroptera richness	1	10	6	6
Plecoptera richness	1	4	3	2
Trichoptera richness	4	8	5	7
Number of sensitive taxa	2	7	3	3
Percent filterers	1.7%	0.6%	0.7%	1.6%
Percent tolerant taxa	7.6%	0.9%	8.8%	9.4%
METRIC SCORES				
Ephemeroptera richness	0	3	3	3
Plecoptera richness	1	3	2	2
Trichoptera richness	2	3	3	3
Number of sensitive taxa	2	3	2	2
Percent filterers	3	3	3	3
Percent tolerant taxa	2	3	2	2
TOTAL SCORE (max.=18)	10	18	15	15
PERCENT OF MAX.	55.6%	100.0%	83.3%	83.3%
Impairment classification*	**SLI**	**NON**	**NON**	**NON**

* Impairment classifications: (NON) non-impaired (score ≥75% of maximum), (SLI) slightly impaired (score 50-75% of maximum), (MOD) moderately impaired (score 25-50% of maximum), (SEV) severely impaired (score <25% of maximum).

Ousel

Water quality

Water quality appears to be good at this site. Ten mayfly and 7 sensitive taxa were collected. Some of the sensitive taxa were mayflies that were abundant, including *Drunella doddsii* (21.7%, the dominant animal in the collection) and *Epeorus deceptivus* (5.4%). The HBI value (2.84) was low and within expectations for a montane stream. No hemoglobin-bearing animals were collected and pollution tolerant organisms composed only 0.9% of the assemblage. Collectors were abundant (36.2%), but they were not the dominant functional group. The low MTI (2.21) and the presence of many heptageniid mayfly taxa suggest no metal contamination.

Thermal condition

Six cold stenotherm taxa, accounting for a very large (33.0%) proportion of the assemblage, were found in this sample. *Drunella doddsii* and *Epeorus deceptivus* were two very abundant cold stenotherms. Other cold stenotherms collected from this site included the stonefly family Leuctridae and the caddisfly *Rhyacophila vofixa* Gr. The temperature preference of the assemblage was 12.0 °C.

Sediment deposition

Sediment probably does not limit macroinvertebrate colonization at this site because 8 caddisfly and 22 "clinger" taxa were collected in this reach. These results are supported by the high FSBI (6.02) that indicates an assemblage that is moderately intolerant of fine sediment.

Habitat diversity and integrity

Forty unique macroinvertebrate taxa were found in this sample, which was the highest taxa richness of any of the sites sampled in 2016; however, this number is still somewhat lower than expectations for a montane stream. In addition, only 4 stonefly taxa were found at this site, although *Sweltsa* sp. (2.5%), *Kogotus* sp. (1.6%) and *Skwala* sp. (1.6%) were common. Thus, some disruption of instream habitats and impairment of channel morphology, streambanks, or riparian function might characterize this site. Four long-lived taxa were collected and only the caddisfly *Arctopsyche* sp. (2.5%) was common, indicating that disruption in year-round surface flow and the possibility of catastrophes such as thermal stress or scouring sediment pulses cannot be ruled out. A functional mix dominated by scrapers (45.3%) and collector gatherers (35.5%) suggest the importance of both autochthonous algal production (and perhaps an open canopy) and fine particulate material to the energy flow in the system. Interestingly, shredders (1.3%) and collector filterers (0.6%) were not well represented in this sample. Lack of shredders may be due to the lack of riparian inputs or little retention of such material in this reach.

American Bank

Water quality

The results were mixed concerning water quality at this site. Mayfly taxa richness (6) was somewhat lower than expected for a montane stream. One taxon in the family Baetidae, 4 taxa in the family Ephemerellidae, and 1 taxon in the family Heptageniidae were collected. All of these taxa were either abundant (the ephemerellid *Drunella* sp. (8.2%)) or common (e.g., the ephemerellid *Ephemerella excrucians* (2.0%)), except for the ephemerellid *Caudatella* sp. (0.3%), which was represented by only 1 individual. The HBI (4.95) was elevated, but the high value was probably, in part, due to the abundance of the water mite *Torrenticola* sp. (21.6%, the most abundant organism in this sample) that has a high

biotic index value. The biotic index values for water mites have not been well studied and should be considered provisional. However, a relatively high percentage of tolerant organisms (8.8%), few sensitive taxa (3; *Potthastia longimanus* Gr. (4.8%) was abundant, *Drunella doddsii* (2.0%) was common), and the dominance of collectors (49.0%) in the functional mix suggest some impact to water quality. In addition, hemoglobin-bearing taxa (5.2%) were abundant; thus, sediments may be hypoxic perhaps as a result of nutrient enrichment. These results suggest that slight water quality impairment through nutrient enrichment cannot be ruled out here. There was no evidence of metal pollution as the MTI (3.98) was lower than the HBI and a few specimens of one heptageniid mayfly taxon were found in the sample.

Thermal condition

Only 2 cold stenotherm taxa were reported from this site and they accounted for only 2.3% of the assemblage. The temperature preference of the assemblage was 13.2 °C.

Sediment deposition

Five caddisfly and 15 "clinger" taxa were recorded from this reach. These numbers are somewhat lower than expected, but when combined with an FSBI of 5.62, indicating an assemblage that is moderately intolerant of fine sediment, they suggest that sediment probably does not limit invertebrate colonization in this reach.

Habitat diversity and integrity

Overall taxa richness (33) was lower than expected, consequently some disturbance of instream habitats cannot be ruled out at this site. Only 3 stonefly taxa (*Sweltsa* sp., *Kogotus* sp., *Skwala* sp.), each represented by only 1 specimen, were found in this sample suggesting that streambanks and channels may have been disrupted and riparian function may have been compromised. As with the other sites sampled in 2016, 4 less motile, semivoltine taxa were sampled from this site; however, both *Arctopsyche* sp. (2.0%) and *Optioservus* sp. (2.6%) were common making catastrophes such as disruption of year-round surface flows, thermal stress or scouring sediment pulses less likely at this site than at West Fork and Ousel. The functional mix was dominated by collector-gatherers (48.4%). Predators (27.8%) were the second most abundant functional group primarily because of the abundance of the water mites. Scrapers (18.3%) were well represented. Thus, fine particulate organic matter and autochthonous algal production are important to the energy flow in this reach. As with all the other sites sampled this year collector-filterers (0.7%) were scarce. Shredders (2.9%) and collector-filterers (0.7%) were not abundant.

South Fork

Water quality

Results for this site were mixed and very similar to the results for American Bank. Mayfly taxa richness (6) was lower than expected. The ubiquitous *Baetis tricaudatus* complex (9.4%) was abundant, *Drunella doddsii* (1.6%) was common, and all other taxa were represented by only a few specimens. The HBI value (5.08) was higher than expected for a montane stream, but as with American Bank, was probably influenced by the dominance of mites such as *Torrenticola* sp. (16.5%, the most abundant organism in this sample) that have a high, but perhaps understudied and unconfirmed, biotic index value. However unlike American Bank, the annelid worm *Nais* sp. (13.6%), which is very tolerant to organic pollution and has a high biotic index value, was also abundant. Only 3 sensitive taxa, none of which were abundant, were reported and included the mayflies *Drunella doddsii* and *Caudatella* sp. (0.7%) and *Potthastia*

longimanus Gr. (0.7%). As with American Bank, tolerant organisms (9.4%) were abundant and collectors composed over 50% of the assemblage. However unlike American Bank, hemoglobin-bearing taxa (1.3%) were uncommon. Slight water quality impairment through nutrient enrichment cannot be dismissed. There was no support for metal contamination because the MTI value of 3.74 was lower than the HBI value.

Thermal condition

Again similar to American Bank, only 2 cold stenotherm taxa were collected here and they accounted for only 2.3% of the assemblage. The temperature preference of the assemblage was 13.8 °C.

Sediment deposition

The data suggest that deposition of fine sediment did not limit colonization in this reach. Although both caddisfly taxa richness (7) and "clinger" taxa richness (16) were somewhat lower than expected, the FSBI (5.71) indicated an assemblage that was moderately intolerant of fine sediment.

Habitat diversity and integrity

Again the data that reflect the condition of the habitat were very similar to those at Amercian Bank: taxa richness (37) and stonefly taxa richness (2) were below expectations for a montane stream. These data may reflect some disturbance to instream habitats, riparian zones, channel morphology and/or stream banks. As with all the other sites, only 4 long-lived taxa were recorded from this sample; however, *Arctopsyche* sp. (5.2%) and *Brachycentrus* sp. (1.3%) were common suggesting that this site, similar to American Bank, is probably more stable with no scour, toxic inputs, or thermal extremes than West Fork and Ousel. Collector-gatherers (50%) and predators (37.7%; mostly as a result of abundant mites) dominated the functional groups. Scrapers (4.2%) and shredders (5.8%) were also well represented. Only the collector-filterers (1.6%) were not common, as was seen at all the other sites sampled in 2016. Consequently, similar to the other sites, fine particulate material deposited on the stream bed appears to be important to the energy flow in this reach. However, the relatively high percentage of shredders suggests an abundance of large particulate organic matter entering the stream from the riparian zone in this reach, which is different than the other sites that were sampled in 2016.

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Appendix

Taxa lists and metric summaries

Gallatin River Task Force
Gallatin River

September 2016

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR001

RAI No.: **BWTF16GR001** Sta. Name: **West Fork**
Client ID: **West Fork**
Date Coll.: **9/7/2016** No. Jars: **2** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Oligochaeta							
Enchytraeidae							
Enchytraeus sp.	**1**	**0.33%**	**Yes**	**Unknown**		**4**	**CG**
Naididae							
Nais sp.	**89**	**29.47%**	**Yes**	**Unknown**		**8**	**CG**
Naididae							
Tubificinae	**1**	**0.33%**	**Yes**	**Immature**		**11**	**CG**
Feltriidae							
Feltria sp.	**1**	**0.33%**	**Yes**	**Adult**		**11**	**PR**
Sperchontidae							
Sperchon sp.	**5**	**1.66%**	**Yes**	**Adult**		**11**	**PR**
Torrenticolidae							
Torrenticola sp.	**13**	**4.30%**	**Yes**	**Adult**		**8**	**PR**
Ephemeroptera							
Ephemerellidae							
Drunella grandis	**11**	**3.64%**	**Yes**	**Larva**		**2**	**PR**
Plecoptera							
Nemouridae							
Nemouridae	**1**	**0.33%**	**Yes**	**Larva**	**Damaged**	**2**	**SH**
Trichoptera							
Brachycentridae							
Brachycentrus sp.	**2**	**0.66%**	**Yes**	**Larva**	**Early Instar**	**1**	**CF**
Hydropsychidae							
Arctopsyche sp.	**2**	**0.66%**	**Yes**	**Larva**		**2**	**PR**
Lepidostomatidae							
Lepidostoma sp.	**4**	**1.32%**	**Yes**	**Larva**		**1**	**SH**
Rhyacophilidae							
Rhyacophila sp.	**1**	**0.33%**	**Yes**	**Larva**	**Early Instar**	**1**	**PR**
Coleoptera							
Elmidae							
Optioservus sp.	**1**	**0.33%**	**Yes**	**Adult**		**5**	**SC**
Optioservus sp.	**4**	**1.32%**	**No**	**Larva**		**5**	**SC**
Zaitzevia sp.	**1**	**0.33%**	**Yes**	**Adult**		**5**	**CG**
Diptera							
Athericidae							
Atherix sp.	**16**	**5.30%**	**Yes**	**Larva**		**2**	**PR**
Empididae							
Clinocera sp.	**2**	**0.66%**	**Yes**	**Larva**		**5**	**PR**
Neoplasta sp.	**2**	**0.66%**	**Yes**	**Larva**		**5**	**PR**
Tipulidae							
Antocha monticola	**1**	**0.33%**	**Yes**	**Larva**		**3**	**CG**
Dicranota sp.	**1**	**0.33%**	**Yes**	**Larva**		**3**	**PR**

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR001

RAI No.: **BWTF16GR001** Sta. Name: **West Fork**
Client ID: **West Fork**
Date Coll.: **9/7/2016** No. Jars: **2** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Chironomidae							
Chironomidae	**5**	**1.66%**	**No**	**Pupa**		**10**	**CG**
Chironominae							
Stictochironomus sp.	**1**	**0.33%**	**Yes**	**Larva**		**5**	**CG**
Chironominae							
Micropsectra sp.	**5**	**1.66%**	**Yes**	**Larva**		**4**	**CG**
Rheotanytarsus sp.	**2**	**0.66%**	**Yes**	**Larva**		**6**	**CF**
Sublettea coffmani	**15**	**4.97%**	**Yes**	**Larva**		**4**	**UN**
Tanytarsini	**1**	**0.33%**	**No**	**Larva**	**Early Instar**	**6**	**CF**
Diamesinae							
Pagastia sp.	**3**	**0.99%**	**Yes**	**Larva**		**1**	**CG**
Potthastia Longimanus Gr.	**9**	**2.98%**	**Yes**	**Larva**		**2**	**CG**
Orthocladiinae							
Eukiefferiella Gracei Gr.	**32**	**10.60%**	**Yes**	**Larva**		**8**	**CG**
Hydrobaenus sp.	**1**	**0.33%**	**Yes**	**Larva**		**8**	**SC**
Orthocladiinae	**7**	**2.32%**	**No**	**Larva**	**Early Instar**	**6**	**CG**
Orthocladius sp.	**56**	**18.54%**	**Yes**	**Larva**		**6**	**CG**
Thienemanniella sp.	**1**	**0.33%**	**Yes**	**Larva**		**6**	**CG**
Tvetenia Bavarica Gr.	**5**	**1.66%**	**Yes**	**Larva**		**5**	**CG**
Sample Count	302						

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR002

RAI No.: **BWTF16GR002** Sta. Name: **Ousel**
Client ID: **Ousel**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Oligochaeta							
Enchytraeidae							
Mesenchytraeus sp.	**5**	**1.57%**	**Yes**	**Unknown**		**4**	**CG**
Lebertiidae							
Lebertia sp.	**7**	**2.20%**	**Yes**	**Adult**		**8**	**PR**
Sperchontidae							
Sperchon sp.	**2**	**0.63%**	**Yes**	**Adult**		**11**	**PR**
Ephemeroptera							
Ameletidae							
Ameletus sp.	**2**	**0.63%**	**Yes**	**Larva**		**0**	**SC**
Baetidae							
Acentrella turbida	**1**	**0.31%**	**Yes**	**Larva**		**4**	**CG**
Baetis bicaudatus complex	**5**	**1.57%**	**Yes**	**Larva**		**1**	**CG**
Baetis Rhodani Gr.	**9**	**2.83%**	**No**	**Larva**	**Early Instar**	**11**	**CG**
Baetis tricaudatus complex	**28**	**8.81%**	**Yes**	**Larva**		**5**	**CG**
Ephemerellidae							
Drunella sp.	**5**	**1.57%**	**Yes**	**Larva**	**Early Instar**	**1**	**SC**
Drunella doddsii	**69**	**21.70%**	**Yes**	**Larva**		**1**	**SC**
Ephemerella sp.	**16**	**5.03%**	**Yes**	**Larva**	**Early Instar**	**1.5**	**SC**
Heptageniidae							
Cinygmula sp.	**7**	**2.20%**	**Yes**	**Larva**		**0**	**SC**
Epeorus deceptivus	**17**	**5.35%**	**Yes**	**Larva**		**0**	**SC**
Rhithrogena sp.	**9**	**2.83%**	**Yes**	**Larva**		**0**	**SC**
Plecoptera							
Chloroperlidae							
Sweltsa sp.	**8**	**2.52%**	**Yes**	**Larva**		**0**	**PR**
Leuctridae							
Leuctridae	**1**	**0.31%**	**Yes**	**Larva**	**Early Instar**	**0**	**SH**
Perlodidae							
Kogotus sp.	**5**	**1.57%**	**Yes**	**Larva**		**1**	**PR**
Skwala sp.	**5**	**1.57%**	**Yes**	**Larva**		**3**	**PR**
Trichoptera							
Apataniidae							
Apatania sp.	**8**	**2.52%**	**Yes**	**Larva**		**3**	**SC**
Brachycentridae							
Brachycentrus sp.	**2**	**0.63%**	**Yes**	**Larva**	**Early Instar**	**1**	**CF**
Hydropsychidae							
Arctopsyche sp.	**8**	**2.52%**	**Yes**	**Larva**		**2**	**PR**
Rhyacophilidae							
Rhyacophila Betteni Gr.	**2**	**0.63%**	**Yes**	**Larva**		**0**	**PR**
Rhyacophila Brunnea/Vemna Gr.	**1**	**0.31%**	**Yes**	**Larva**		**2**	**PR**
Rhyacophila Hyalinata Gr.	**8**	**2.52%**	**Yes**	**Larva**		**0**	**PR**
Rhyacophila Vofixa Gr.	**1**	**0.31%**	**Yes**	**Larva**		**0**	**PR**
Uenoidae							
Oligophlebodes sp.	**9**	**2.83%**	**Yes**	**Larva**		**3**	**SC**

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR002

RAI No.: **BWTF16GR002** Sta. Name: **Ousel**
Client ID: **Ousel**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Coleoptera							
Elmidae							
Elmidae	**2**	**0.63%**	**No**	**Larva**	**Early Instar**	**4**	**CG**
Heterlimnius corpulentus	**2**	**0.63%**	**Yes**	**Larva**		**3**	**CG**
Optioservus sp.	**2**	**0.63%**	**Yes**	**Adult**		**5**	**SC**
Diptera							
Athericidae							
Atherix sp.	**1**	**0.31%**	**Yes**	**Larva**		**2**	**PR**
Ceratopogonidae							
Ceratopogoninae	**1**	**0.31%**	**Yes**	**Larva**		**6**	**PR**
Empididae							
Clinocera sp.	**1**	**0.31%**	**Yes**	**Larva**		**5**	**PR**
Psychodidae							
Pericoma / Telmatoscopus	**3**	**0.94%**	**Yes**	**Larva**		**4**	**CG**
Tipulidae							
Dicranota sp.	**2**	**0.63%**	**Yes**	**Larva**		**3**	**PR**
Hexatoma sp.	**3**	**0.94%**	**Yes**	**Larva**		**2**	**PR**
Chironomidae							
Chironomidae	**4**	**1.26%**	**No**	**Pupa**		**10**	**CG**
Diamesinae							
Pagastia sp.	**5**	**1.57%**	**Yes**	**Larva**		**1**	**CG**
Orthocladiinae							
Cricotopus (Cricotopus) sp.	**3**	**0.94%**	**Yes**	**Larva**		**7**	**SH**
Eukiefferiella Brehmi Gr.	**3**	**0.94%**	**Yes**	**Larva**		**8**	**CG**
Eukiefferiella Devonica Gr.	**1**	**0.31%**	**Yes**	**Larva**		**8**	**CG**
Eukiefferiella Gracei Gr.	**14**	**4.40%**	**Yes**	**Larva**		**8**	**CG**
Eukiefferiella Pseudomontana Gr.	**1**	**0.31%**	**Yes**	**Larva**		**8**	**CG**
Orthocladius sp.	**30**	**9.43%**	**Yes**	**Larva**		**6**	**CG**
Sample Count	318						

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR003

RAI No.: **BWTF16GR003** Sta. Name: **American Bank**
Client ID: **American Bank**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Other Non-Insect							
Planariidae							
Polycelis sp.	**5**	**1.63%**	**Yes**	**Unknown**		**1**	**OM**
Enchytraeidae							
Mesenchytraeus sp.	**18**	**5.88%**	**Yes**	**Unknown**		**4**	**CG**
Naididae							
Nais sp.	**3**	**0.98%**	**Yes**	**Unknown**		**8**	**CG**
Lebertiidae							
Lebertia sp.	**2**	**0.65%**	**Yes**	**Adult**		**8**	**PR**
Sperchontidae							
Sperchon sp.	**4**	**1.31%**	**Yes**	**Adult**		**11**	**PR**
Torrenticolidae							
Torrenticola sp.	**66**	**21.57%**	**Yes**	**Adult**		**8**	**PR**
Ephemeroptera							
Baetidae							
Baetis tricaudatus complex	**6**	**1.96%**	**Yes**	**Larva**		**5**	**CG**
Ephemerellidae							
Caudatella sp.	**1**	**0.33%**	**Yes**	**Larva**	**Early Instar**	**0**	**CG**
Drunella sp.	**25**	**8.17%**	**Yes**	**Larva**	**Early Instar**	**1**	**SC**
Drunella doddsii	**6**	**1.96%**	**Yes**	**Larva**		**1**	**SC**
Ephemerella excrucians	**6**	**1.96%**	**Yes**	**Larva**		**4**	**SH**
Heptageniidae							
Cinygmula sp.	**1**	**0.33%**	**Yes**	**Larva**		**0**	**SC**
Plecoptera							
Chloroperlidae							
Sweltsa sp.	**1**	**0.33%**	**Yes**	**Larva**		**0**	**PR**
Perlodidae							
Kogotus sp.	**1**	**0.33%**	**Yes**	**Larva**		**1**	**PR**
Perlodidae	**1**	**0.33%**	**No**	**Larva**	**Early Instar**	**2**	**PR**
Skwala sp.	**1**	**0.33%**	**Yes**	**Larva**		**3**	**PR**
Trichoptera							
Brachycentridae							
Brachycentrus americanus	**2**	**0.65%**	**Yes**	**Larva**		**1**	**CF**
Micrasema sp.	**3**	**0.98%**	**Yes**	**Larva**		**1**	**SH**
Hydropsychidae							
Arctopsyche sp.	**6**	**1.96%**	**Yes**	**Larva**		**2**	**PR**
Hydroptilidae							
Hydroptila sp.	**1**	**0.33%**	**Yes**	**Larva**		**6**	**PH**
Rhyacophilidae							
Rhyacophila narvae	**1**	**0.33%**	**Yes**	**Larva**		**0**	**PR**
Coleoptera							
Elmidae							
Heterlimnius corpulentus	**1**	**0.33%**	**Yes**	**Larva**		**3**	**CG**
Optioservus sp.	**8**	**2.61%**	**Yes**	**Larva**		**5**	**SC**

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR003

RAI No.: **BWTF16GR003** Sta. Name: **American Bank**
Client ID: **American Bank**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Athericidae							
Atherix sp.	**2**	**0.65%**	**Yes**	**Larva**		**2**	**PR**
Psychodidae							
Pericoma / Telmatoscopus	**34**	**11.11%**	**Yes**	**Larva**		**4**	**CG**
Chironomidae							
Chironomidae	**1**	**0.33%**	**No**	**Pupa**		**10**	**CG**
Chironominae							
Stictochironomus sp.	**16**	**5.23%**	**Yes**	**Larva**		**5**	**CG**
Chironominae							
Constempellina sp.	**2**	**0.65%**	**Yes**	**Larva**		**6**	**CG**
Micropsectra sp.	**7**	**2.29%**	**Yes**	**Larva**		**4**	**CG**
Diamesinae							
Pagastia sp.	**1**	**0.33%**	**Yes**	**Larva**		**1**	**CG**
Potthastia Longimanus Gr.	**14**	**4.58%**	**Yes**	**Larva**		**2**	**CG**
Orthocladiinae							
Eukiefferiella Gracei Gr.	**4**	**1.31%**	**Yes**	**Larva**		**8**	**CG**
Hydrobaenus sp.	**16**	**5.23%**	**Yes**	**Larva**		**8**	**SC**
Orthocladius sp.	**33**	**10.78%**	**Yes**	**Larva**		**6**	**CG**
Tvetenia Bavarica Gr.	**7**	**2.29%**	**Yes**	**Larva**		**5**	**CG**
Sample Count	306						

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR004

RAI No.: **BWTF16GR004** Sta. Name: **South Fork**
Client ID: **South Fork**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Oligochaeta							
Enchytraeidae							
Mesenchytraeus sp.	**42**	**13.55%**	**Yes**	**Unknown**		**4**	**CG**
Naididae							
Nais sp.	**42**	**13.55%**	**Yes**	**Unknown**		**8**	**CG**
Sphaeriidae							
Sphaeriidae	**1**	**0.32%**	**Yes**	**Immature**		**8**	**CF**
Hygrobatidae							
Hygrobates sp.	**8**	**2.58%**	**Yes**	**Adult**		**8**	**PR**
Sperchontidae							
Sperchon sp.	**11**	**3.55%**	**Yes**	**Adult**		**11**	**PR**
Torrenticolidae							
Torrenticola sp.	**51**	**16.45%**	**Yes**	**Adult**		**8**	**PR**
Ephemeroptera							
Baetidae							
Baetis tricaudatus complex	**29**	**9.35%**	**Yes**	**Larva**		**5**	**CG**
Ephemerellidae							
Caudatella sp.	**2**	**0.65%**	**Yes**	**Larva**	**Early Instar**	**0**	**CG**
Drunella sp.	**3**	**0.97%**	**Yes**	**Larva**	**Early Instar**	**1**	**SC**
Drunella doddsii	**5**	**1.61%**	**Yes**	**Larva**		**1**	**SC**
Ephemerella excrucians	**3**	**0.97%**	**Yes**	**Larva**		**4**	**SH**
Heptageniidae							
Rhithrogena sp.	**2**	**0.65%**	**Yes**	**Larva**		**0**	**SC**
Plecoptera							
Chloroperlidae							
Sweltsa sp.	**1**	**0.32%**	**Yes**	**Larva**		**0**	**PR**
Perlidae							
Hesperoperla pacifica	**1**	**0.32%**	**Yes**	**Larva**		**1**	**PR**
Trichoptera							
Brachycentridae							
Brachycentrus sp.	**4**	**1.29%**	**Yes**	**Larva**	**Early Instar**	**1**	**CF**
Micrasema sp.	**1**	**0.32%**	**Yes**	**Larva**		**1**	**SH**
Glossosomatidae							
Glossosoma sp.	**1**	**0.32%**	**Yes**	**Larva**		**0**	**SC**
Hydropsychidae							
Arctopsyche sp.	**16**	**5.16%**	**Yes**	**Larva**		**2**	**PR**
Lepidostomatidae							
Lepidostoma sp.	**8**	**2.58%**	**Yes**	**Larva**		**1**	**SH**
Rhyacophilidae							
Rhyacophila Hyalinata Gr.	**4**	**1.29%**	**Yes**	**Larva**		**0**	**PR**
Rhyacophila narvae	**2**	**0.65%**	**Yes**	**Larva**		**0**	**PR**
Coleoptera							
Elmidae							
Elmidae	**2**	**0.65%**	**No**	**Larva**	**Early Instar**	**4**	**CG**
Optioservus sp.	**2**	**0.65%**	**Yes**	**Adult**		**5**	**SC**

Taxa Listing

Project ID: BWTF16GR
RAI No.: BWTF16GR004

RAI No.: **BWTF16GR004** Sta. Name: **South Fork**
Client ID: **South Fork**
Date Coll.: **9/7/2016** No. Jars: **1** STORET ID: **South Fork**

Taxonomic Name	Count	PRA	Unique	Stage	Qualifier	BI	Function
Diptera							
Athericidae							
Atherix sp.	**22**	**7.10%**	**Yes**	**Larva**		**2**	**PR**
Muscidae							
Muscidae	**1**	**0.32%**	**Yes**	**Larva**		**10**	**PR**
Psychodidae							
Pericoma / Telmatoscopus	**3**	**0.97%**	**Yes**	**Larva**		**4**	**CG**
Chironomidae							
Chironomidae	**3**	**0.97%**	**No**	**Pupa**		**10**	**CG**
Chironominae							
Polypedilum sp.	**2**	**0.65%**	**Yes**	**Larva**		**6**	**SH**
Stictochironomus sp.	**2**	**0.65%**	**Yes**	**Larva**		**5**	**CG**
Chironominae							
Cladotanytarsus sp.	**2**	**0.65%**	**Yes**	**Larva**		**7**	**CG**
Micropsectra sp.	**7**	**2.26%**	**Yes**	**Larva**		**4**	**CG**
Sublettea coffmani	**3**	**0.97%**	**Yes**	**Larva**		**4**	**UN**
Diamesinae							
Pagastia sp.	**1**	**0.32%**	**Yes**	**Larva**		**1**	**CG**
Potthastia Longimanus Gr.	**2**	**0.65%**	**Yes**	**Larva**		**2**	**CG**
Orthocladiinae							
Cricotopus (Cricotopus) sp.	**1**	**0.32%**	**Yes**	**Larva**		**7**	**SH**
Cricotopus trifascia	**3**	**0.97%**	**Yes**	**Larva**		**7**	**SH**
Eukiefferiella Devonica Gr.	**1**	**0.32%**	**Yes**	**Larva**		**8**	**CG**
Orthocladius sp.	**12**	**3.87%**	**Yes**	**Larva**		**6**	**CG**
Tvetenia Bavarica Gr.	**4**	**1.29%**	**Yes**	**Larva**		**5**	**CG**
Sample Count	310						

Metrics Report

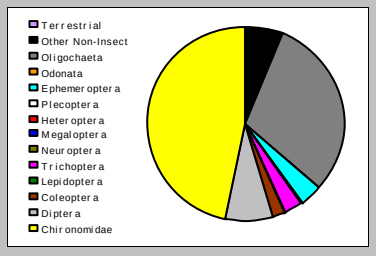
Project ID: BWTF16GR
RAI No.: BWTF16GR001
Sta. Name: West Fork
Client ID: West Fork
STORET ID South Fork
Coll. Date: 9/7/2016
Latitude: 45.265826 **Longitude:** -111.257027

Abundance Measures

Sample Count: 302
Sample Abundance: 2,265.00 13.33% of sample used
Coll. Procedure:
Sample Notes: * Site sampled many time in past as West or West Fork of Gallatin upstream of Big Sky Spur bridge. In Rhithron reports 9/2011-3/2012,

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	3	19	6.29%
Oligochaeta	3	91	30.13%
Odonata			
Ephemeroptera	1	11	3.64%
Plecoptera	1	1	0.33%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	4	9	2.98%
Lepidoptera			
Coleoptera	2	6	1.99%
Diptera	5	22	7.28%
Chironomidae	11	143	47.35%

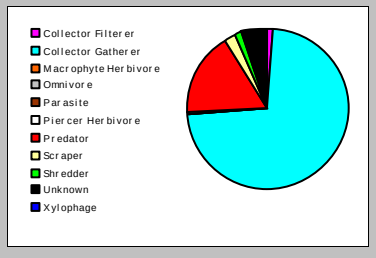


Dominant Taxa

Category	A	PRA
Nais	89	29.47%
Orthocladius	56	18.54%
Eukiefferiella Gracei Gr.	32	10.60%
Atherix	16	5.30%
Sublettea coffmani	15	4.97%
Torrenticola	13	4.30%
Drunella grandis	11	3.64%
Potthastia Longimanus Gr.	9	2.98%
Orthocladiinae	7	2.32%
Tvetenia Bavarica Gr.	5	1.66%
Sperchon	5	1.66%
Optioservus	5	1.66%
Micropsectra	5	1.66%
Chironomidae	5	1.66%
Lepidostoma	4	1.32%

Functional Composition

Category	R	A	PRA
Predator	10	54	17.88%
Parasite			
Collector Gatherer	13	217	71.85%
Collector Filterer	2	5	1.66%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	2	6	1.99%
Shredder	2	5	1.66%
Omnivore			
Unknown	1	15	4.97%

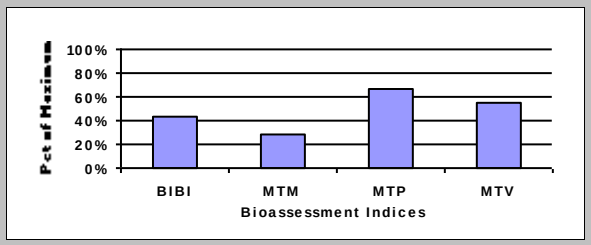


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	30
E Richness	1
P Richness	1
T Richness	4
EPT Richness	6
EPT Percent	6.95%
All Non-Insect Abundance	110
All Non-Insect Richness	6
All Non-Insect Percent	36.42%
Oligochaeta+Hirudinea Percent	30.13%
Baetidae/Ephemeroptera	0.000
Hydropsychidae/Trichoptera	0.222
Dominance	
Dominant Taxon Percent	29.47%
Dominant Taxa (2) Percent	48.01%
Dominant Taxa (3) Percent	58.61%
Dominant Taxa (10) Percent	83.77%
Diversity	
Shannon H (loge)	2.354
Shannon H (log2)	3.395
Margalef D	5.130
Simpson D	0.158
Evenness	0.071
Function	
Predator Richness	10
Predator Percent	17.88%
Filterer Richness	2
Filterer Percent	1.66%
Collector Percent	73.51%
Scraper+Shredder Percent	3.64%
Scraper/Filterer	1.200
Scraper/Scraper+Filterer	0.545
Habit	
Burrower Richness	2
Burrower Percent	0.99%
Swimmer Richness	0
Swimmer Percent	0.00%
Clinger Richness	10
Clinger Percent	9.27%
Characteristics	
Cold Stenotherm Richness	0
Cold Stenotherm Percent	0.00%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	0.33%
Air Breather Richness	2
Air Breather Percent	0.66%
Voltinism	
Univoltine Richness	11
Semivoltine Richness	4
Multivoltine Percent	53.64%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	0.66%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	0.66%
Metals Tolerance Index	4.258
Pollution Sensitive Richness	2
Pollution Tolerant Percent	7.62%
Hilsenhoff Biotic Index	6.068
Intolerant Percent	16.23%
Supertolerant Percent	46.36%
CTQa	80.846

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	22	44.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	20	66.67%	Slight
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	10	55.56%	Slight
MTM	Montana DEQ Mountains (Bukantis 1998)	6	28.57%	Moderate



Thursday, October 13, 2016

Metrics Report

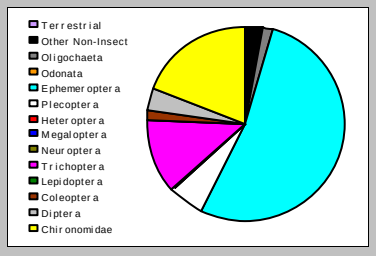
Project ID: BWTF16GR
RAI No.: BWTF16GR002
Sta. Name: Ousel
Client ID: Ousel
STORET ID South Fork
Coll. Date: 9/7/2016
Latitude: 45.265826 **Longitude:** -111.257027

Abundance Measures

Sample Count: 318
Sample Abundance: 477.00 66.67% of sample used
Coll. Procedure:
Sample Notes: *Site sampled in August 2013 and 9/12 Note in both Rhithron reports as Ousel

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	2	9	2.83%
Oligochaeta	1	5	1.57%
Odonata			
Ephemeroptera	10	168	52.83%
Plecoptera	4	19	5.97%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	8	39	12.26%
Lepidoptera			
Coleoptera	2	6	1.89%
Diptera	6	11	3.46%
Chironomidae	7	61	19.18%

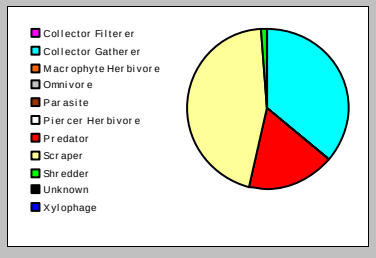


Dominant Taxa

Category	A	PRA
Drunella doddsii	69	21.70%
Orthocladius	30	9.43%
Baetis tricaudatus complex	28	8.81%
Epeorus deceptivus	17	5.35%
Ephemerella	16	5.03%
Eukiefferiella Gracei Gr.	14	4.40%
Rhithrogena	9	2.83%
Oligophlebodes	9	2.83%
Baetis Rhodani Gr.	9	2.83%
Sweltsa	8	2.52%
Rhyacophila Hyalinata Gr.	8	2.52%
Arctopsyche	8	2.52%
Apatania	8	2.52%
Lebertia	7	2.20%
Cinygmula	7	2.20%

Functional Composition

Category	R	A	PRA
Predator	15	55	17.30%
Parasite			
Collector Gatherer	12	113	35.53%
Collector Filterer	1	2	0.63%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	10	144	45.28%
Shredder	2	4	1.26%
Omnivore			
Unknown			

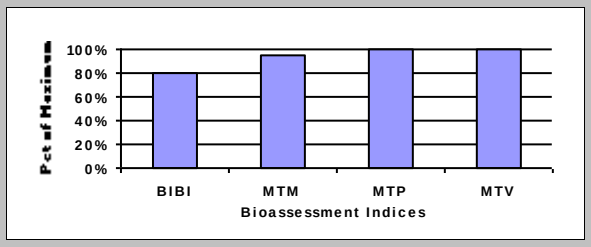


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	40
E Richness	10
P Richness	4
T Richness	8
EPT Richness	22
EPT Percent	71.07%
All Non-Insect Abundance	14
All Non-Insect Richness	3
All Non-Insect Percent	4.40%
Oligochaeta+Hirudinea Percent	1.57%
Baetidae/Ephemeroptera	0.256
Hydropsychidae/Trichoptera	0.205
Dominance	
Dominant Taxon Percent	21.70%
Dominant Taxa (2) Percent	31.13%
Dominant Taxa (3) Percent	39.94%
Dominant Taxa (10) Percent	65.72%
Diversity	
Shannon H (loge)	3.003
Shannon H (log2)	4.332
Margalef D	6.826
Simpson D	0.083
Evenness	0.047
Function	
Predator Richness	15
Predator Percent	17.30%
Filterer Richness	1
Filterer Percent	0.63%
Collector Percent	36.16%
Scraper+Shredder Percent	46.54%
Scraper/Filterer	72.000
Scraper/Scraper+Filterer	0.986
Habit	
Burrower Richness	2
Burrower Percent	1.89%
Swimmer Richness	4
Swimmer Percent	14.15%
Clinger Richness	22
Clinger Percent	60.06%
Characteristics	
Cold Stenotherm Richness	6
Cold Stenotherm Percent	33.02%
Hemoglobin Bearer Richness	
Hemoglobin Bearer Percent	
Air Breather Richness	2
Air Breather Percent	1.57%
Voltinism	
Univoltine Richness	22
Semivoltine Richness	4
Multivoltine Percent	23.90%
Tolerance	
Sediment Tolerant Richness	2
Sediment Tolerant Percent	1.57%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	2.52%
Metals Tolerance Index	2.208
Pollution Sensitive Richness	7
Pollution Tolerant Percent	0.94%
Hilsenhoff Biotic Index	2.844
Intolerant Percent	55.03%
Supertolerant Percent	9.43%
CTQa	50.962

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	40	80.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	30	100.00%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	18	100.00%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	20	95.24%	None



Thursday, October 13, 2016

Metrics Report

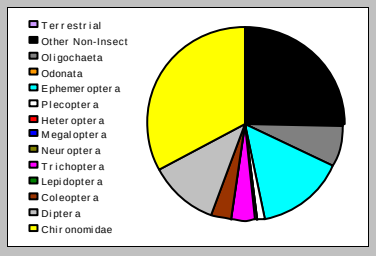
Project ID: BWTF16GR
RAI No.: BWTF16GR003
Sta. Name: American Bank
Client ID: American Bank
STORET ID South Fork
Coll. Date: 9/7/2016
Latitude: 45.26564 **Longitude:** -111.288551

Abundance Measures

Sample Count: 306
Sample Abundance: 1,836.00 16.67% of sample used
Coll. Procedure:
Sample Notes: *Site sampled in August 2013 as American Bank

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	4	77	25.16%
Oligochaeta	2	21	6.86%
Odonata			
Ephemeroptera	6	45	14.71%
Plecoptera	3	4	1.31%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	5	13	4.25%
Lepidoptera			
Coleoptera	2	9	2.94%
Diptera	2	36	11.76%
Chironomidae	9	101	33.01%

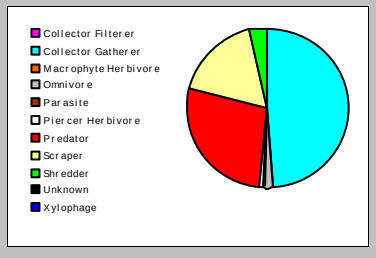


Dominant Taxa

Category	A	PRA
Torrenticola	66	21.57%
Pericoma / Telmatoscopus	34	11.11%
Orthocladius	33	10.78%
Drunella	25	8.17%
Mesenchytraeus	18	5.88%
Stictochironomus	16	5.23%
Hydrobaenus	16	5.23%
Potthastia Longimanus Gr.	14	4.58%
Optioservus	8	2.61%
Tvetenia Bavarica Gr.	7	2.29%
Micropsectra	7	2.29%
Ephemerella excrucians	6	1.96%
Drunella doddsii	6	1.96%
Baetis tricaudatus complex	6	1.96%
Arctopsyche	6	1.96%

Functional Composition

Category	R	A	PRA
Predator	9	85	27.78%
Parasite			
Collector Gatherer	14	148	48.37%
Collector Filterer	1	2	0.65%
Macrophyte Herbivore			
Piercer Herbivore	1	1	0.33%
Xylophage			
Scraper	5	56	18.30%
Shredder	2	9	2.94%
Omnivore	1	5	1.63%
Unknown			

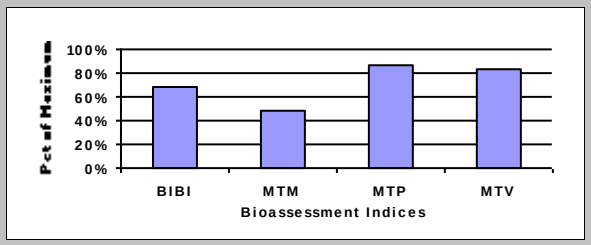


Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	33
E Richness	6
P Richness	3
T Richness	5
EPT Richness	14
EPT Percent	20.26%
All Non-Insect Abundance	98
All Non-Insect Richness	6
All Non-Insect Percent	32.03%
Oligochaeta+Hirudinea Percent	6.86%
Baetidae/Ephemeroptera	0.133
Hydropsychidae/Trichoptera	0.462
Dominance	
Dominant Taxon Percent	21.57%
Dominant Taxa (2) Percent	32.68%
Dominant Taxa (3) Percent	43.46%
Dominant Taxa (10) Percent	77.45%
Diversity	
Shannon H (loge)	2.796
Shannon H (log2)	4.033
Margalef D	5.597
Simpson D	0.091
Evenness	0.055
Function	
Predator Richness	9
Predator Percent	27.78%
Filterer Richness	1
Filterer Percent	0.65%
Collector Percent	49.02%
Scraper+Shredder Percent	21.24%
Scraper/Filterer	28.000
Scraper/Scraper+Filterer	0.966
Habit	
Burrower Richness	2
Burrower Percent	16.34%
Swimmer Richness	1
Swimmer Percent	1.96%
Clinger Richness	15
Clinger Percent	21.24%
Characteristics	
Cold Stenotherm Richness	2
Cold Stenotherm Percent	2.29%
Hemoglobin Bearer Richness	1
Hemoglobin Bearer Percent	5.23%
Air Breather Richness	0
Air Breather Percent	0.00%
Voltinism	
Univoltine Richness	13
Semivoltine Richness	4
Multivoltine Percent	58.50%
Tolerance	
Sediment Tolerant Richness	0
Sediment Tolerant Percent	0.00%
Sediment Sensitive Richness	1
Sediment Sensitive Percent	1.96%
Metals Tolerance Index	3.977
Pollution Sensitive Richness	3
Pollution Tolerant Percent	8.82%
Hilsenhoff Biotic Index	4.947
Intolerant Percent	22.88%
Supertolerant Percent	30.07%
CTQa	72.577

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	34	68.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	26	86.67%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	15	83.33%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	10	47.62%	Moderate



Metrics Report

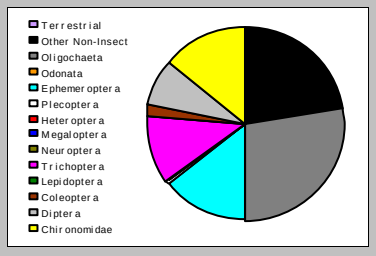
Project ID: BWTF16GR
RAI No.: BWTF16GR004
Sta. Name: South Fork
Client ID: South Fork
STORET ID South Fork
Coll. Date: 9/7/2016
Latitude: 45.266534 **Longitude:** -111.280014

Abundance Measures

Sample Count: 310
Sample Abundance: 1,550.00 20.00% of sample used
Coll. Procedure:
Sample Notes: * Site sampled in 2013 and noted in past Rhithron reports as"Knaubs" and in April 2009 as "South Fork of West Fork of Gallatin"

Taxonomic Composition

Category	R	A	PRA
Terrestrial			
Other Non-Insect	4	71	22.90%
Oligochaeta	2	84	27.10%
Odonata			
Ephemeroptera	6	44	14.19%
Plecoptera	2	2	0.65%
Heteroptera			
Megaloptera			
Neuroptera			
Trichoptera	7	36	11.61%
Lepidoptera			
Coleoptera	1	4	1.29%
Diptera	3	26	8.39%
Chironomidae	12	43	13.87%

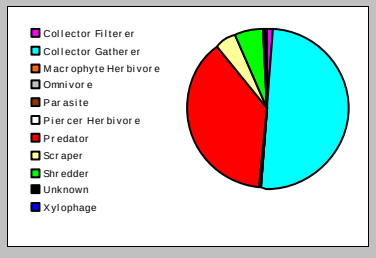


Dominant Taxa

Category	A	PRA
Torrenticola	51	16.45%
Nais	42	13.55%
Mesenchytraeus	42	13.55%
Baetis tricaudatus complex	29	9.35%
Atherix	22	7.10%
Arctopsyche	16	5.16%
Orthocladius	12	3.87%
Sperchon	11	3.55%
Lepidostoma	8	2.58%
Hygrobates	8	2.58%
Micropsectra	7	2.26%
Drunella doddsii	5	1.61%
Tvetenia Bavarica Gr.	4	1.29%
Rhyacophila Hyalinata Gr.	4	1.29%
Brachycentrus	4	1.29%

Functional Composition

Category	R	A	PRA
Predator	10	117	37.74%
Parasite			
Collector Gatherer	13	154	49.68%
Collector Filterer	2	5	1.61%
Macrophyte Herbivore			
Piercer Herbivore			
Xylophage			
Scraper	5	13	4.19%
Shredder	6	18	5.81%
Omnivore			
Unknown	1	3	0.97%



Metric Values and Scores

Metric	Value
Composition	
Taxa Richness	37
E Richness	6
P Richness	2
T Richness	7
EPT Richness	15
EPT Percent	26.45%
All Non-Insect Abundance	155
All Non-Insect Richness	6
All Non-Insect Percent	50.00%
Oligochaeta+Hirudinea Percent	27.10%
Baetidae/Ephemeroptera	0.659
Hydropsychidae/Trichoptera	0.444
Dominance	
Dominant Taxon Percent	16.45%
Dominant Taxa (2) Percent	30.00%
Dominant Taxa (3) Percent	43.55%
Dominant Taxa (10) Percent	77.74%
Diversity	
Shannon H (loge)	2.836
Shannon H (log2)	4.091
Margalef D	6.293
Simpson D	0.086
Evenness	0.053
Function	
Predator Richness	10
Predator Percent	37.74%
Filterer Richness	2
Filterer Percent	1.61%
Collector Percent	51.29%
Scraper+Shredder Percent	10.00%
Scraper/Filterer	2.600
Scraper/Scraper+Filterer	0.722
Habit	
Burrower Richness	2
Burrower Percent	1.61%
Swimmer Richness	1
Swimmer Percent	9.35%
Clinger Richness	16
Clinger Percent	17.10%
Characteristics	
Cold Stenotherm Richness	2
Cold Stenotherm Percent	2.26%
Hemoglobin Bearer Richness	2
Hemoglobin Bearer Percent	1.29%
Air Breather Richness	0
Air Breather Percent	0.00%
Voltinism	
Univoltine Richness	16
Semivoltine Richness	4
Multivoltine Percent	36.45%
Tolerance	
Sediment Tolerant Richness	0
Sediment Tolerant Percent	0.00%
Sediment Sensitive Richness	2
Sediment Sensitive Percent	5.48%
Metals Tolerance Index	3.736
Pollution Sensitive Richness	3
Pollution Tolerant Percent	9.35%
Hilsenhoff Biotic Index	5.077
Intolerant Percent	24.19%
Supertolerant Percent	34.52%
CTQa	68.893

Bioassessment Indices

BioIndex	Description	Score	Pct	Rating
BIBI	B-IBI (Karr et al.)	34	68.00%	
MTP	Montana DEQ Plains (Bukantis 1998)	25	83.33%	None
MTV	Montana Revised Valleys/Foothills (Bollman 1998)	15	83.33%	None
MTM	Montana DEQ Mountains (Bukantis 1998)	10	47.62%	Moderate