

Antietam Creek Watershed Benthic Macroinvertebrate Data 2018 - 2020

Presented at the Seneca Valley Trout Unlimited Chapter Meeting
February 8, 2021

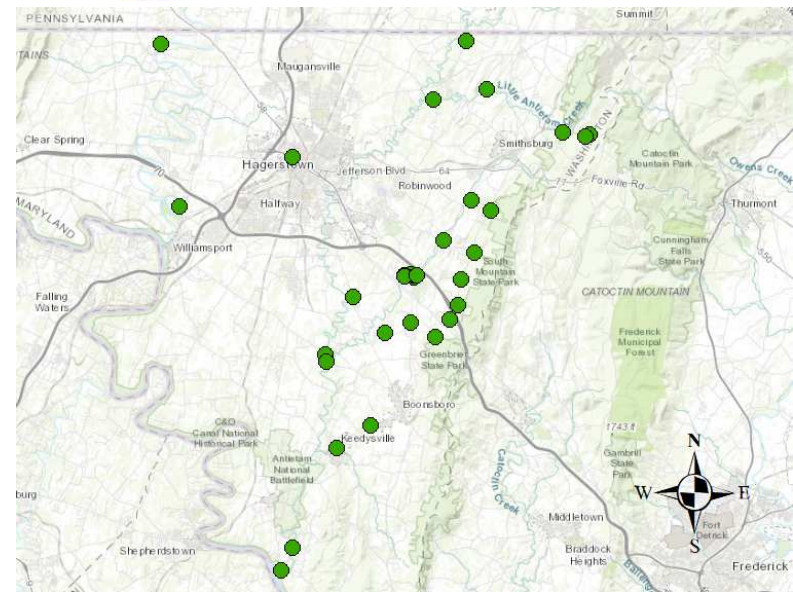
Matt Lawrence
Department of Natural Resources
Fishing and Boating Services



Washington County Benthic Sample Collection Locations



- Benthic macroinvertebrate surveys have been conducted throughout the Antietam Creek watershed and in Conococheague Creek.
- Samples collected from 2018 to 2020.
- 36 samples collected.
- This presentation will discuss the results for:
 - Little Antietam Creek
 - Beaver Creek
 - 2020 Beaver Creek trout survey
 - Beaver Creek tributaries



Why the Antietam Creek Watershed?



- Long history of diverse land use practices.
- Much effort has been invested into restoration projects.
- These efforts have been highly successful and have resulted in improved water quality and highly productive fisheries.
- Community interest continues to drive improved watershed management.



Benthic Sample Collection Methods



- Samples are collected using a D frame kick net and three, 30 second kicks.
- Benthic materials are filtered through a three tier sieve system.
- All benthic macroinvertebrates are separated from debris and placed in containers with isopropyl alcohol.
- Full samples are processed under a dissecting scope. All invertebrates are counted.
- Benthic invertebrates counts are used to generate metrics that describe water and habitat quality.



Benthic Macroinvertebrate Metrics



Richness and Diversity

Taxa Richness

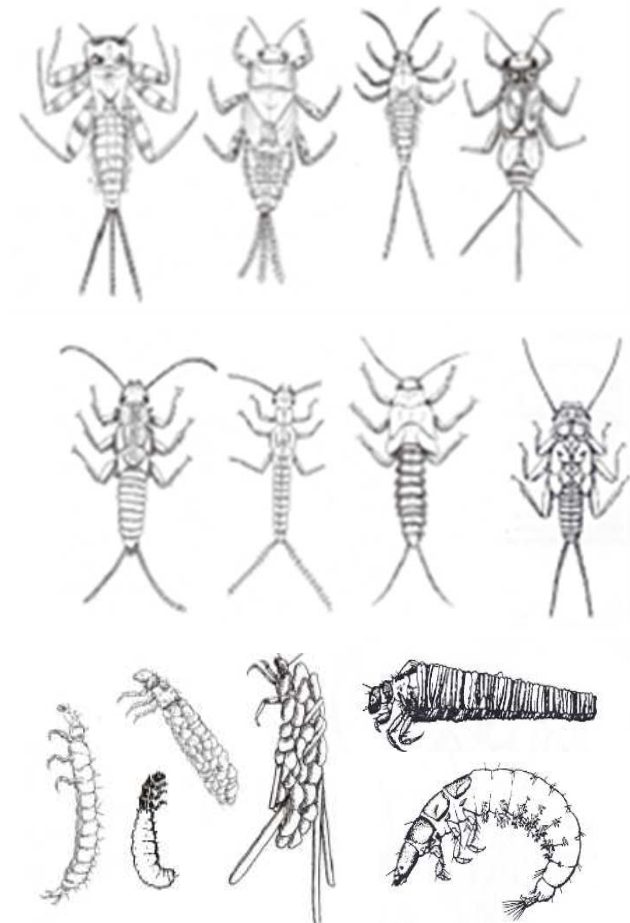
- Total number of taxa observed in the sample
- High quality streams tend to have high richness.

EPT Richness

- Total number of taxa observed from Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies).
- More taxa indicates a healthy stream.

Diversity Index

- Considers total richness and representation of each taxon.
- Preferred scores are 3.00 or greater. Scores less than 1.00 are considered to be severely impaired.
- Equitability score is based on a predicted diversity.



Benthic Macroinvertebrate Metrics



Hilsenhoff Biotic Index (HBI)

- Calculated using tolerance values for each taxon.
- Tolerance values determined by the Maryland Biological Stream Survey.
- Scores range from 0 to 10.
- Lower scores mean less tolerance to habitat degradation. Sensitive taxa have scores of 3 or less.



$$\text{Formula: } \sum_{i=1}^S (n_i * T_i) / N$$

ID	Class	Order	Family	Genus	TolVal	FFG	Habit	InvertSpeciesCode
366	Insecta	Ephemeroptera	Ephemeridae	Hexagenia	6	Collector	bu	108
330	Insecta	Diptera	Tipulidae	Hexatoma	1.5	Predator	bu, sp	109
343	Insecta	Ephemeroptera	Ameletidae	Ameletus	2.6	Collector	sw, cb	11
135	Malacostraca	Amphipoda	Hyalellidae	Hyalella	4.2	Shredder	sp	110
537	Insecta	Trichoptera	Limnephilidae	Hydatophylax	3.4	Shredder	sp, cb	111
566	Arachnida	Arachnoidea		Hydracarina	6	Predator	sw	113
18	Insecta	Coleoptera	Hydrophilidae	Hydrobius	4.1	Collector	cb, cn, sp	115
166	Insecta	Coleoptera	Dytiscidae	Hydroporus	4.6	Predator	sw, cb	116
520	Insecta	Trichoptera	Hydropsychida	Hydropsyche	7.5	Filterer	cn	117
524	Insecta	Trichoptera	Hydroptilidae	Hydroptila	6	Scraper	cn	119
109	Gastropoda	Mesogastropoda	Hydrobiidae	Amnicola	8	Scraper	cb	12
436	Insecta	Odonata	Coenagrionidae	Ischnura	9	Predator	cb	120
377	Insecta	Ephemeroptera	Isonychiidae	Isonychia	2.5	Filterer	sw, cn	123
495	Insecta	Plecoptera	Perlodidae	Isoperla	2.4	Predator	cn, sp	124
33	Insecta	Collembola	Isotomidae	Isotomurus	4.8			125
167	Insecta	Coleoptera	Dytiscidae	Laccophilus	5.4	Predator	sw, dv	128
473	Insecta	Plecoptera	Nemouridae	Amphinemura	3	Shredder	so, cn	13

Benthic Macroinvertebrate Metrics



Functional Feeding Group Analysis

- Determined by benthic macroinvertebrate feeding behavior.
- Based on Vannote's River Continuum Concept.



Scraper Filterer Ratio

- Compares total scrapers to total filterers.
- Scrapers feed primarily on the biofilm of algae and bacteria that grows on benthic substrates (periphyton).
- Filterers collect fine particulate organic matter from the water column.

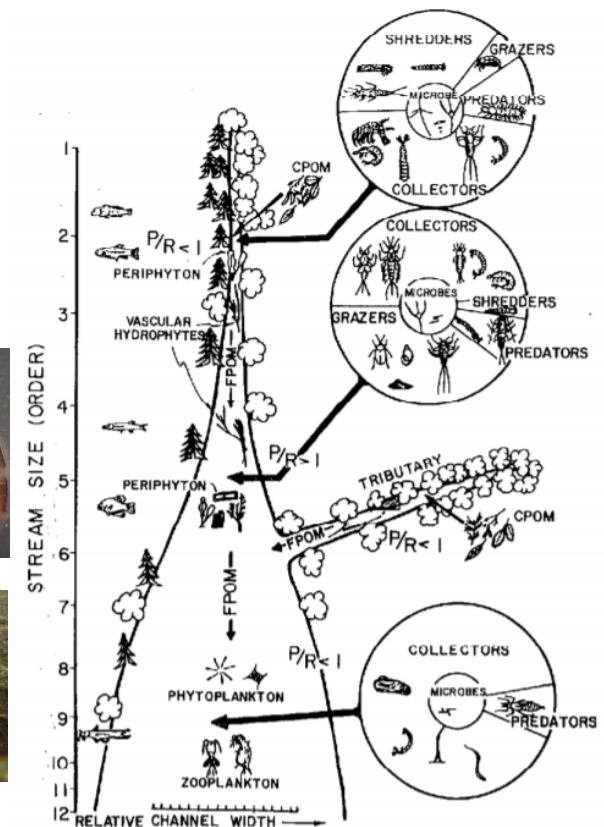


Proportion of Shredders

- Proportion of shredders in the sample.
- Shredders feed on coarse particulate organic matter (leaf litter).



Photo credit: USGS



Credit: Vannote et al. 1980

Benthic Macroinvertebrate Metrics



Coldwater Obligates

- Two stonefly genera have been identified by Maryland Biological Stream Survey as excellent indicators of coldwater resources.
- Strong correlation with brook trout.
- Taxa includes:
 - Roach-like stoneflies (*Tallaperla*)
 - Green stoneflies (*Sweltsa*)



Credit: D.S. Chandler/discoverlife.org

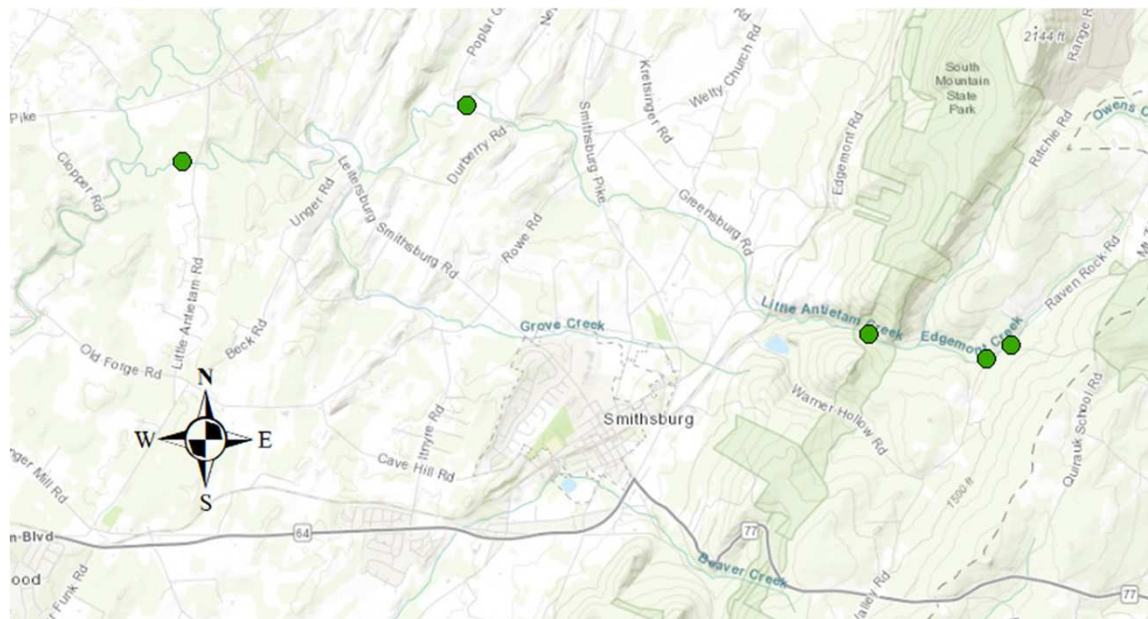


Credit: D.S. Chandler/discoverlife.org

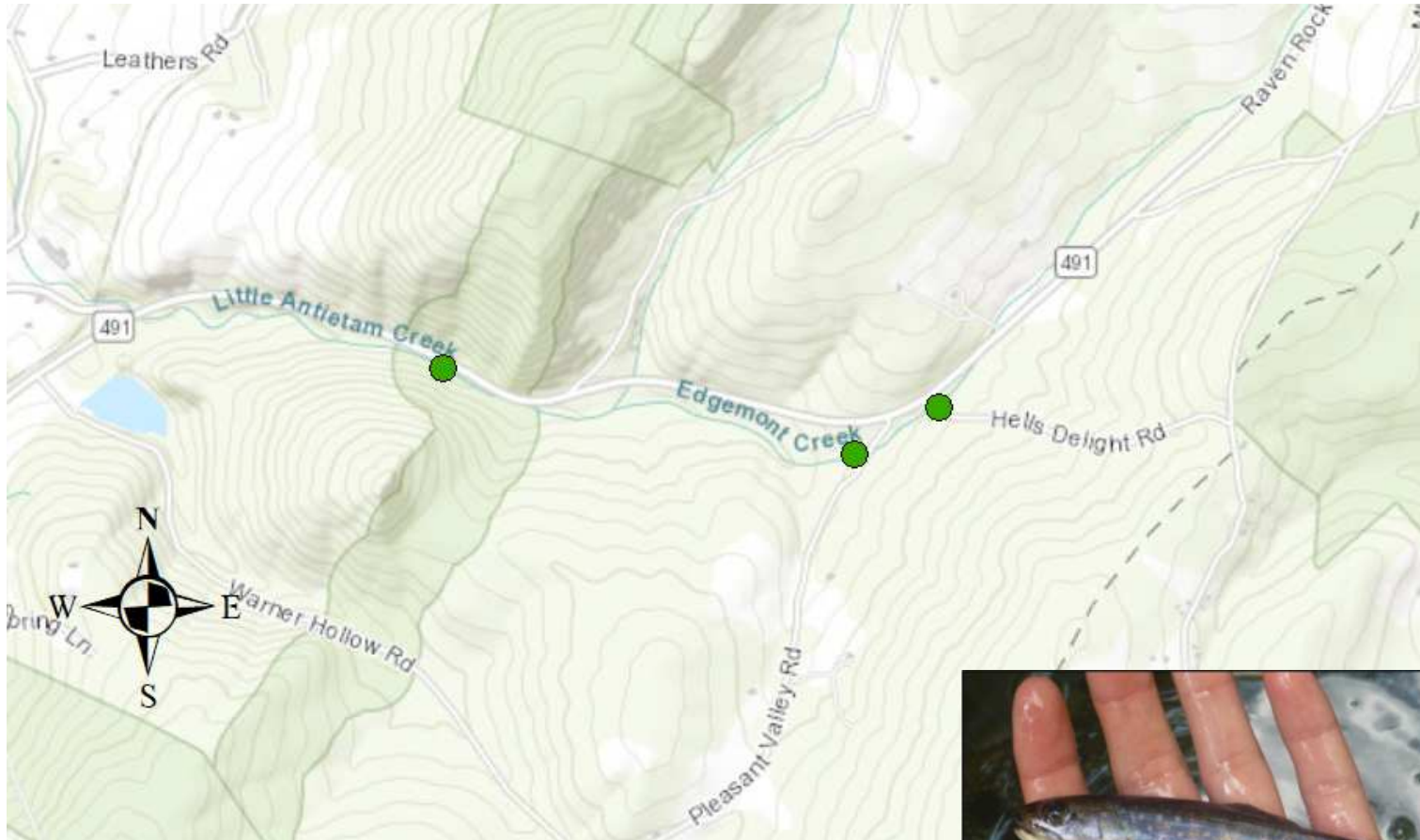
Little Antietam Creek



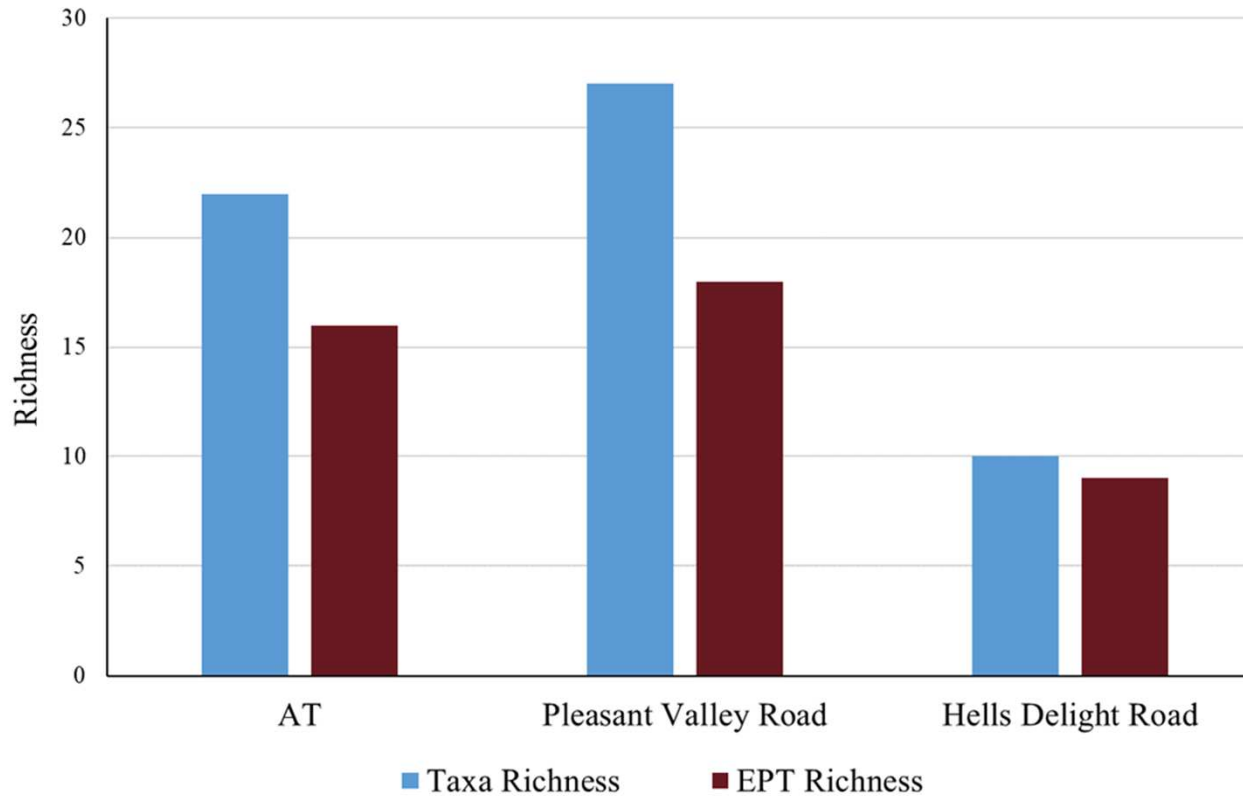
- One of only a few streams that supports wild brook trout, brown trout, and rainbow trout.
- Brook trout population inhabits Little Antietam Creek above Route 491.
- Some habitat related issues have impacted the brook trout populations, so monitoring is important.



Little Antietam Creek



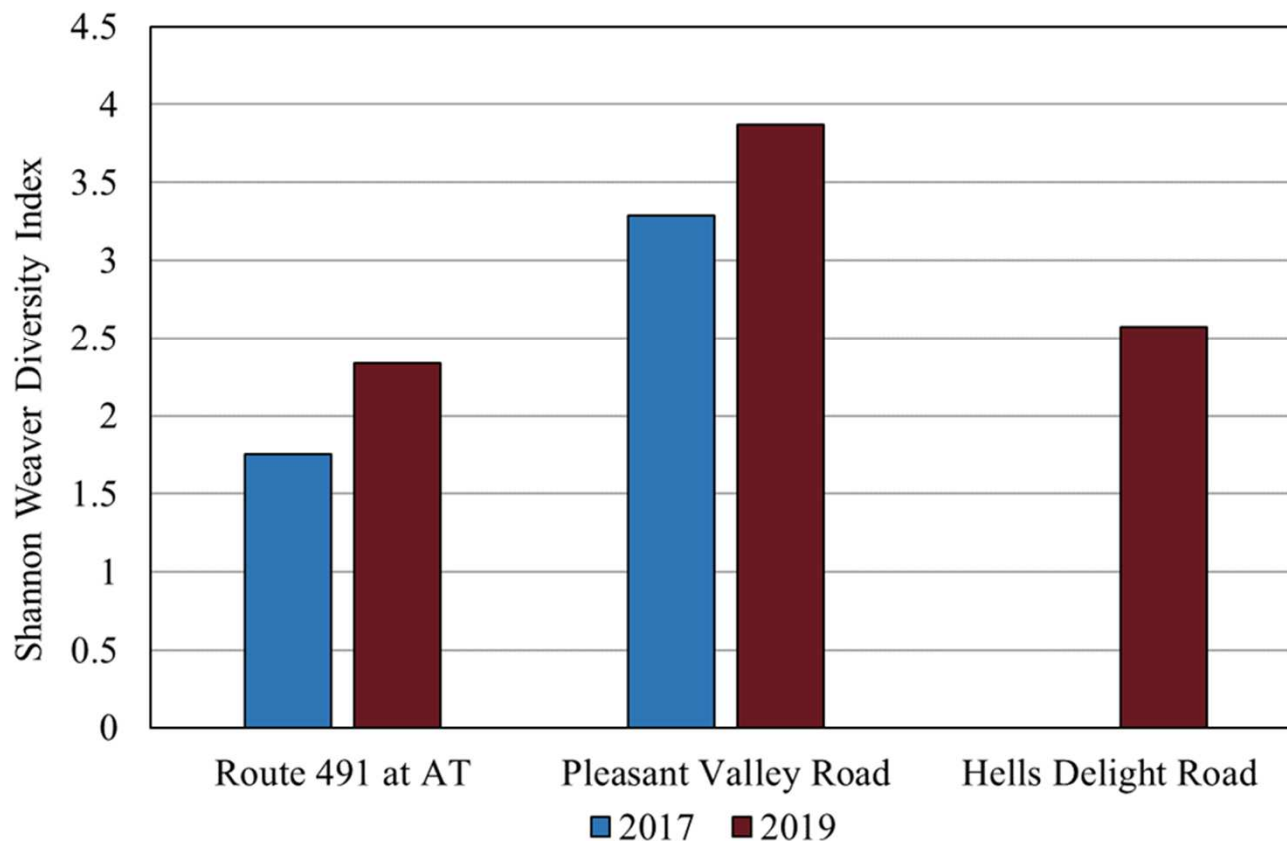
Little Antietam Creek - Richness



Popular Grove Road: Taxa richness = 8; EPT taxa = 3

Upstream of mouth: Taxa richness = 21; EPT taxa = 6

Little Antietam Creek – Diversity and Equitability

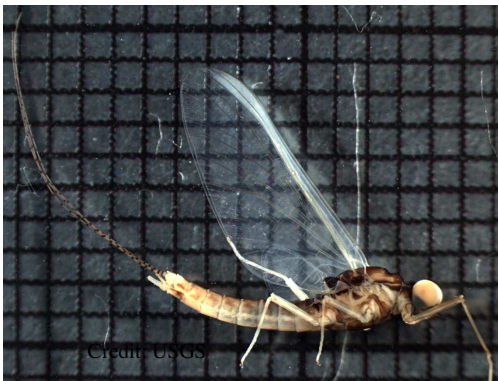


- Equitability scores above Route 491 suggested impairment in 2017, but improved in 2019.
- Results from downstream sites varied. Only the Popular Grove Road diversity score suggested impairment (2.02).

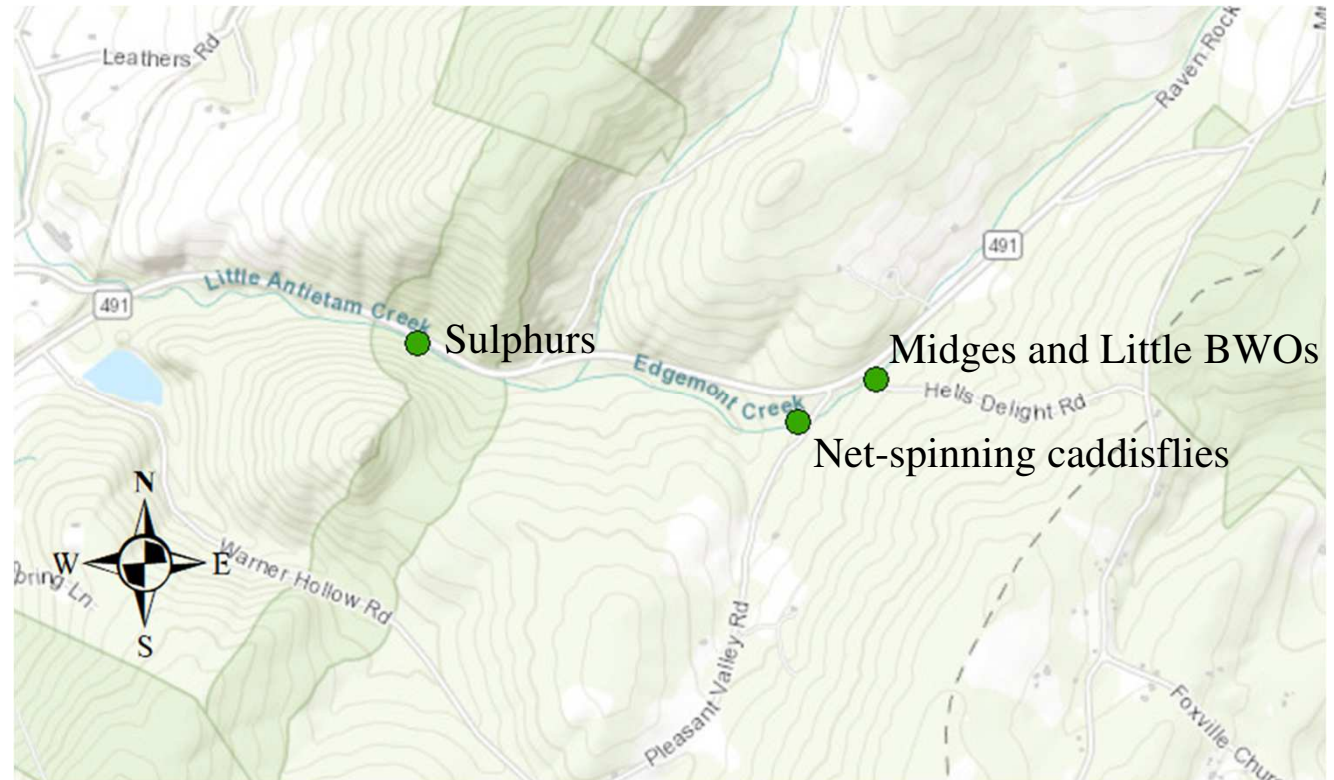
Little Antietam Creek – Dominant Taxa



Credit: macroinvertebrates.org



Credit: USGS



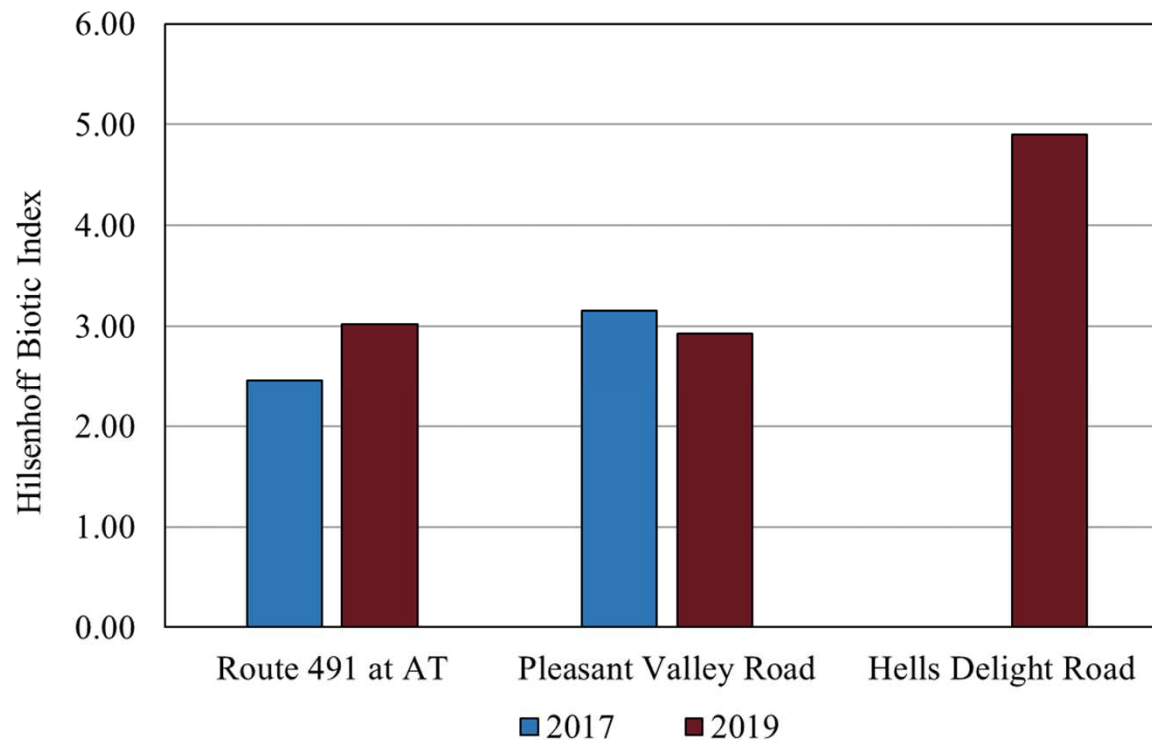
Coldwater obligates:

- Hells Delight Road (*Sweltsa*)
- Pleasant Valley Road (*Sweltsa* and *Tallaperla*)
- Route 491 at AT (*Sweltsa*)

Important taxa also included:

- Blue quills (*Paraleptophlebia*)
- Green sedges (*Rhyacophila*)
- Golden/Common stoneflies (*Acroneuria*)
- Yellow stoneflies (*Isoperla*; 2017)

Little Antietam Creek – Hilsenhoff Biotic Index



- HBI scores were 3.15 or less for both samples at the AT and Pleasant Valley Road.
- The Hells Delight Road score was much higher (4.90). May have been influenced by small sample size.

Little Antietam Creek – Functional Feeding Groups



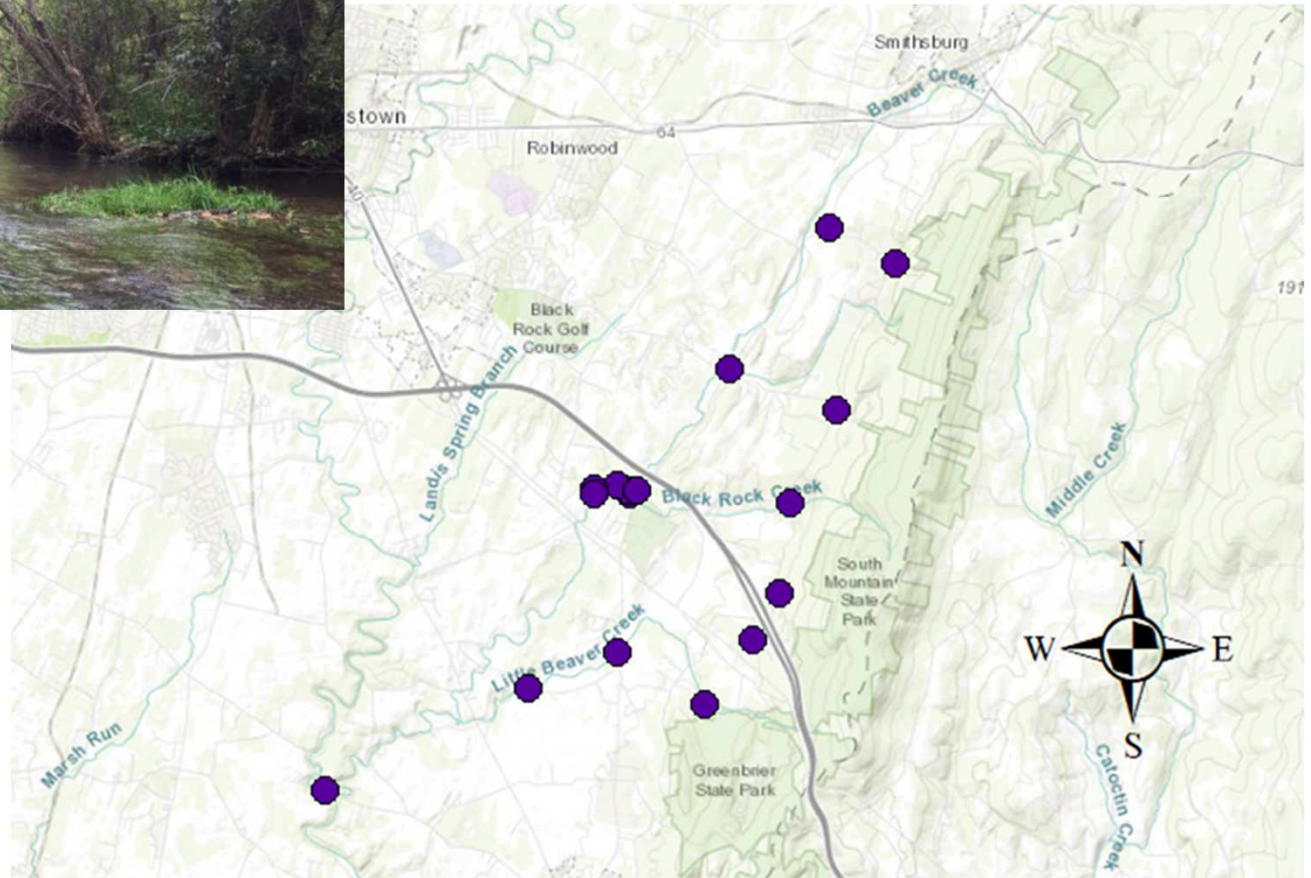
Functional feeding group metrics were generally poor.

- Low scores expected below Route 491.
- Only 2019 scraper filterer ratio at AT and 2017 proportion of shredders at Pleasant Valley Road indicate no impairment.

Location	Scraper Filterer Ratio		Proportion of Shredders	
	2017	2019	2017	2019
Hells Delight Road	--	0.67	--	0.05
Pleasant Valley Road	0.17	0.06	0.45	0.07
Route 491 at AT	0.12	2.13	0.05	0.01
Poplar Grove Road	--	0.06	--	0.07
Upstream of mouth*	--	0.63	--	0.01

* = 2018

Beaver Creek



Beaver Creek – Sample Locations

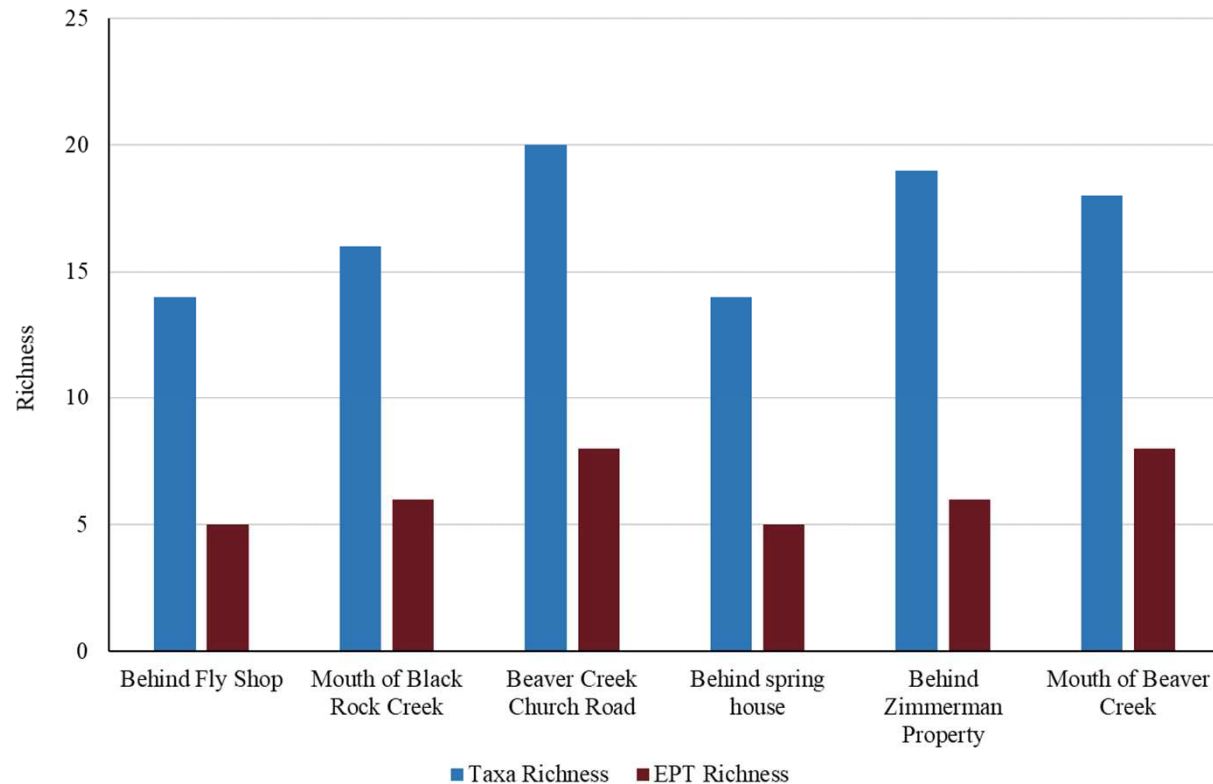


Stations include:

- Behind the Fly Shop
- Mouth of Black Rock Creek
- Beaver Creek Church Road
- Behind the Spring House
- Behind Zimmerman Property
- Mouth of Beaver Creek (not pictured)



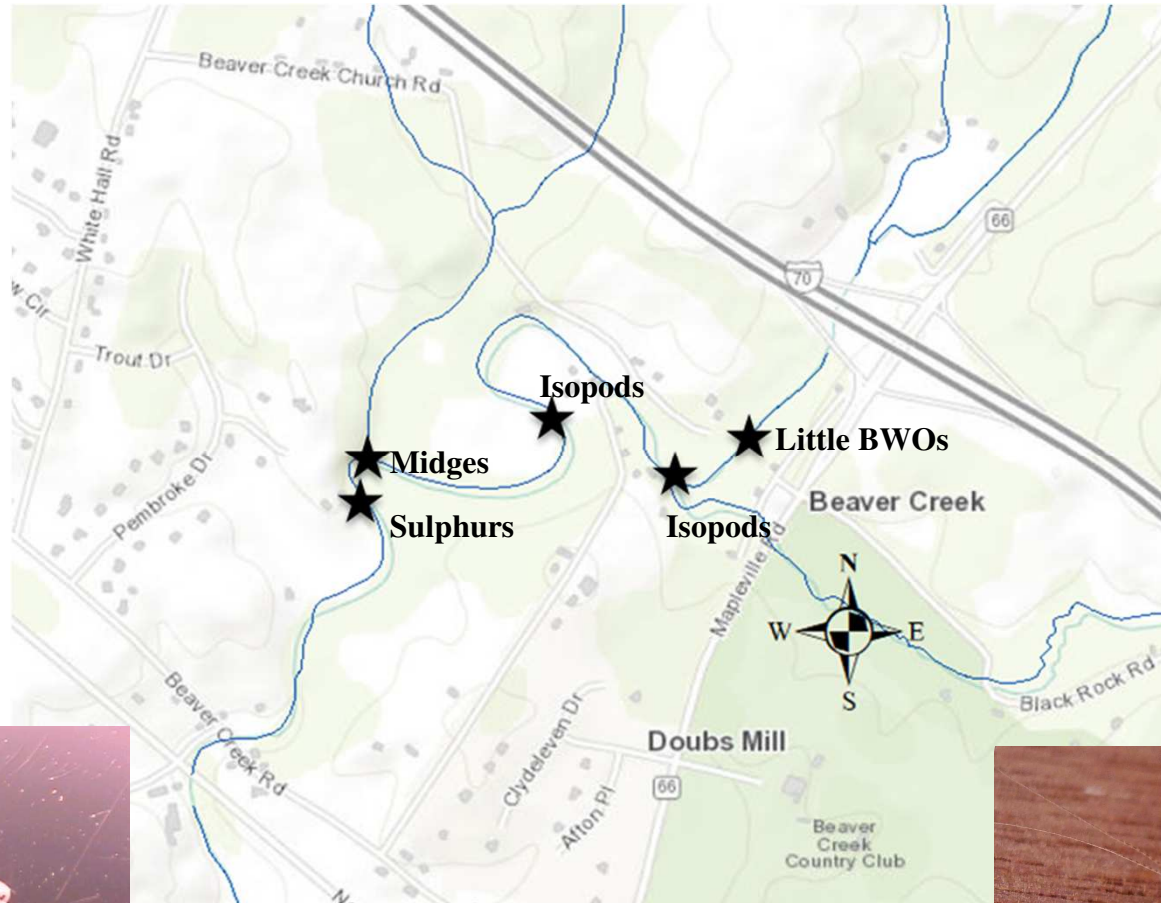
Beaver Creek – Richness



Richness:

- Average taxa richness from the fly shop to Zimmerman Property was 16.6 (14 - 20).
- Average EPT richness from the fly shop to Zimmerman Property was 6 (5-7).
- Taxa richness at the mouth was 18.
- Diversity and equitability indices support the richness metrics.

Beaver Creek – Dominant Taxa



Credit: Erin Hayes-Pontius



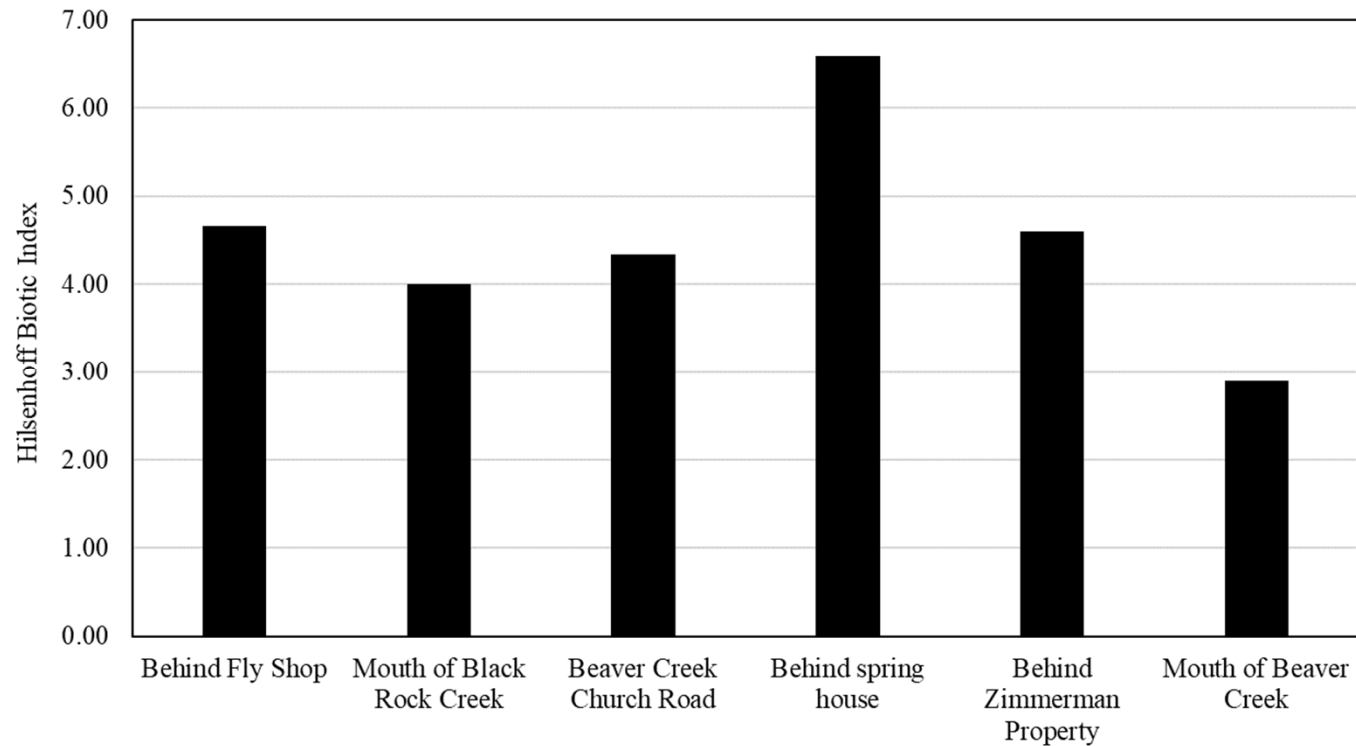
Credit: Gail Hampshire

Beaver Creek – Hilsenhoff Biotic Index



Upstream HBI: 4.40 (Very Good).

Downstream HBI: 2.89 (Excellent) - high representation of sulphurs (*Ephemerella*).



Beaver Creek – Historic Data



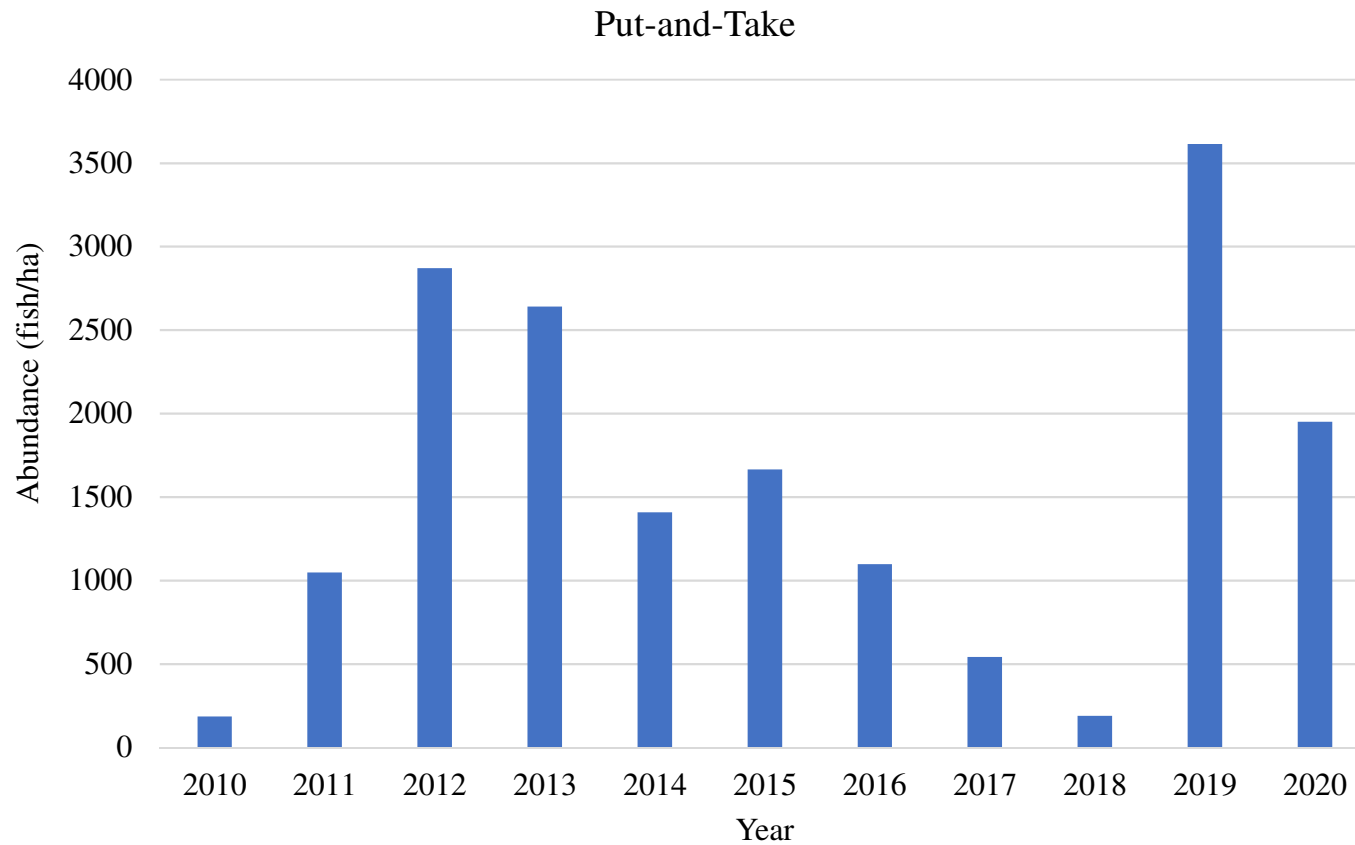
Metric	1999 (Average)	2018
Taxa Richness	16 (max = 17)	20
EPT Richness	6 (max = 9)	8
Diversity	2.54	2.22
Equitability	0.51	0.3
Dominant taxa	Isopods, 46.7%	Isopods, 55%
HBI	4.75	4.33
Scraper filterer ratio	0.19	0.79
Proportion of shredders	0.13	0.17



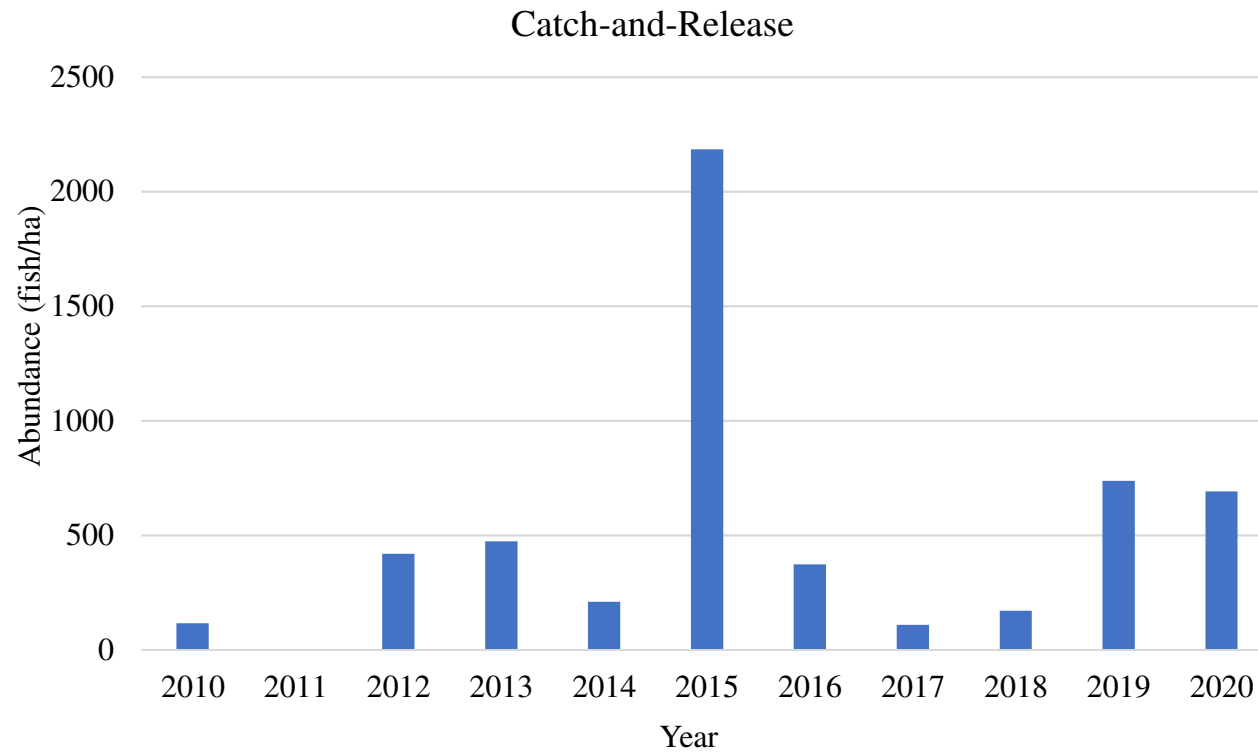
Beaver Creek – 2020 Trout Survey



Beaver Creek Trout Survey – Young-of-Year



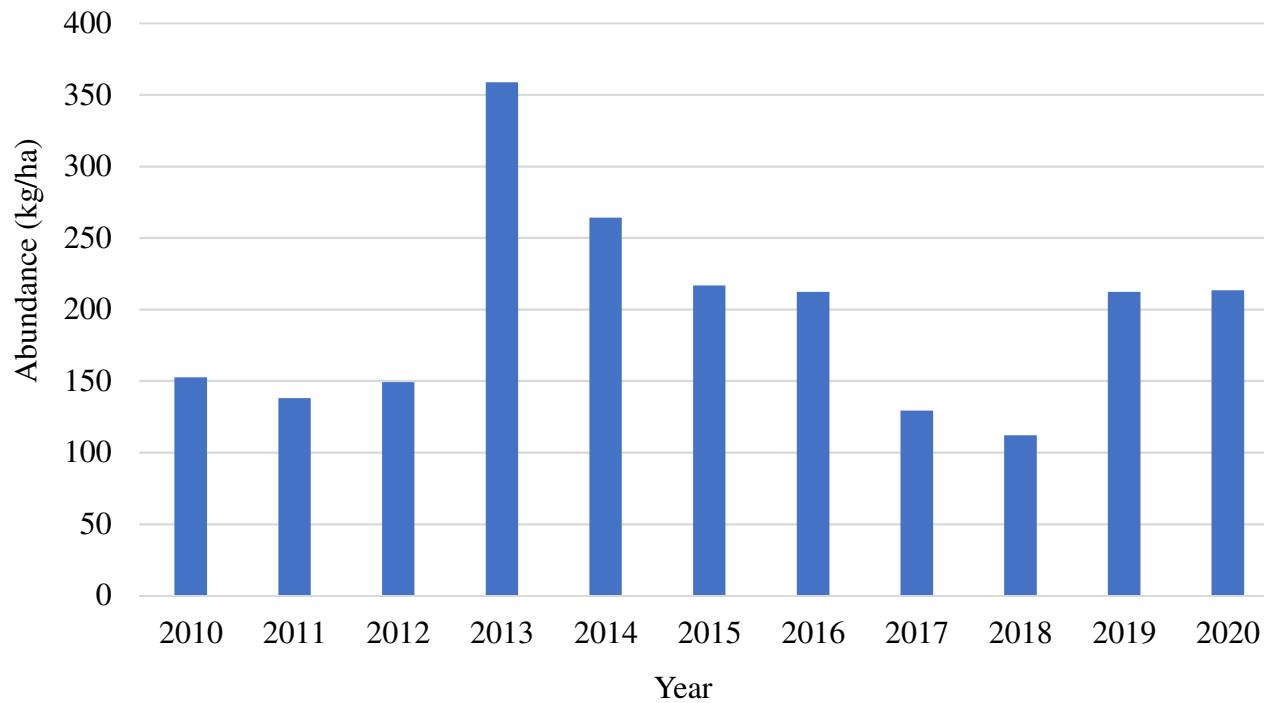
Beaver Creek Trout Survey – Young-of-Year



Beaver Creek Trout Survey – Adult



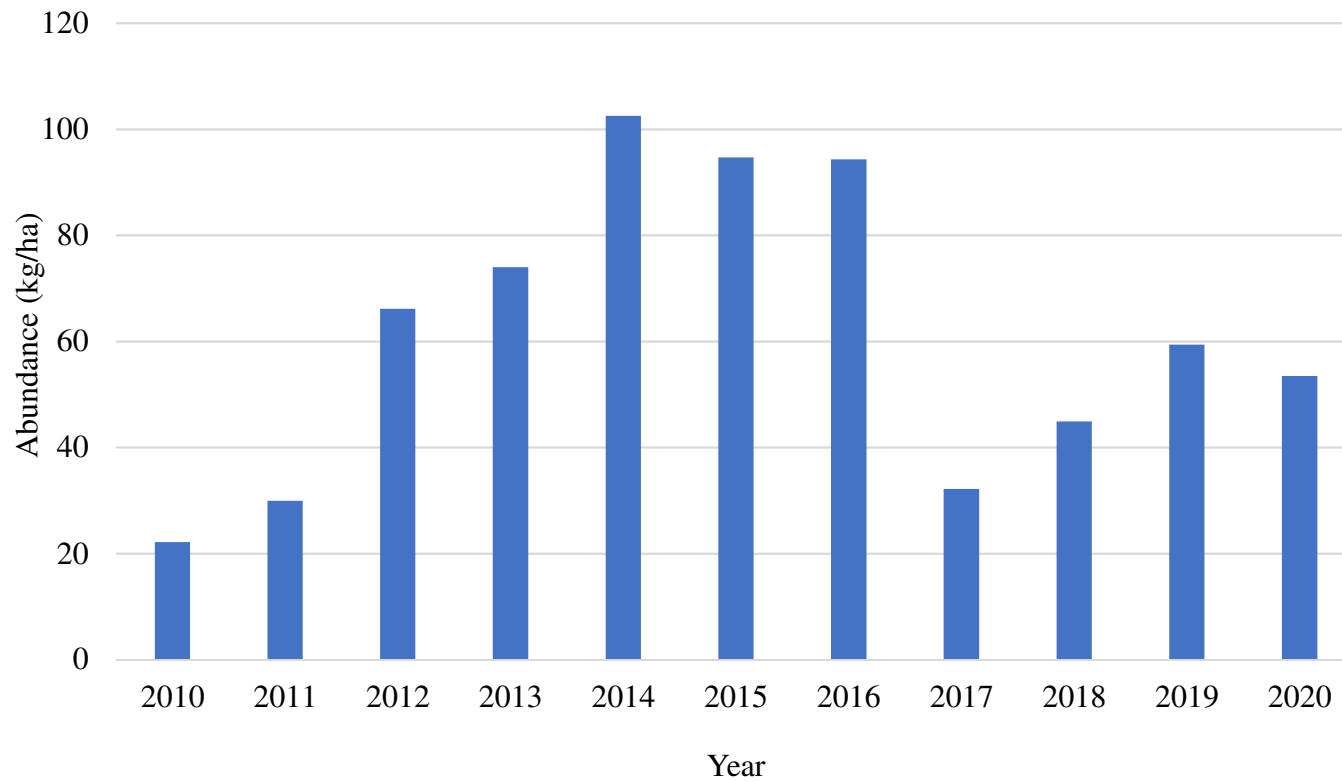
Put-and-Take



Beaver Creek Trout Survey – Adult



Catch-and-Release



Beaver Creek Trout Survey



Average Total Biomass kg/Ha

Top 8 (2015-2019)

Beaver Creek

Middle Fork

Gunpowder Falls - below Dam

Little Savage River

Poplar Lick

Savage River - below Dam

Koontz Run

Savage River – middle

Average Number of Trout > 10 inches/Ha

Top 8 (2015-2019)

Beaver Creek

Savage River - below Dam

Hunting Creek - middle

Savage River - middle

Gunpowder Falls - below Dam

Little Hunting Creek - middle

Bee Tree Run - middle

Hunting Creek - upper

Black Rock Creek – Survey Locations



Benthic samples collected at:

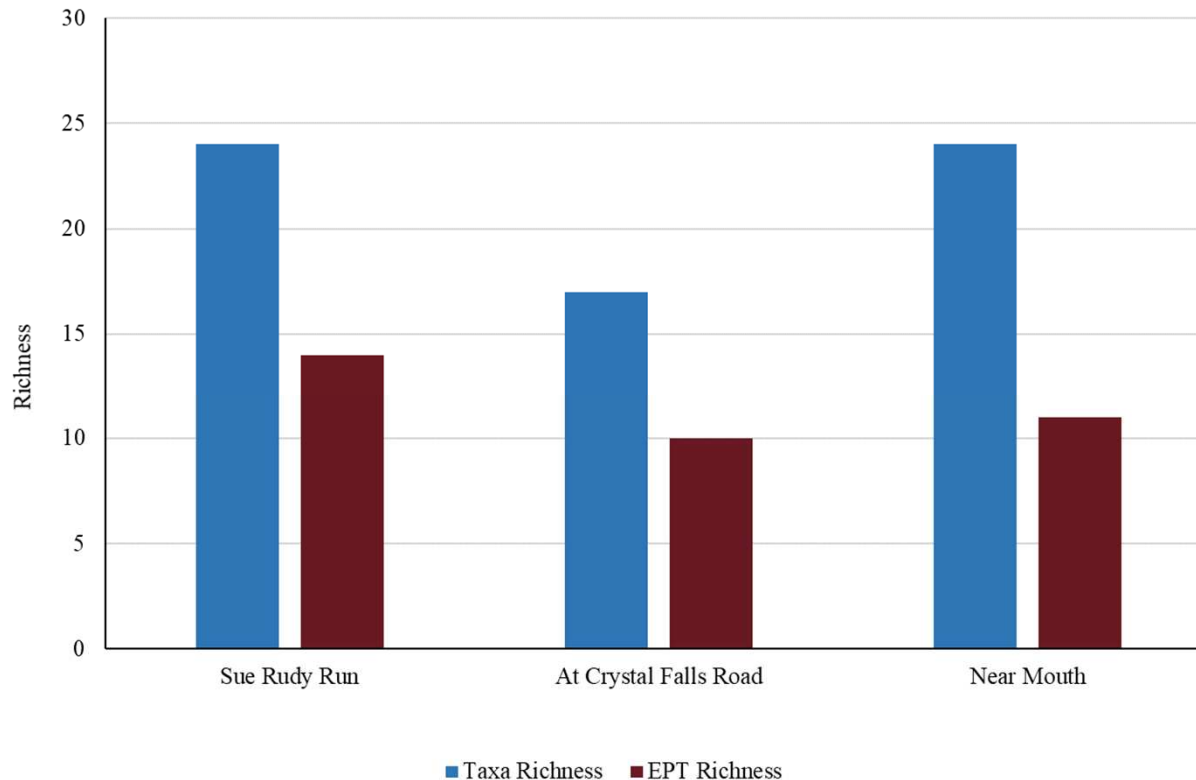
- Crystal Falls Road (2018 and 2019)
- Confluence with Beaver Creek (2018)
- In Sue Rudy Run near Crystal Falls Road (2020)

Black Rock Creek – Richness

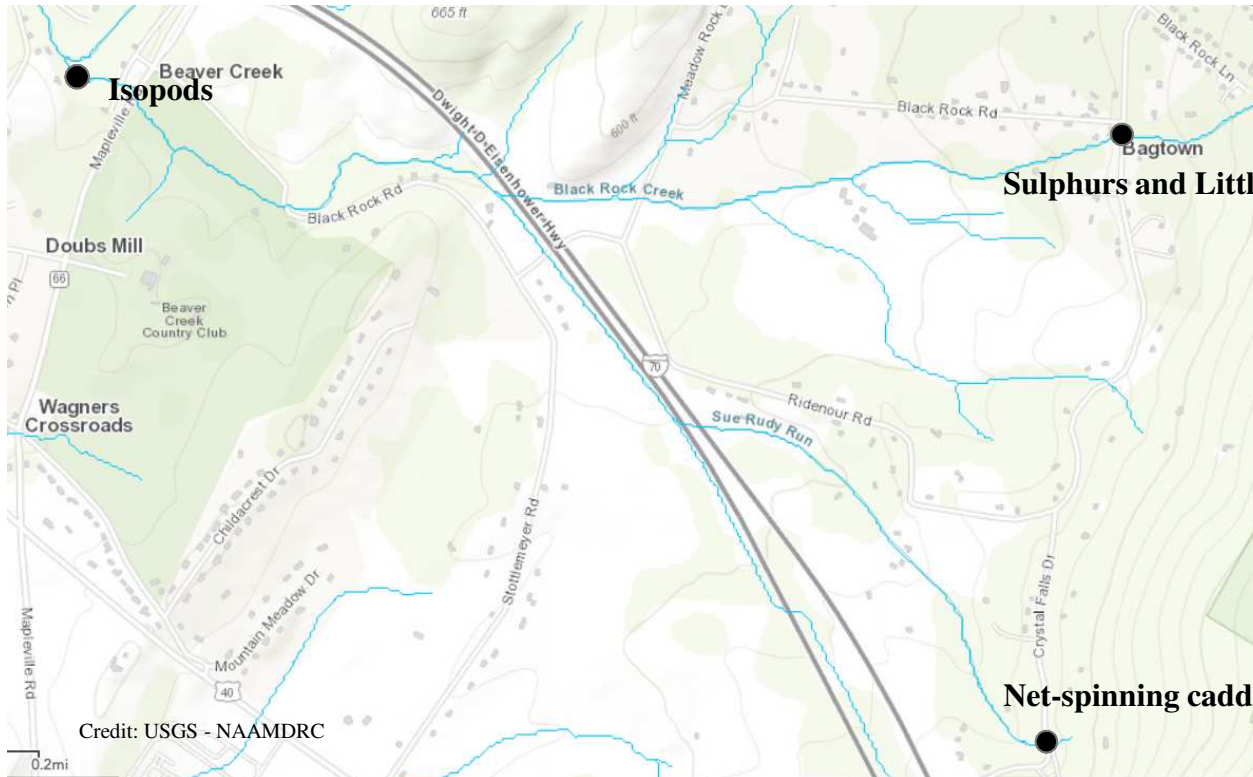


Excluding the sample collected in the mainstem at Crystal Falls Road:

- Taxa richness range: 20 – 24.
- EPT richness > 10
- Diversity and equitability indices indicated minimal impairment.
- Mainstem at Crystal Falls Road showed signs of degradation in 2018, but rebounded in 2019.



Black Rock Creek – Dominant Taxa



Sulphurs and Little BWOs



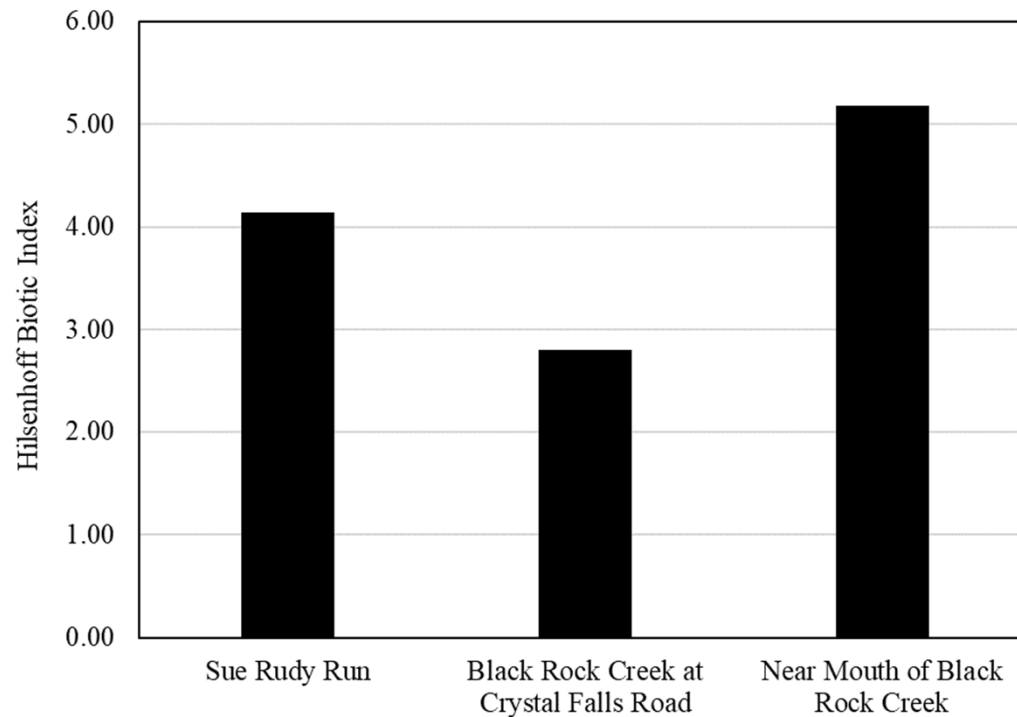
Net-spinning caddisflies



Additional benthic assemblage information:

- 9 *Tallaperla* identified in 2019 Crystal Falls Road sample.
- No coldwater obligates observed at other stations, but Sue Rudy Run sample included blue quills, green sedges, and *Diplectrona*.

Black Rock Creek – Hilsenhoff Biotic Index



HBI scores ranged from 5.17 at the mouth of Black Rock Creek to 2.80 (average) at Crystal Falls Road.

Black Rock Creek – Historic Data



Credit: USGS - NAAMDRC



Credit: D.S. Chandler/discoverlife.org

Metric	1999 (avg.)	2018
Taxa Richness	18 (max = 20)	24
EPT Richness	7 (max = 9)	11
Diversity	2.87	3.78
Equitability	0.61	0.83
Dominant taxa	Isopods, 33%	Isopods, 25%
HBI	3.46	5.17
Scraper filterer ratio	2.59	0.66
Proportion of shredders	0.12	0.10

Mount Aetna Creek and Unnamed Tributary at Pondsville Road



Collection locations:

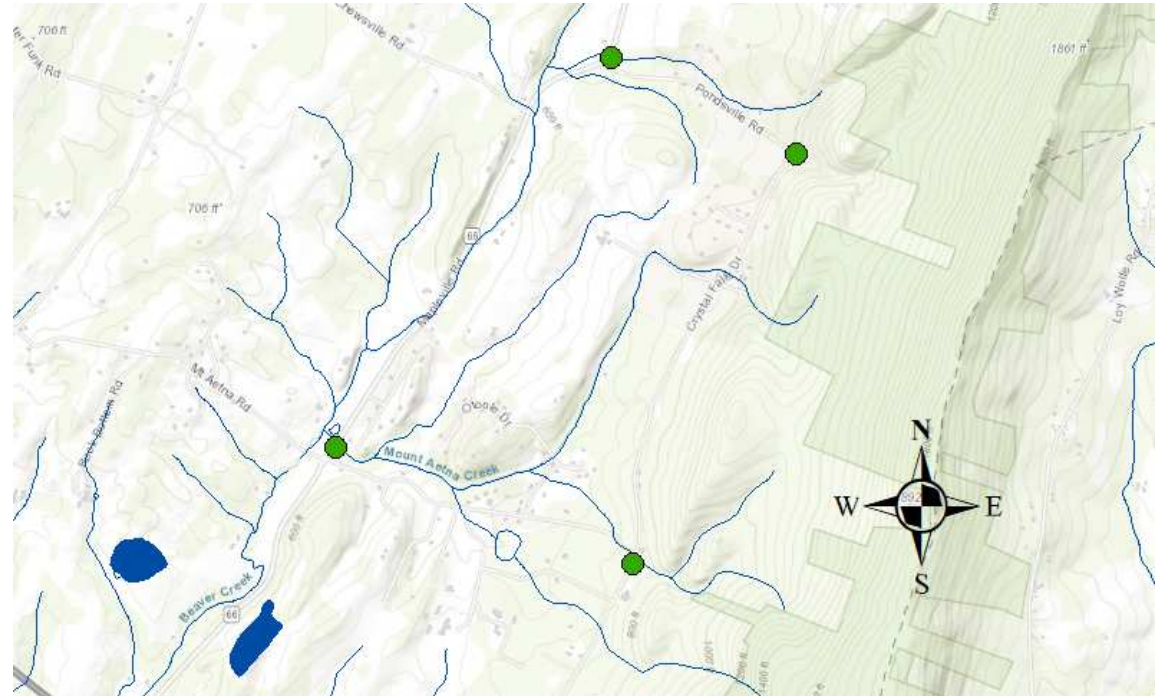
UT at Pondsville Road

- Crystal Falls Road
- Route 66

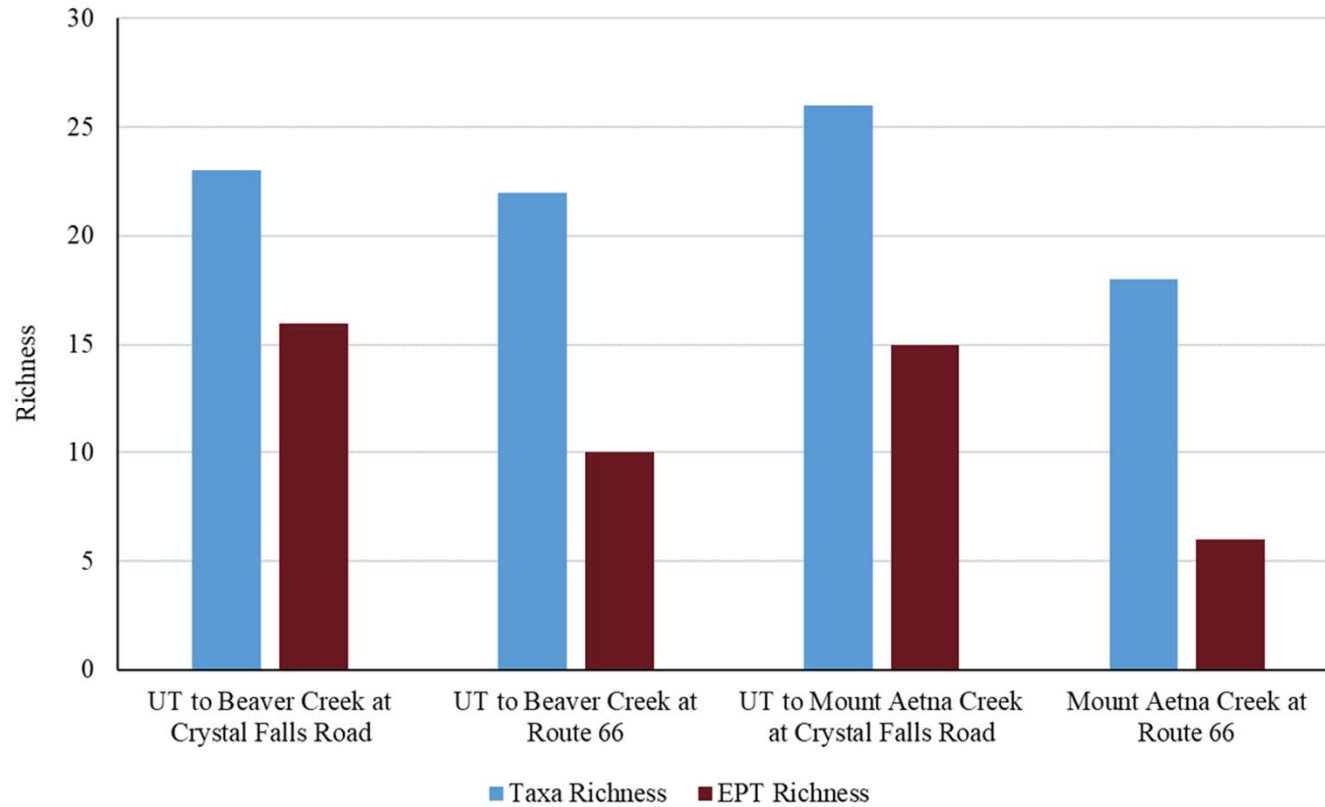
Mount Aetna Creek

- UT at Crystal Falls Road
- Route 66

All samples collected in 2018.

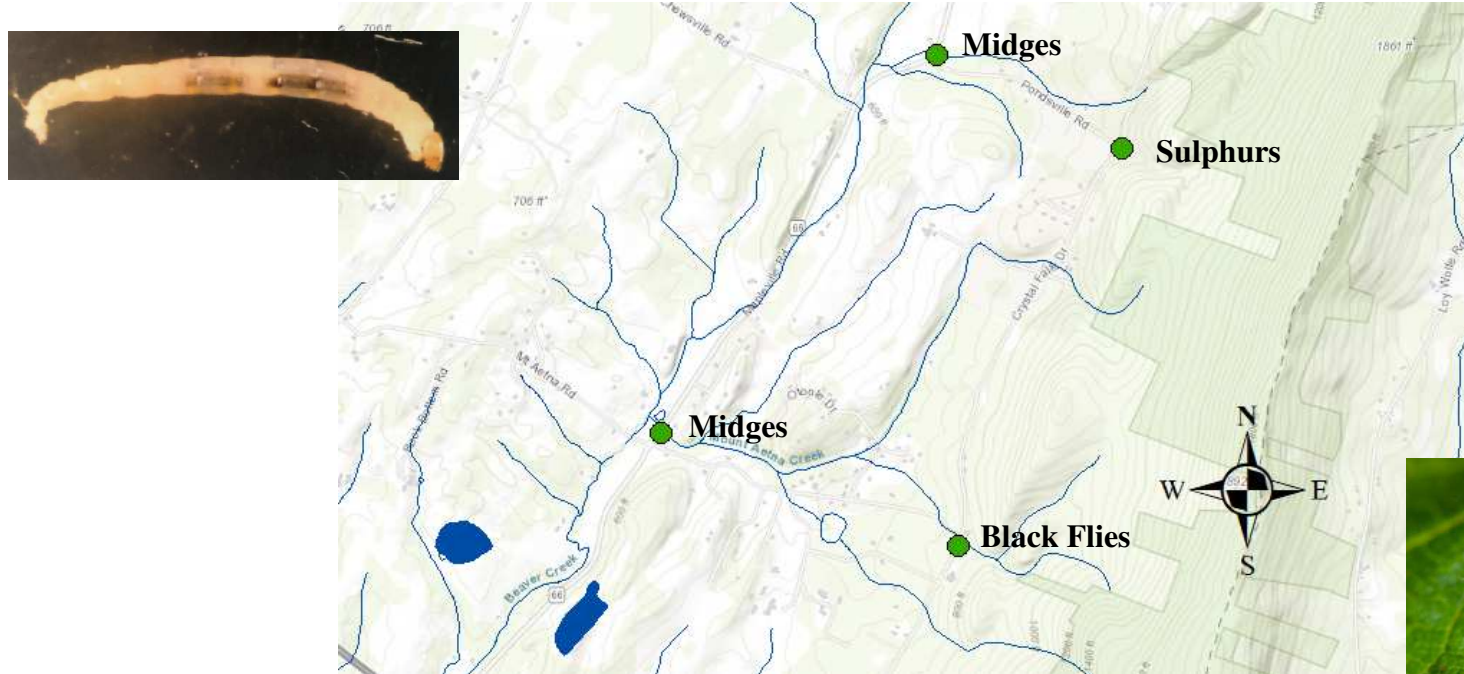


Mount Aetna Creek and Unnamed Tributary at Pondsville Road Richness



- Richness indicated moderate impairment only at Mount Aetna Creek and Route 66.
- Diversity and equitability indices suggest minimal impairment at all sites.

Mount Aetna Creek and Unnamed Tributary at Pondsville Road Dominant Taxa



Credit: Matt Bertone/NC St

Other important taxa included:

- Blue quills
- Yellow stoneflies
- Golden/Common stoneflies
- Giant stoneflies
- Green sedges
- *Diplectrona*

Coldwater obligates:

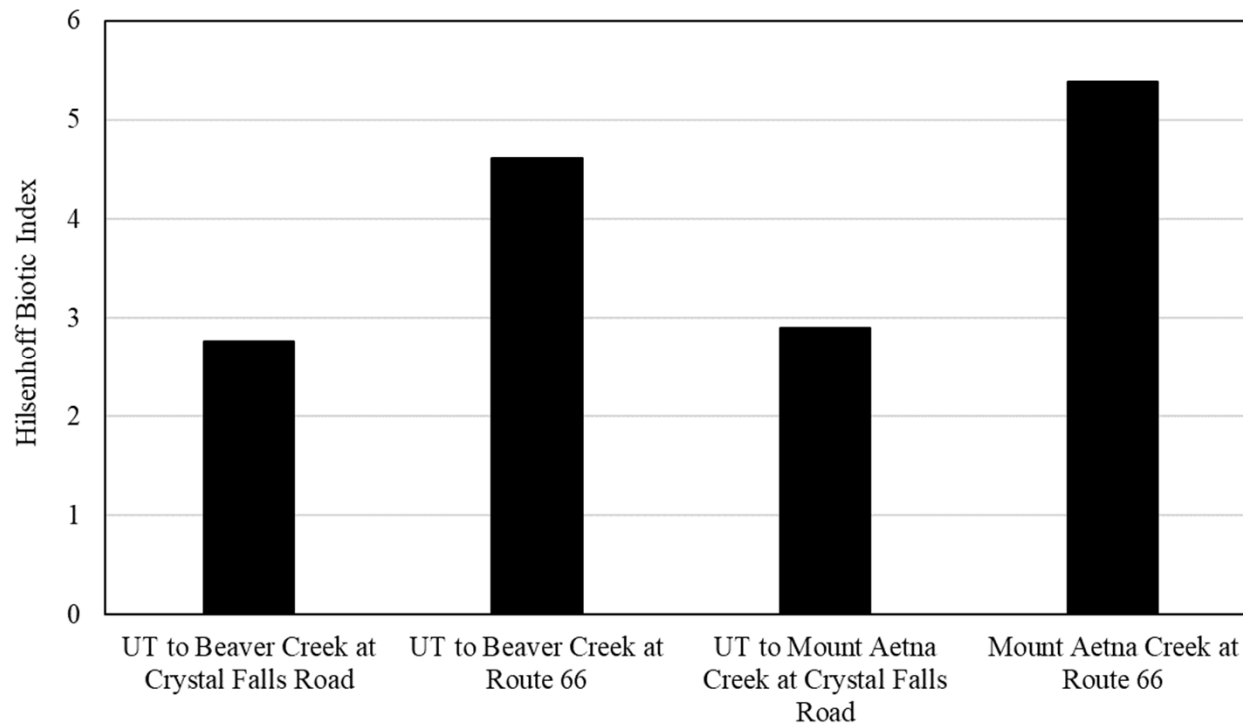
- Identified in both upstream stations.
- UT at Pondsville Road:
 - 4 *Sweltsa*
 - 2 *Tallaperla*
- UT to Mount Aetna Creek
 - 2 *Sweltsa*
 - 11 *Tallaperla*

Mount Aetna Creek and Unnamed Tributary at Pondsville Road
Hilsenhoff Biotic Index



HBI scores were all 5.38 or less, with upstream scores better than downstream scores.

- Both samples at Crystal Falls Road had a score of less than 3.00.
- Both samples collected near Route 66 suggested some impairment, but had a narrative score of “good”.



Mount Aetna Creek and Unnamed Tributary at Pondsville Road
Functional Feeding Groups



Functional Feeding Group Metrics

- All tributary scraper filterer ratios were 1.00 or less but improve downstream.
- Proportion of shredders was more predictable, with higher representation of shredders upstream.

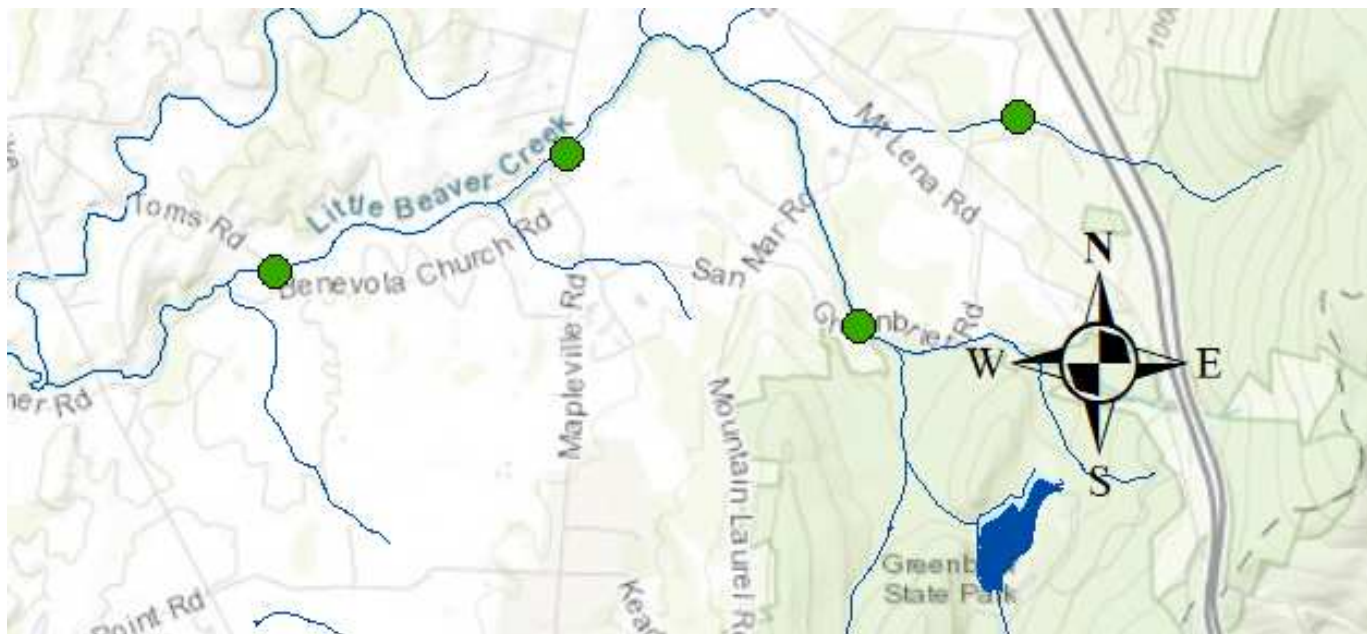
Location	<i>Scraper Filterer Ratio</i>	<i>Proportion of Shredders</i>
UT to Beaver Creek at Crystal Falls Road	0.42	0.11
UT to Beaver Creek at Route 66	0.75	0.03
UT to Mount Aetna Creek at Crystal Falls Road	0.34	0.31
Mount Aetna Creek at Route 66	1.00	0.22
Beaver Creek - Beaver Creek Church Road	0.78	0.17
Beaver Creek – above mouth	2.07	0.00

Little Beaver Creek

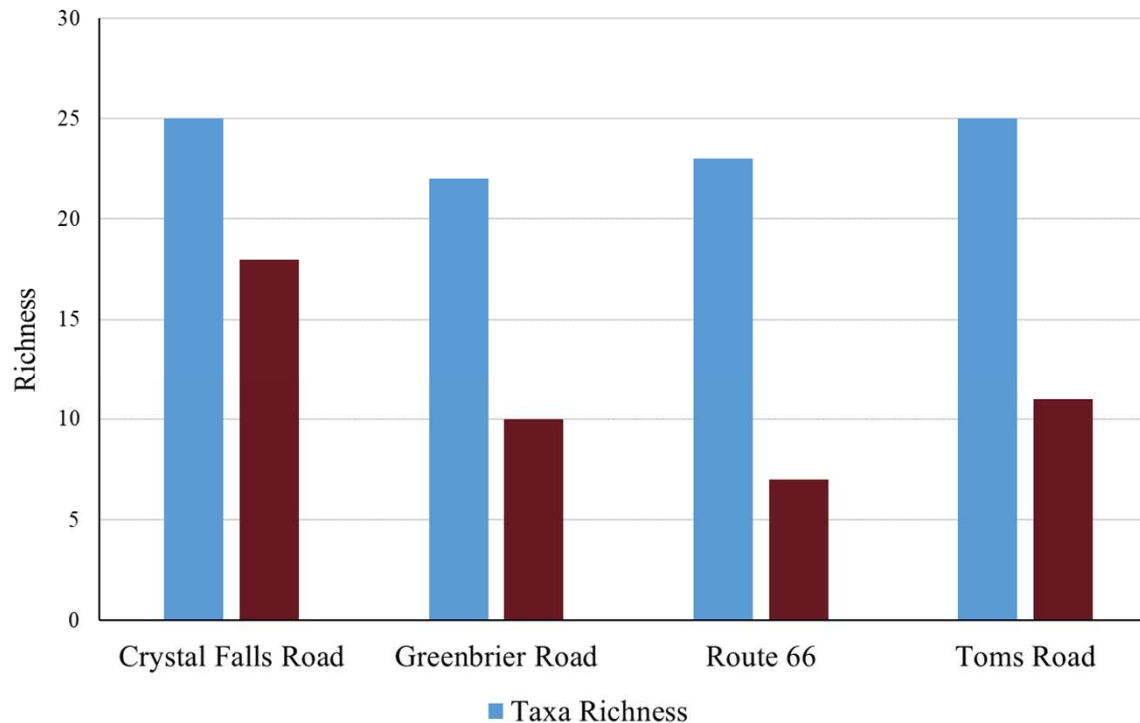


Little Beaver Creek survey sites.

- UT to Little Beaver Creek at Crystal Falls Road
- Little Beaver Creek at Greenbrier Road
- Little Beaver Creek at Route 66 (2019)
- Little Beaver Creek at Toms Road.



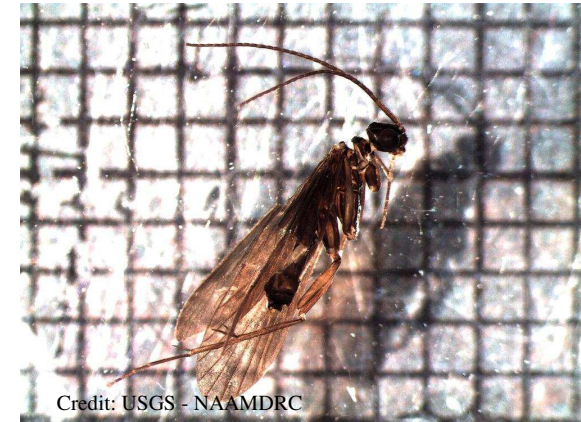
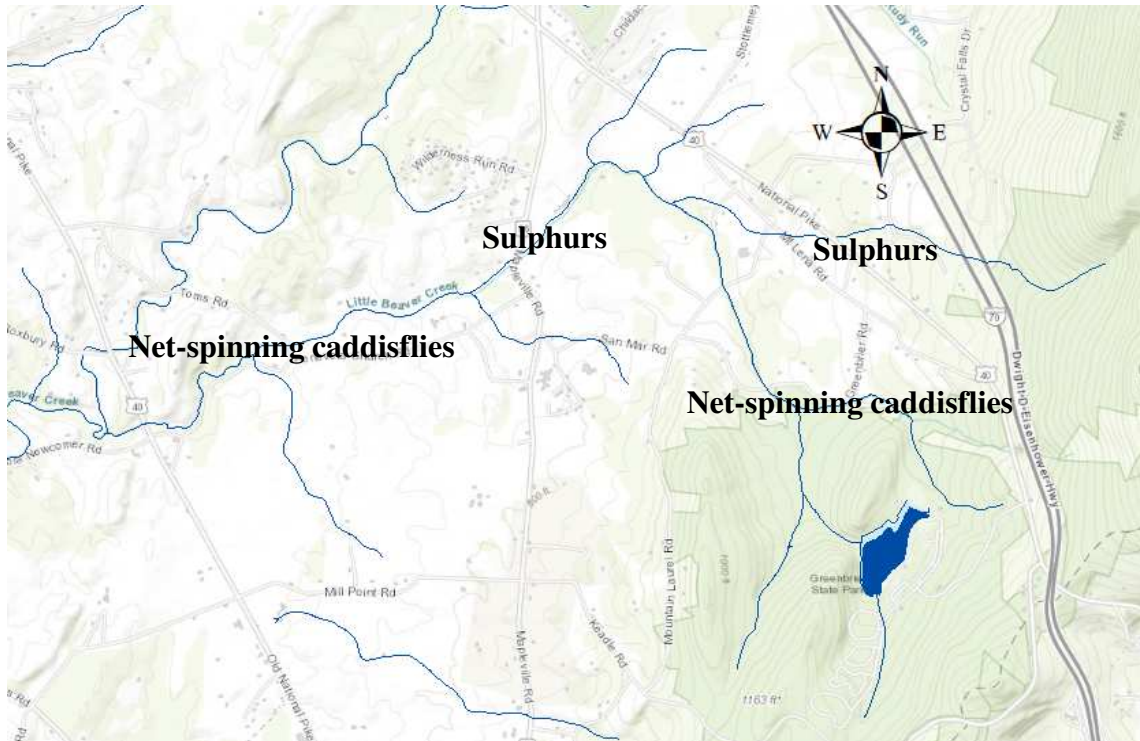
Little Beaver Creek- Richness



Richness Scores

- Taxa richness ranged from 22 to 25 (slightly impacted).
- EPT richness ranged from 7 to 18.
 - Only Route 66 considered to be slightly impacted.

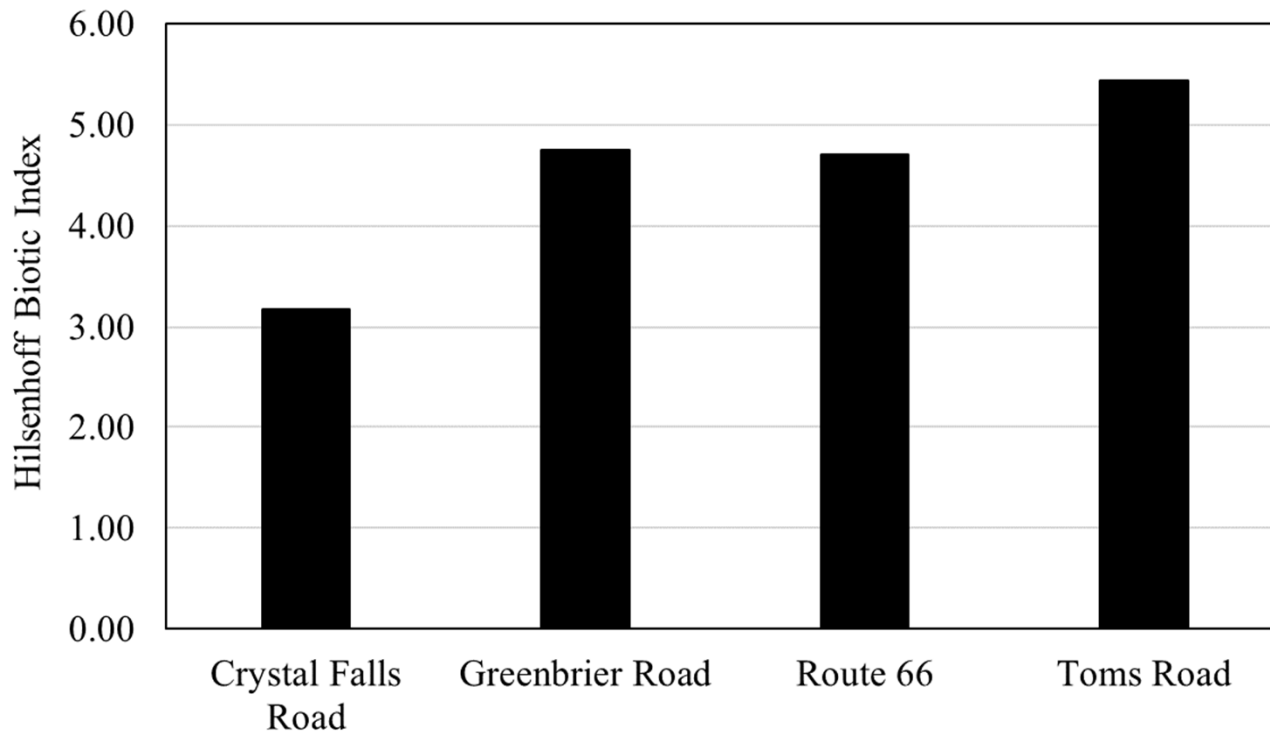
Little Beaver Creek - Dominant Taxa



Location	<i>Sweltsa</i>	<i>Tallaperla</i>
UT at Crystal Falls Road	4	2
Greenbrier Road	2	0
Route 66	0	0
Toms Road	0	0



Little Beaver Creek – Hilsenhoff Biotic Index



HBI scores were all 5.43 or less.

- Crystal Falls Road – 3.16
- Greenbrier Road – 4.75
- Route 66 – 4.70
- Toms Road – 5.43

Little Beaver Creek – Functional Feeding Groups



Functional Feeding Groups

- Scraper filterer ratio declined at downstream stations.
- Shredders were under represented at all stations except UT at Crystal Falls Road.

Location	Scraper Filterer Ratio	Proportion of Shredders
UT at Crystal Falls Road	1.80	0.10
Greenbrier Road	0.45	0.03
Route 66	0.23	0.00
Toms Road	0.16	0.00

Thank you

