Spatial and Temporal Trends in Biological, Physical, and Chemical Data (1995 – 2020) Collected at 30 Stream Sites within the Maryland Sentinel Site Network

November 2023

Department of Natural Resources
Resource Assessment Service

DNR 12-042823-354

Wes Moore, Governor

Josh Kurtz, Secretary

Resource Assessment Service
Monitoring and Non-Tidal Assessment
580 Taylor Ave, C-2
Annapolis, Maryland 21401
410-260-8610 Phone
410-260-8620 Fax
dnr.maryland.gov

Prepared by Mary Genovese, Jason Cessna, Jay Kilian, and Scott Stranko

Additional Telephone Contact Information:
Toll free in Maryland: 877-620-8DNR ext. 8540 OR
Individual unit/program toll-free number
Out of state call: 410-260-8540
Text Telephone (TTY) users call via the Maryland Relay

The facilities and services of the Maryland Department of Natural Resources are available to all without regard to race, color, religion, sex, sexual orientation, age, national origin or physical or mental disability. This document is available in alternative format upon request from a qualified individual with disability.

ACKNOWLEDGEMENTS: Sentinel Site Network monitoring is conducted and primarily funded by the Maryland Department of Natural Resources, Resource Assessment Service. Monitoring during certain years was partially funded through the State Wildlife Grant provided by the U.S. Congress and administered through the Maryland Department of Natural Resources, Natural Heritage Program. The University of Maryland Center for Environmental Science provided water sample analysis. Many Department of Natural Resources biologists and technicians participated in field sampling, benthic sample processing, data management, and data analysis. This report builds on previous reports on Sentinel Site Network monitoring results also published by the Maryland Department of Natural Resources.

Suggested citation: Resource Assessment Service. 2023. Spatial and Temporal Trends in Biological, Physical, and Chemical Data (1995 – 2020) Collected at 30 Stream Sites within the Maryland Sentinel Site Network. Maryland Department of Natural Resources. 580 Taylor Avenue, Annapolis, Maryland 21401. DNR 12-042823-354.

ABSTRACT

The Maryland Department of Natural Resources (MD DNR) has collected biological, physical, and chemical data at sites within the Maryland Sentinel Site Network (SSN) since 2000 (some sites as early as 1995). This network includes 30 minimally degraded stream sites located in four regions across the state (Eastern Coastal Plain, Western Coastal Plain, Eastern Piedmont, and Highlands). Monitoring of these sites allows MD DNR to better understand natural conditions of Maryland streams by region and how these conditions vary annually. Data from these sites can also be used in comparison with degraded streams throughout the state to determine which annual differences are the result of natural variation versus those potentially resulting from anthropogenic influence.

With more than twenty years of data collected from sites within the SSN, similarities and differences in biological communities as well as chemical and physical stream characteristics were observed by region and these spatial patterns matched geographical and geological expectations. Significant correlations between biological, chemical, and physical stream characteristics and sampling year were also investigated and common patterns among sites were noted. Few sites saw significant correlation between sampling year and indices of biotic integrity, however % intolerant benthic macroinvertebrate taxa and fish abundance per square meter appeared to be lower in recent years compared to years past at several sites. Number of benthic macroinvertebrate taxa and more specifically EPT taxa appeared to be higher in recent years at several sites, an unexpected result that warrants the investigation of variations in sampling technique and sample processing over time. Instream habitat (a metric of the Maryland Biological Stream Survey's physical habitat assessment) appeared to be lower at many sites in recent years. Variation in estimation by different habitat assessors appeared to have influence on lower % shading and % embeddedness observed in recent years at many sites. Greater stream area at several sites in recent years may correlate with higher rainfall amounts. Water chemistry parameters including conductivity, chloride, acid neutralizing capacity, pH, nitrate-nitrogen, and total nitrogen were all higher at several sites in recent years while sulfate was lower at several sites. Nitrite-nitrogen, ammonia-nitrogen, orthophosphate, and bromide appeared to be higher in recent years at many sites as well, however, many of the values recorded for these parameters were below corresponding detection limits (DL), and differences in DLs during different years may have influenced these results. The majority of these biological, physical, and chemical temporal trends were observed in the Eastern Piedmont and Highlands regions of Maryland. Higher water and air temperatures were also observed at many SSN sites in recent years and these trends were not region specific. Coldwater taxa loss was evident but minimal.

Although sites within the SSN are meant to be representative of minimally degraded Maryland streams, changes in biological, chemical, and physical condition of these sites observed over the past 20+ years may indicate some degradation due to climate change, existing urban and agricultural land cover, and/or land cover change that has occurred at several sites in more recent years. Despite the trends observed, most sites in the SSN continue to meet criteria to be designated as sentinel sites. Only two sites in the network (JONE-109-S in the Eastern Piedmont region and WIRH-220-S in the Eastern Coastal Plain region) no longer meet certain criteria. Both sites have had nitrate levels exceeding 4 mg/L in

several sampling years and JONE-109-S has had mean BIBI/FIBI scores < 3 most sampling years. It should be noted that the small upstream catchment of JONE-109-S (162.5 acres) may have influenced these low mean BIBI/FIBI scores. Those using Maryland sentinel sites as references in their own studies should be sure to note the conditions of these two sites as they may be becoming less representative of Maryland streams under minimally degraded conditions.

TABLES OF CONTENTS

INTRODUCTION **1**
METHODS **1**
Biological Communities *2*
Water Chemistry *2*
Physical Habitat *3*
Water and Air Temperature *3*
Precipitation *3*
Land Cover *4*
Statistical Methods *4*
RESULTS *13*
Spatial Patterns *13*
Biological Community Composition 13
Indices of Biotic Integrity 13
Water Chemistry 20
Physical Habitat Trends 26
Water and Air Temperature 29
Temporal Patterns *38*
Index of Biotic Integrity Trends 38
Coldwater Taxa Trends 41
Water Chemistry Trends 44
Physical Habitat Trends 48
Water and Air Temperature Trends 51
Annual Rainfall 54
Change in Land Cover 54
DISCUSSION **56**
Spatial Patterns *56*
Biological Community Composition 56
Indices of Biotic Integrity 57
Water Chemistry 58
Physical Habitat 58
Water and Air Temperature 58
Temporal Patterns *59*
Index of Biotic Integrity Trends 59
Coldwater Taxa Trends 59
Water Chemistry Trends 60
Physical Habitat Trends 62

Water and Air Temperature Trends 63
Changes in Land Cover 63
Sentinel Site Criteria *63*
REFERENCES **64**

INTRODUCTION

The Maryland Biological Stream Survey (MBSS), led by the Maryland Department of Natural Resources (MD DNR), has assessed the ecological condition of wadeable streams throughout Maryland since 1995 through the collection of biological, physical, and chemical data. In addition to monitoring a random selection of Maryland stream sites, MBSS also monitors a group of 30 high quality, minimally degraded streams that make up the Maryland Sentinel Site Network (SSN). Most of these sites, located within the Highlands, Eastern Piedmont, and Coastal Plain of Maryland, have been monitored by MBSS since 2000 (some as early as 1995). Only two of these sites (PTOB-002-S and ZEKI-012-S in the Coastal Plain) are no longer sampled due to lack of site access. Data collected at sites in the SSN allow for the assessment of natural annual variability in Maryland stream health. The majority of temporal trends observed at these sites are likely due to seasonal and/or annual differences in precipitation, temperature, and natural biotic interactions rather than the effects of anthropogenic activity. With over twenty years of data collected at streams within the SSN, MBSS has been able to produce an extensive database that can be used to assess both natural variations in Maryland stream condition and the potential effects of climate change on stream biota in Maryland over time (Prochaska 2005, Becker et al. 2007, Becker et al. 2008, Becker et al. 2010, Saville et al. 2014).

The following report aims to (1) describe spatial patterns in Maryland fish and benthic macroinvertebrate community compositions as well as physical habitat, water chemistry, and temperature using data collected at sites within the SSN, (2) describe temporal patterns observed in biological, chemical, and physical SSN data, (3) examine sites that no longer meet sentinel site criteria, and (4) provide MBSS data collected at these sites (Appendices A - D) to be used as references to compare to other stream sites sampled in Maryland.

METHODS

The Maryland Biological Stream Survey (MBSS) established the Sentinel Site Network (SSN) in 2000 to assess natural variability in biological, physical, and chemical characteristics of Maryland non-tidal streams over time. The SSN is made up of 30 minimally degraded streams (28 sites continue to be sampled annually), ranging in size from 1st order to 3rd order (based on a 1:100,000 scale stream map), and located in all regions of Maryland, including the Highlands, Eastern Piedmont, and Coastal Plain (Figures 1- 4).

Prochaska (2005) provides a detailed description of the criteria followed in the SSN stream selection process. The following basic criteria are used to reduce the potential for anthropogenic influence confounding SSN monitoring results (Prochaska 2005, Becker et al. 2007, Becker et al. 2008, Becker et al. 2010, Saville et al. 2014):

- no evidence of acid mine drainage in the site catchment
- sulfate concentrations < 50 mg/L
- pH > 6.0 or dissolved organic carbon concentrations (DOC) > 8.0 mg/L (pH could be < 6 if the stream is naturally acidic blackwater)

- nitrate-nitrogen concentrations < 4.0 mg/L
- forested land cover > 50 % of catchment area
- mean of fish (FIBI) and benthic macroinvertebrate (BIBI) indices of biotic integrity > 3.0 (or a blackwater stream)

Of the 30 sites in the SSN, several were not sampled during certain years from 2000 to 2020 due to lack of site access, high flows, lack of water, water contamination, and/or the COVID-19 pandemic (Table 1). MBSS protocols used when collecting biological, physical, and chemical data at these sites are summarized below (Prochaska 2005, Becker et al. 2007, Becker et al. 2008, Becker et al. 2010, Saville et al. 2014). A more detailed version of these protocols can be found in Stranko et al. 2009 and Stranko et al. 2019.

Biological Communities

Each spring (March-April), benthic macroinvertebrates were collected using 20 0.093 m^2 samples of the best available habitat found within each 75-m site using a 540- micron mesh D-net. Backpack electrofishing with block nets (two passes) at each 75-m site were used to collect fishes each summer (June-September). Benthic macroinvertebrates were identified to genus or lowest practical taxonomic level in a lab (Boward and Friedman 2019), while fish were identified in the field to species level by MBSS-certified taxonomists and then released (Stranko et al. 2019).

Indices of biotic integrity (IBI) developed specifically for Maryland streams (Roth et al. 1998, Southerland et al. 2005, Southerland et al. 2007) were calculated using MBSS benthic macroinvertebrate and fish data. The metrics composing the IBIs differ by region to best represent region-specific biological conditions.

Water Chemistry

Water chemistry grab-samples were taken once each spring (March-April) to measure the following parameters: pH, acid neutralizing capacity, sulfate, nitrate-nitrogen, nitrite-nitrogen, ammonia-nitrogen, total nitrogen, orthophosphate, total phosphorus, chloride, specific conductivity, and dissolved organic carbon. Bromide was included in these samples starting in 2013. Four additional analytes (zinc, copper, magnesium, and calcium) were included in these samples starting in 2014. At each site, 1.5L grab-samples were collected (sample bottles were leached in deionized water prior to sampling) along with 125mL of filtered water (filtered through a 0.45µm disposable syringe filter into 125-mL trace metal-clean polyethylene bottles, and stored in plastic bags), and at least 50mL of unfiltered water in a closed syringe. Grab-samples were collected toward the center of the stream channel, in deep, flowing water, upstream of any disturbance created by benthic sampling, or other activities in the stream. Note that grab-samples were collected annually from one location within each site, rather than multiple locations. Samples were then shipped on ice to the UMCES Appalachian Lab within 48 hours of collection. The results from these samples do not necessarily represent annual temporal variation at each site as just one sample

was taken per year, however, these samples do allow for the investigation of general patterns in spring water chemistry by site.

Due to the COVID-19 Pandemic, 2020 spring water chemistry samples were only collected at Highland sentinel sites and one Eastern Piedmont sentinel site (LIBE-102-S).

Physical Habitat

Physical habitat assessments were performed in summer months (June-September) at the same time as fish sampling. The availability of suitable habitat for stream biota as well as the potential for anthropogenic influence were recorded using specific metrics. The following physical habitat metrics were examined in this report: instream habitat, epifaunal substrate, velocity/depth diversity, pool quality, riffle quality, % shading, and % embeddedness. One-time summer discharge measurements (cubic feet per second; cfs) as well as stream area (meters squared) were also examined. Variations observed over time in the habitat metrics listed above may partially be due to variation in scoring by different habitat assessors as the role of habitat assessor has changed hands at most sites in the SSN over the past 20+ years. This was considered when analyzing physical habitat assessment data in this report.

Water and Air Temperature

Water temperatures were recorded every 20 minutes at each sentinel site, June through August, from 2000 to 2020, using instream temperature loggers. Year-round air temperature data along with water temperatures collected during non-summer months (January through May and September through December) were collected from around 2010 to 2020 (varied by site). There may be missing data (either a year or multiple years) at many sites within the SSN either due to the logger becoming dewatered or buried, the logger being physically lost when field crews attempted retrieval, or the lack of logger deployment altogether. Average daily mean water and air temperatures by season (winter, spring, summer, and fall) and average daily mean water and air temperatures from the warmest week of each season were calculated by site for each sampling year. Percentages of summer temperatures above 20°C and summer temperatures above 24°C were also calculated by site for each sampling year.

Precipitation

Differences in annual rainfall can assist in explaining annual changes in IBI score and biological communities in general at streams within the SSN. Annual rainfall data provided by the National Oceanic and Atmospheric Administration (NOAA) from 1995 to 2020 were summarized in this report. These data were acquired from the U.S Climate Divisional Database.

Land Cover

Although sites in the SSN were chosen in areas with minimal anthropogenic disturbance, none have upstream catchments that are completely protected from changes in land cover. The percentages of forest, agriculture, urban, and other land cover from the 2016 National Land Cover Database (NLCD; Homer et al. 2020) were extracted for the catchment upstream of each site for the following years: 2001, 2004, 2006, 2008, 2011, 2013, and 2016. It should be noted that NLCD data used for a specific sampling year were never more recent than that sampling year. Catchment boundaries were drawn by hand using digital USGS 7.5 minute topographic quadrangle maps.

Since minor changes in land cover may affect sentinel site quality and confound attempts to evaluate the effects of natural variability and climate change, it was important to understand land cover changes that occurred in sentinel site catchments over time. To accomplish this task, 2001 and 2016 land cover data for each site were compared.

Statistical Methods

Non-metric multidimensional scaling analysis was used for benthic macroinvertebrate and fish community spatial analysis. One-way analysis of variance (ANOVA) and Tukey multiple pairwise-comparisons were performed for all other spatial comparisons (water chemistry, physical habitat, and temperature). Pearson's correlation tests were performed for each site to determine how IBI scores/metrics, coldwater taxa, water chemistry parameters, physical habitat assessment metrics, and temperature measurements correlated with sampling year (temporal comparisons). All statistics listed above were calculated using the computer analysis program R.

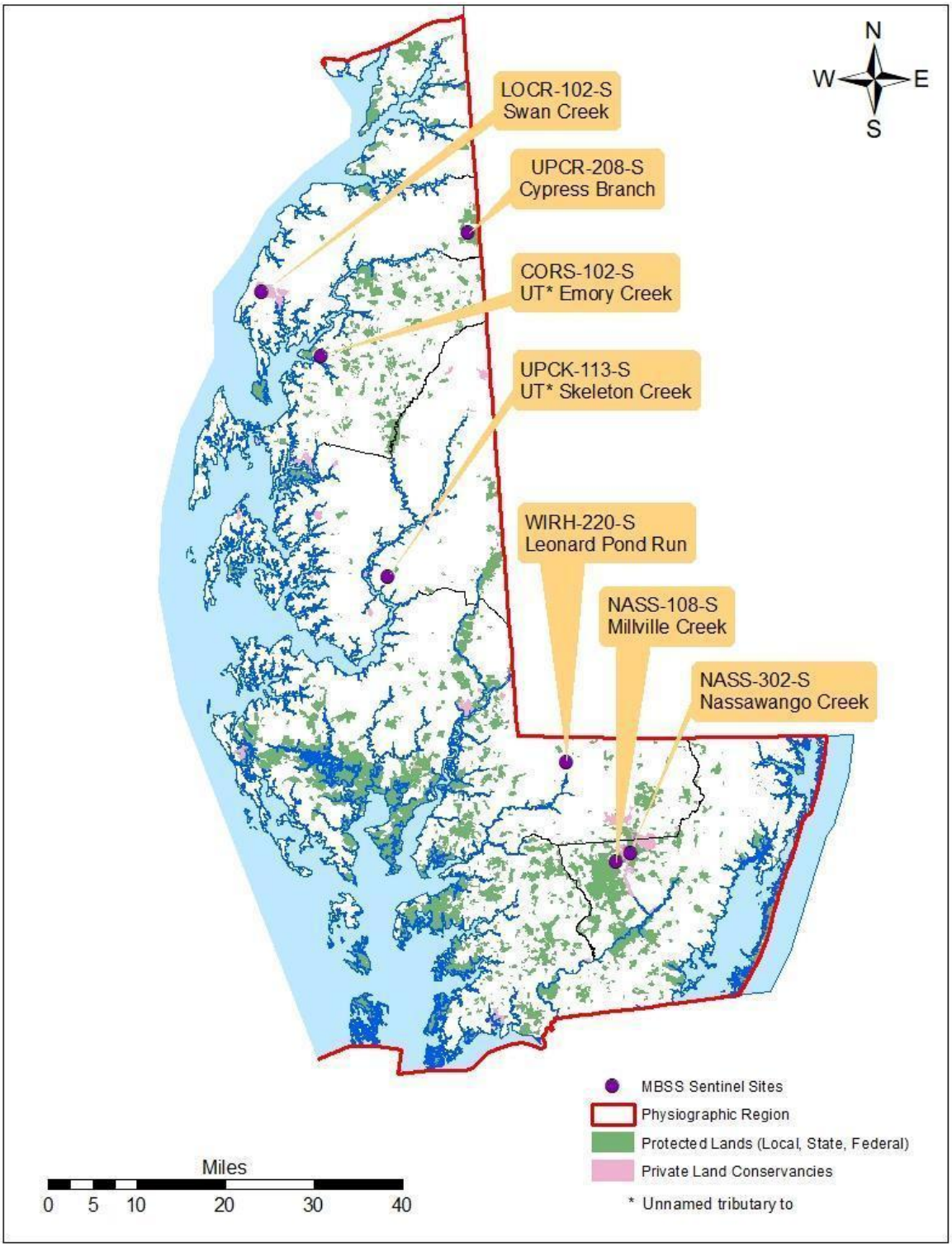


Figure 1 – Maryland Sentinel Sites in the Coastal Plain – Eastern Shore Region

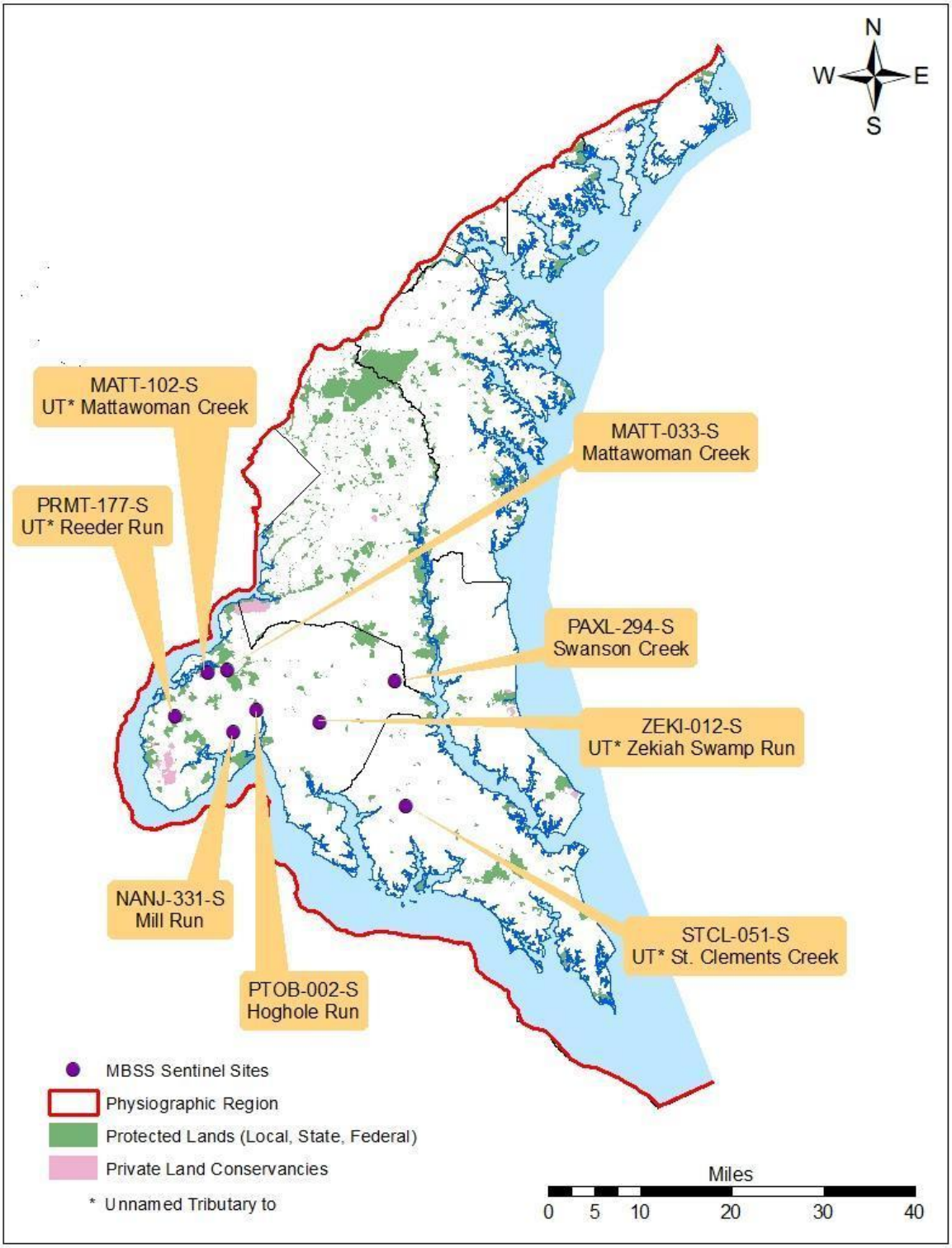


Figure 2 – Maryland Sentinel Sites in the Coastal Plain – Western Shore Region

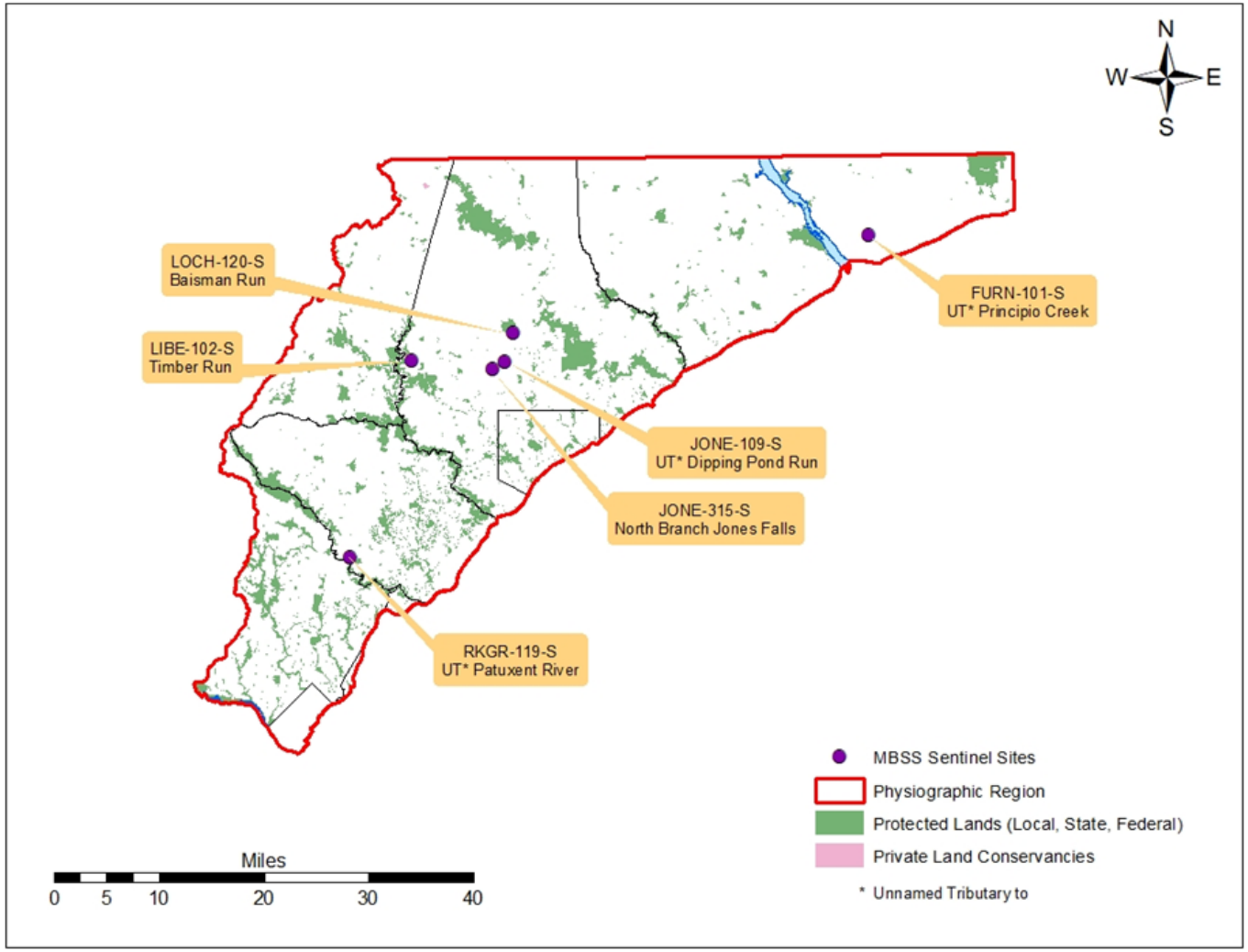


Figure 3 – Maryland Sentinel Sites in the Eastern Piedmont Region.

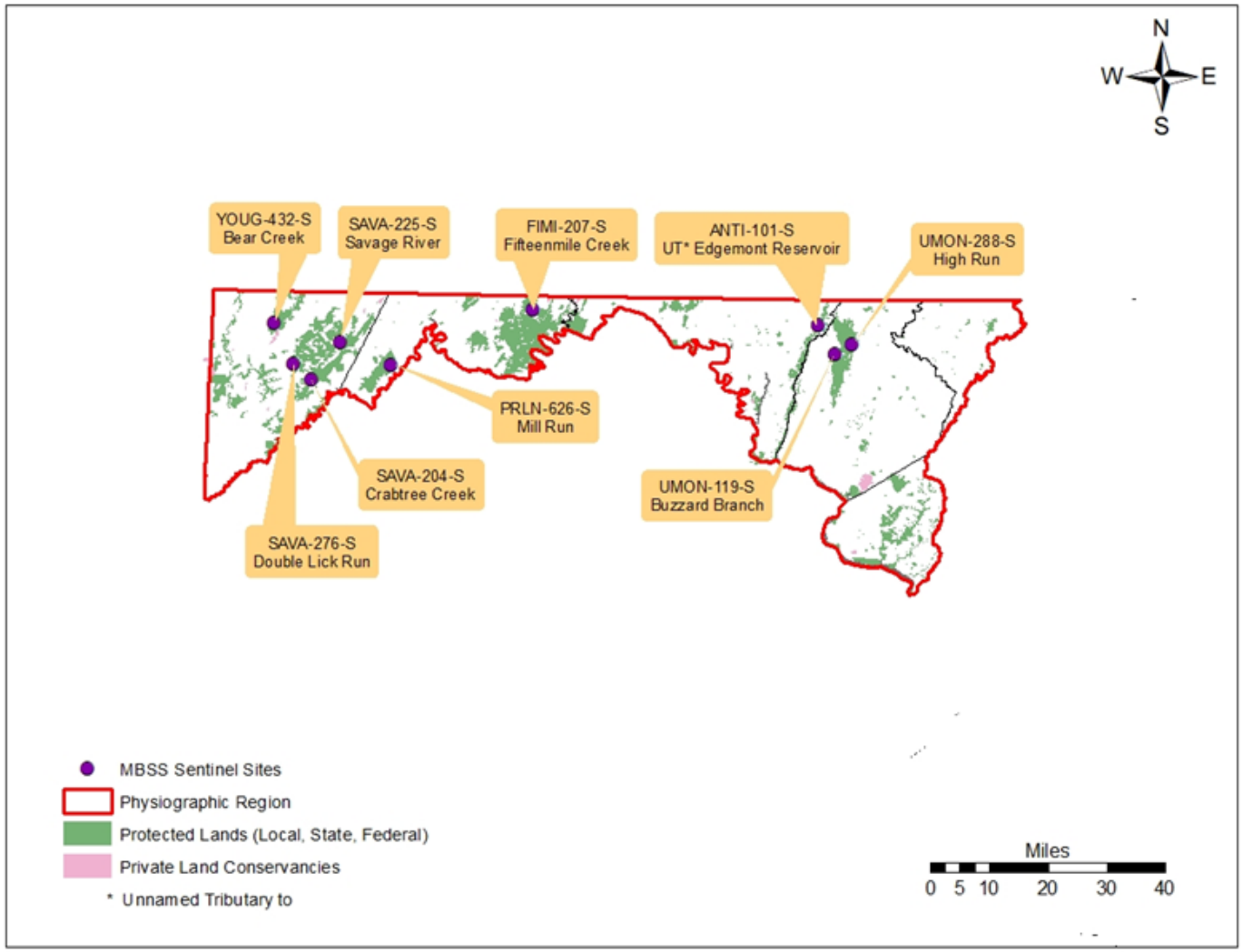


Figure 4 – Maryland Sentinel Sites in the Highlands Region.

Table 1 - Sampling Years – Eastern Coastal Plain

SITE	CORS-102-S	LOCR-102-S	NASS-108-S	NASS-302-S	UPCK-113-S	UPCR-208-S	WIRH-220-S
STREAM NAME	UT to Emory Creek	Swan Creek	Millville Creek	Nassawango Creek	UT to Skeleton Creek	Cypress Branch	Leonard Pond Run
1995		X					
1996					X		
1997			X				
2000	X	X	X		X		X
2001	X	X	X	X	X		X
2002	X	X	X	X	X		X
2003	X	X	X	X	X		X
2004	X	X	X	X[5]	X	X	X
2005	X	X	X	X	X[2]		X
2006	X	X	X	X	X		X
2007	X	X	X	X	X		X
2008	X	X	X	X	X	X	X
2009	X	X	X	X	X	X	X
2010	X	X	X[4]	X[6]	X	X	X
2011	X	X	X[4]	X	X	X	X
2012	X	X	X[4]	X	X	X	X
2013	X	X	X	X	X	X	X
2014	X	X	X	X	X	X	X
2015	X	X	X	X	X	X	X
2016	X	X	X	X	X	X	X
2017	X	X	X	X	X	X	X
2018	X	X	X	X	X	X	X
2019	X	X	X	X	X	X	X
2020	X[7]	X[7]	X[7]	X[7]	X[7]	X[7]	X[7]

[1] fish and physical habitat data not collected due to contamination concerns at Bear Creek Hatchery
[2] fish and physical habitat data not collected due to lack of access to the site
[3] no data collected due to lack of access to the site
[4] fish and physical habitat data not collected due to lack of water
[5] fish and physical habitat data not collected due to high flow conditions
[6] benthic macroinvertebrate data not collected due to high flow conditions
[7] water chemistry data not collected due to the COVID-19 pandemic
[8] site relocated slightly

Table 1 continued - Sampling Years – Western Coastal Plain

SITE	MATT-033-S	MATT-102-S	NANJ-331-S	PAXL-294-S	PRMT-177-S	PTOB-002-S	STCL-051-S	ZEKI-012-S
STREAM NAME	Mattawoman Creek	UT to Mattawoman Creek	Mill Run (Nanjemoy Creek)	Swanson Creek	UT to Reeder Run	Hoghole Run	UT to St. Clements Creek	UT to Zekiah Swamp Run
1995	X						X	
1996								
1997				X				
2000	X		X	X		X	X	X
2001	X		X	X		X	X	X
2002	X		X	X		X	X	X
2003	X		X	X		X	X	X
2004	X		X	X		X	X	X
2005	X		X	X		X	X	X
2006	X		X	X		X	X	X
2007	X		X	X		X	X	X
2008	X		X	X		X	X	X
2009	X		X	X		X	X	[3]
2010	X		X	X		X	X	X
2011	X		X	X		X	X	X
2012	X		X	X	X	X	X	X
2013	X		X	X	X	X	X	X[2]
2014	X		X	X	X	X	X	[3]
2015	X		X	X	X	X	X	[3]
2016	X		X	X	X	X	X	[3]
2017	X	X	X	X	X	X	X	[3]
2018	X	X	X	X	X	X[2]	X	[3]
2019	X	X	X	X	X	[3]	X	[3]
2020	X[7]	X[7]	X[7]	X[7]	X[7]	[3]	X[7]	[3]

[1] fish and physical habitat data not collected due to contamination concerns at Bear Creek Hatchery
[2] fish and physical habitat data not collected due to lack of access to the site
[3] no data collected due to lack of access to the site
[4] fish and physical habitat data not collected due to lack of water
[5] fish and physical habitat data not collected due to high flow conditions
[6] benthic macroinvertebrate data not collected due to high flow conditions
[7] water chemistry data not collected due to the COVID-19 pandemic
[8] site relocated slightly

Table 1 continued - Sampling Years – Eastern Piedmont

SITE	FURN-101-S	JONE-109-S	JONE-315-S	LIBE-102-S	LOCH-120-S	RKGR-119-S
STREAM NAME	UT to Principio Creek	UT to Dipping Pond Run	North Branch Jones Falls	Timber Run	Baisman Run	UT to Patuxent River
1995						
1996			X			
1997						X
2000	X	X	X	X	X	X
2001	X	X	X	X	X	X
2002	X	X	X	X	X	X
2003	X	X	X	X	X	X
2004	X	X	X	X	X	X
2005	X	X	X	X	X	X
2006	X	X	X	X	X	X
2007	X	X	X	X	X	X
2008	X	X	X	X	X	X
2009	X	X	X	X	X	X
2010	X	X	X	X	X	X
2011	X	X	X	X	X	X
2012	X	X	X	X	X	X
2013	X	X	X	X	X	X
2014	X	X	X	X	X	X
2015	X	X	X	X	X	X
2016	X	X	X	X	X	X
2017	X	X	X	X	X	X
2018	X	X	X	X	X	X
2019	X	X	X	X	X	X
2020	X[7]	X[7]	X[7]	X	X[7]	X[7]

[1] fish and physical habitat data not collected due to contamination concerns at Bear Creek Hatchery
[2] fish and physical habitat data not collected due to lack of access to the site
[3] no data collected due to lack of access to the site
[4] fish and physical habitat data not collected due to lack of water
[5] fish and physical habitat data not collected due to high flow conditions
[6] benthic macroinvertebrate data not collected due to high flow conditions
[7] water chemistry data not collected due to the COVID-19 pandemic
[8] site relocated slightly

Table 1 continued - Sampling Years – Highlands

SITE	ANTI-101-S	FIMI-207-S	PRLN-626-S	SAVA-204-S	SAVA-225-S	SAVA-276-S	UMON-119-S	UMON-288-S	YOUG-432-S
STREAM NAME	UT to Edgemont Reservoir	Fifteen mile Creek	Mill Run	Crabtree Creek	Savage River	Double Lick Run	Buzzard Branch	High Run	Bear Creek
1995									
1996									
1997									
2000	X	X	X		X	X		X	X
2001	X	X	X		X	X		X	X
2002		X	X	X	X	X	X	X	X
2003		X	X	X[8]	X	X	X	X	X
2004		X	X	X	X	X	X	X	X
2005		X	X	X	X	X	X	X	X[1]
2006		X	X	X	X	X	X	X	X[1]
2007		X	X	X	X	X	X	X	X[8]
2008		X	X	X	X	X	X	X	X
2009		X	X	X	X	X	X	X	X
2010	X	X	X	X	X	X	X	X	X
2011	X	X	X	X	X	X	X	X	X
2012	X	X	X	X	X	X	X	X	X
2013	X	X	X	X	X	X	X	X	X
2014	X	X	X	X	X	X	X	X	X
2015	X	X	X	X	X	X	X	X	X
2016	X	X	X	X	X	X	X	X	X
2017	X	X	X	X	X	X	X	X	X
2018	X	X	X	X	X	X	X	X	X
2019	X	X	X	X	X	X	X	X	X
2020	X	X	X	X	X	X	X	X	X

[1] fish and physical habitat data not collected due to contamination concerns at Bear Creek Hatchery
[2] fish and physical habitat data not collected due to lack of access to the site
[3] no data collected due to lack of access to the site
[4] fish and physical habitat data not collected due to lack of water
[5] fish and physical habitat data not collected due to high flow conditions
[6] benthic macroinvertebrate data not collected due to high flow conditions
[7] water chemistry data not collected due to the COVID-19 pandemic
[8] site relocated slightly

RESULTS

For biological, chemical, and physical monitoring data collected at each site listed in Table 1, see Appendices A through D. Pearson's correlation coefficients for correlating sampling year with IBI scores/influencing metrics, water chemistry parameters, physical habitat metrics, and seasonal water and air temperatures were calculated and included in these appendices.

Spatial Patterns

Biological Community Composition

Non-metric Multidimensional Scaling (NMDS) analyses (Figures 5 and 6) were conducted to determine similarities and differences among Eastern Coastal, Western Coastal, Eastern Piedmont, and Highland sentinel site fish and benthic macroinvertebrate communities. From these analyses, considerable overlap was observed among the benthic macroinvertebrate communities of all four regions. Less overlap was observed among fish communities. Sentinel site 2020 fish and benthic communities did not appear to differ greatly from those of years past. Covariate overlays for benthic community data suggest higher % EPT (orders Ephemeroptera, Plecoptera, and Trichoptera), % Ephemeroptera, % clingers (adapted to attaching to substrate in fast-moving water), and % intolerant to urbanization, and lower % Diptera in the Highlands and Eastern Piedmont compared to the Coastal Plain. Covariate overlays for fish community data suggest higher % lithophilic spawners and % brook trout in the Highlands and Eastern Piedmont compared to the Coastal Plain, and higher % tolerant fish species in the Coastal Plain compared to the Eastern Piedmont and Highlands.

Indices of Biotic Integrity

Individual sentinel site IBI scores were organized by region and displayed in Figures 7 through 10. Drops in IBI scores observed at these sites in certain years may be linked with annual differences in rainfall (see Figure 20). IBI scores by site were either variable from year to year, consistently low, or consistently high depending on the site's region, catchment size, and/or natural water chemistry.

In the Eastern Coastal Plain, the 95% confidence interval was 3.02 to 3.36 for BIBI scores, and 2.88 to 3.22 for FIBI scores. The lower ends of these confidence intervals were lower than any other Maryland region. Sites in this region had the greatest number of samples with BIBI scores and/or FIBI scores below 3 (considered poor);however, most of the sites in this region also exhibited water chemistry characteristic of blackwater streams (e.g. dissolved organic carbon > 8 mg/L and pH < 6). Blackwater streams can have lower IBI scores compared to other stream types. NASS-108-S, LOCR-102-S, and UPCK-113-S had BIBI and FIBI scores below 3 during most years. CORS-102-S had FIBI scores below 3 during most years, and UPCR-208-S had BIBI scores below 3 during several years. At NASS-302-S, the BIBI dropped below 3 in 2008 following a drought year, and at WIRH-220-S, the BIBI dropped below 3 in 2009 (a flood year). BIBI scores at CORS-102-S dropped below 3 in 2002 following a drought year, and in 2013 (drought year).

In the Western Coastal Plain, the 95% confidence interval was 4.39 to 4.55 for BIBI scores and 3.69 to 3.93 for FIBI scores. The lower end of the BIBI confidence interval for this region was higher than any other Maryland region. Only a small number of fish and/or benthic samples from this region had scores below 3. The most notable trend observed from IBI scores in this region was that FIBI scores at four out of eight sites dropped below 3 in 2003, a year following drought conditions. Other notable drops in IBI scores occurred at STCL-051-S and NANJ-331-S in 2008, a year following drought conditions, where FIBI scores dropped below 3. The same occurred at MATT-033-S in 2006 and 2007 (a drought year).

In the Eastern Piedmont, the 95% confidence interval was 4.21 to 4.42 for BIBI scores and 3.19 to 3.58 for FIBI scores. Most sites in this region had IBI scores consistently above 3 except for JONE-109-S and LOCH-120-S which had FIBI scores below 3 during most years. It should be noted that JONE-109-S has a small upstream catchment (162.5 acres) which may explain the low FIBI score as sites with catchments less than 300 acres tend to have low FIBI scores due to naturally low numbers of fish species (Southerland et al. 2005). JONE-315-S had BIBI scores below 3 in 2009 (a flood year) and 2010.

In the Highlands, the 95% confidence interval was 4.11 to 4.26 for BIBI scores and 4.02 to 4.21 for FIBI scores. The lower end of the FIBI confidence interval for this region was higher than any other Maryland region. Most sites in this region have IBI scores consistently above 3 except for ANTI-101-S (sampled in 2000-2001 and 2010-2020) where FIBI scores were below 3 during several sampling years. At UMON-119-S, BIBI scores dropped below 3 from 2013-2015 and the FIBI dropped below 3 in 2014. Low BIBI scores at this site between 2013 and 2015 were likely due to high percentages of blackfly larvae rather than variations in annual rainfall or other influencing factors.

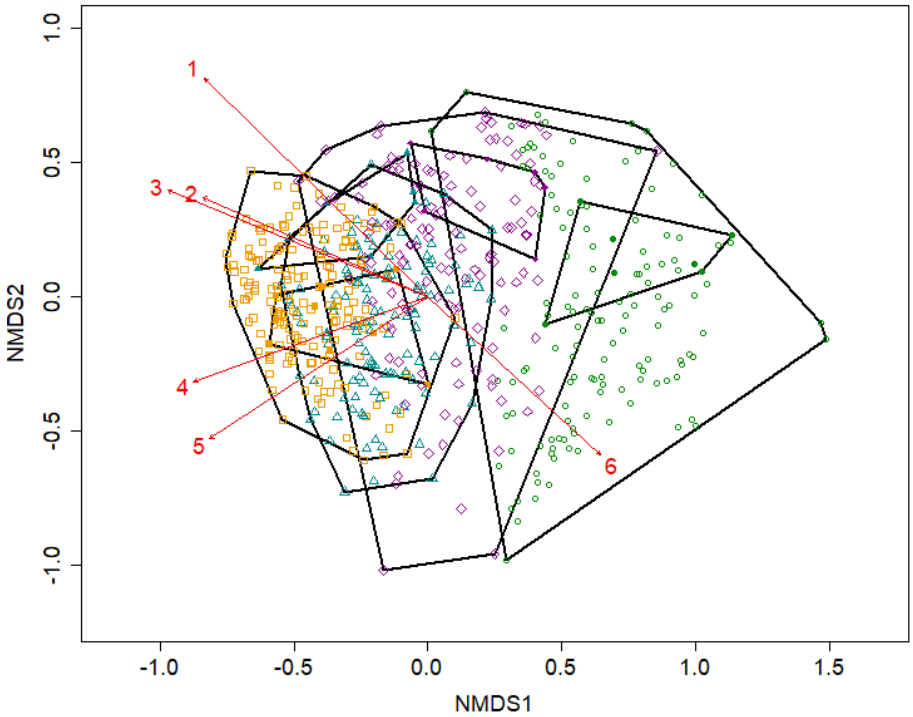


Figure 5 - Non-Metric Multidimensional Scaling ordination plot displaying benthic macroinvertebrate communities by geographic region from 1995 to 2020 (taxa with % abundance < 1% excluded). Eastern Coastal samples are represented by green circles, Western Coastal samples by purple diamonds, Eastern Piedmont samples by blue triangles, and Highland samples by yellow squares. Samples from 1995 to 2019 are represented by open symbols while 2020 samples are represented by filled symbols. 2020 samples are grouped separately from all other annual samples using convex hulls. Red arrows represent covariate overlays with an R-squared value of 0.400 or greater (1 – BIBI score, 2 - % Ephemeroptera, 3 - % EPT taxa, 4 - % clingers, 5 - % intolerant urban, 6 - % Diptera). Stress = 0.167.

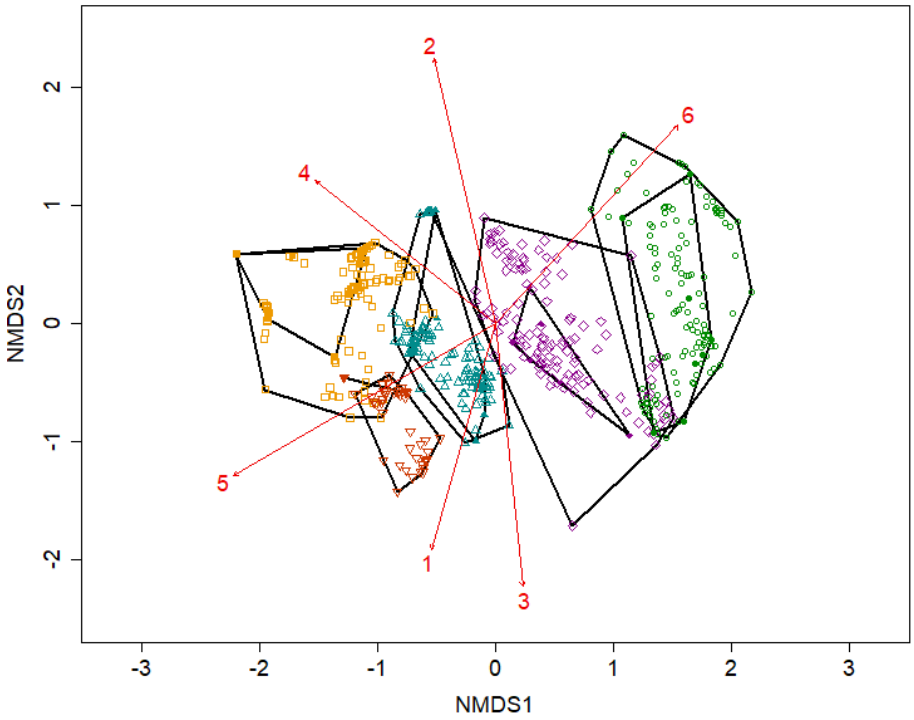


Figure 6 - Non-Metric Multidimensional Scaling ordination plot displaying fish community samples by geographic region from 1995 to 2020 (species with % abundance < 1% excluded). Eastern Coastal samples are represented by green circles, Western Coastal samples by purple diamonds, Eastern Piedmont samples by blue triangles, and Highland samples by yellow squares (coldwater) and orange inverted triangles (warmwater). Samples from 1995 to 2019 are represented by open symbols while 2020 samples are represented by filled symbols. 2020 samples are grouped separately from all other annual samples using convex hulls and line segments. Red lines represent covariate overlays with an R-squared value of 0.400 or greater (1 – FIBI score, 2 - % abundance of dominant species, 3 - # of benthic fish species, 4 - % brook trout, 5 - % lithophilic spawners, 6 - % tolerant fish species). Stress = 0.095.

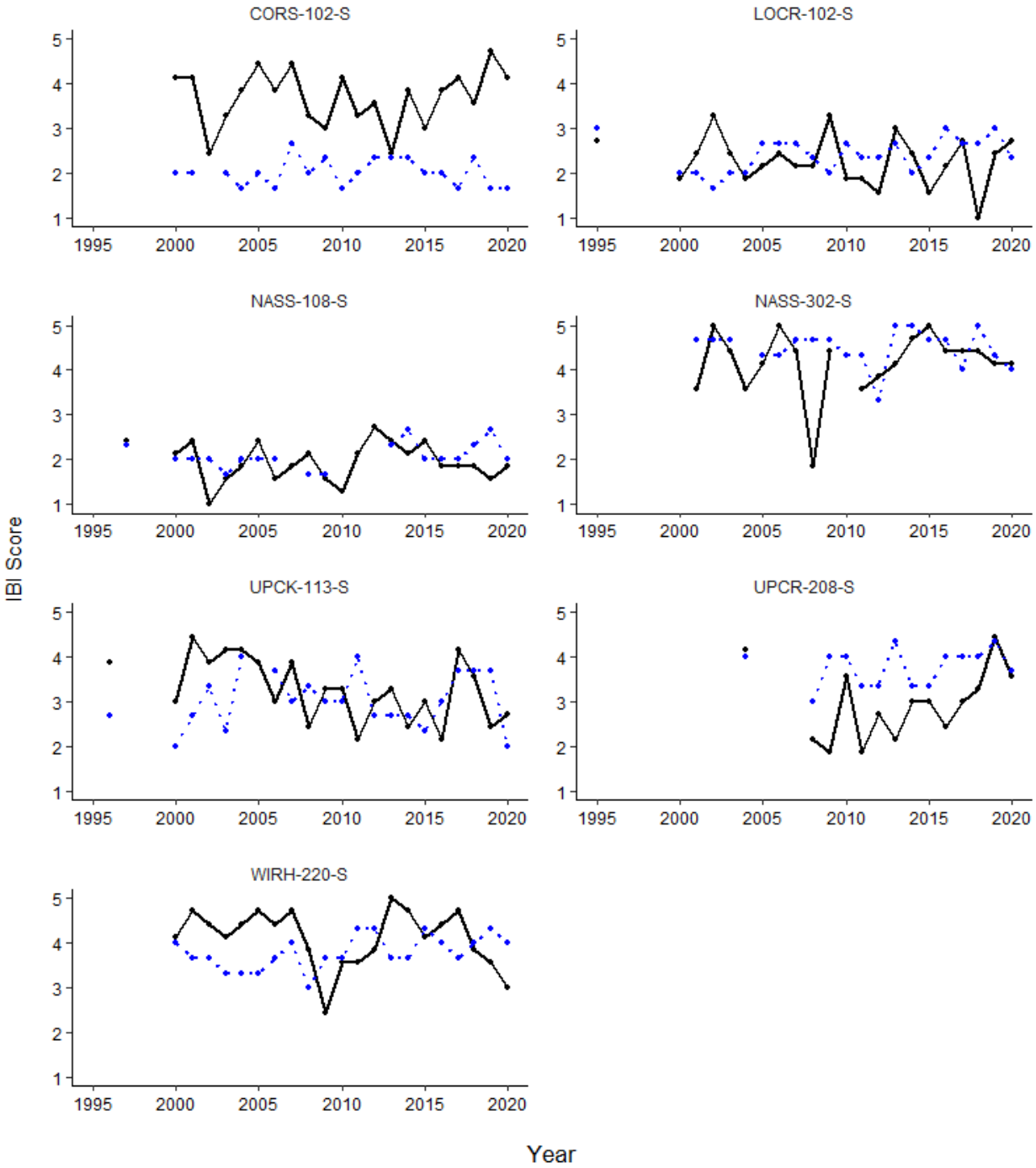


Figure 7 – BIBI (black solid line) and FIBI scores (blue dotted line) – Eastern Coastal Sentinel Sites from 1995 to 2020. UPCR-208-S was not sampled until 2004 and was not sampled from 2005 to 2007.

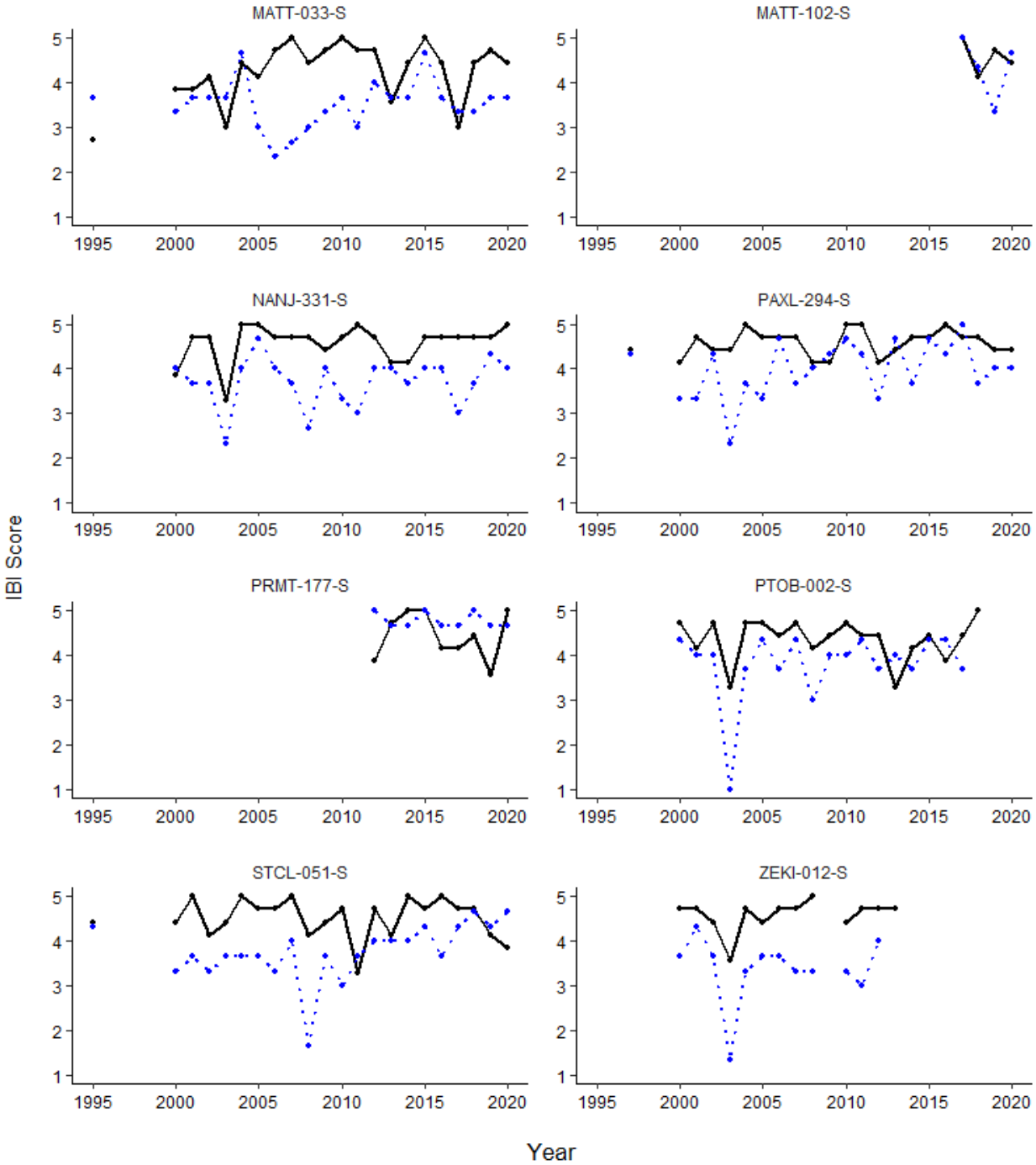


Figure 8 – BIBI (black solid line) and FIBI scores (blue dotted line) – Western Coastal Sentinel Sites from 1995 to 2020. PRMT-177-S was not added to the SSN until 2012. MATT-102-S was not added to the SSN until 2017. Site access was lost at ZEKI-012-S in 2014.

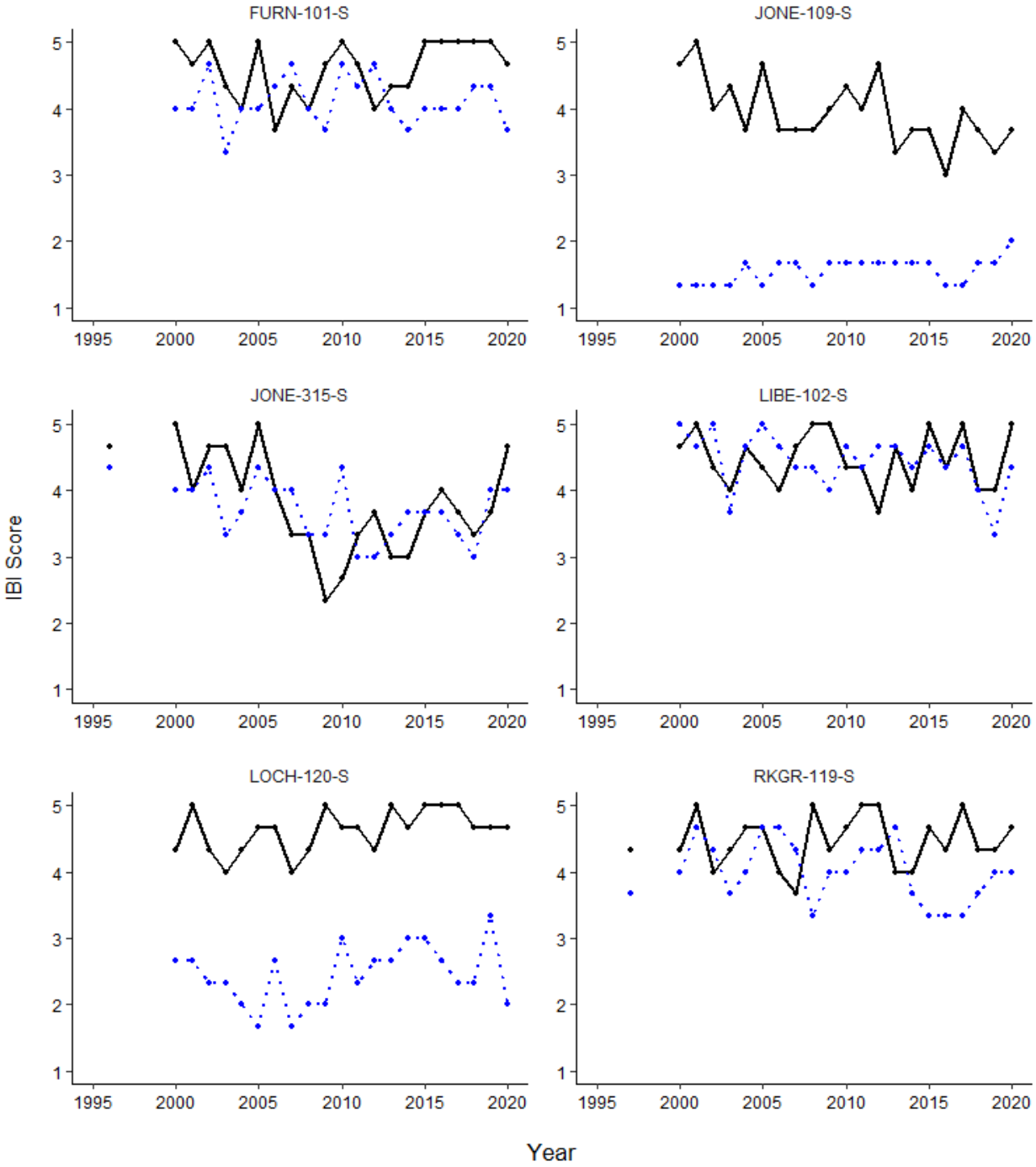


Figure 9 – BIBI (black solid line) and FIBI scores (blue dotted line) – Eastern Piedmont Sentinel Sites from 1995 to 2020.

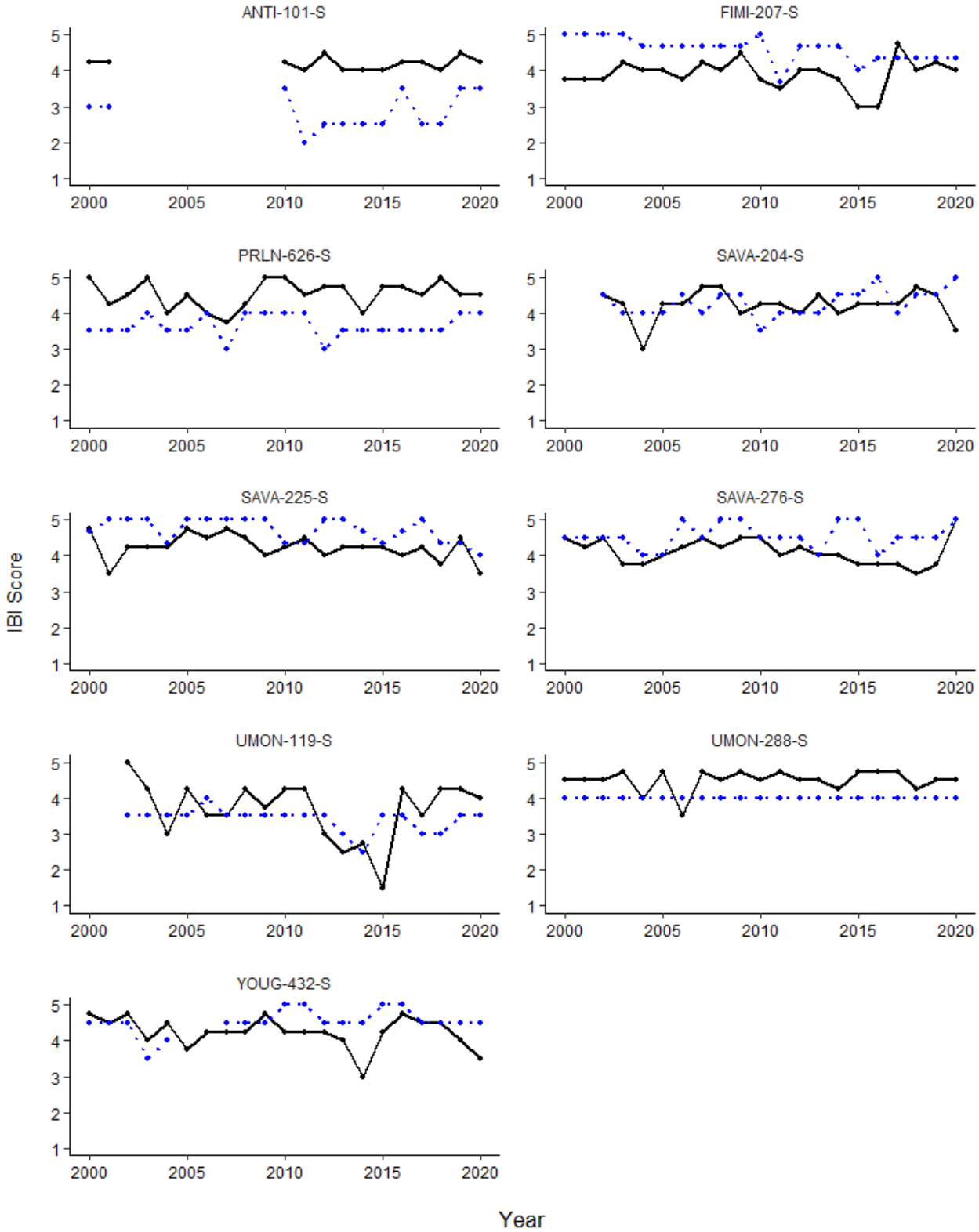


Figure 10 – BIBI (black solid line) and FIBI scores (blue dotted line) – Highland Sentinel Sites from 2000 to 2020. Sentinel sites in the Highlands were not sampled prior to 2000. ANTI-101-S was not sampled from 2002 to 2009.

Water Chemistry

One-way ANOVA tests and Tukey multiple pairwise-comparisons were performed to determine differences in water chemistry by region (Table 2). Distributions by region are displayed as violin plots (Figures 11 through 13).

Total nitrogen differed among all regions ($p < 0.05$), was highest in the Eastern Coastal Plain, and lowest in the Eastern Piedmont. Specific conductance, magnesium, calcium, and chloride were similar among all regions except when comparing each region to the Eastern Piedmont ($p < 0.05$) where these parameters were highest. pH, dissolved organic carbon, orthophosphate, total phosphorus, and zinc were only similar when comparing Eastern Piedmont and Highland sites ($p = 0.467$, 1, 0.409, 0.973, and 0.434, respectively). Dissolved organic carbon, total phosphorus, orthophosphate, and zinc were all highest in the Eastern Coastal Plain and lowest in the Eastern Piedmont and Highlands while the opposite was the case for pH. Ammonia-nitrogen, nitrite-nitrogen, and copper were similar among all regions except when comparing each region to the Eastern Coastal Plain ($p < 0.05$) where they were highest. Acid neutralizing capacity, highest in the Eastern Piedmont and lowest in the Coastal Plain, was only similar when comparing Eastern and Western Coastal sites ($p = 0.927$). Sulfate differed among all regions except when comparing Highlands and Eastern Coastal sites ($p = 0.685$), and Highlands and Western Coastal sites ($p = 0.133$). Sulfate measurements were lowest in the Eastern Piedmont. Nitrate-nitrogen was only similar among Highland and Eastern Coastal sites, was highest in the Eastern Piedmont, and lowest in the Western Coastal Plain. Bromide was similar among Western Coastal and Eastern Coastal sites ($p = 0.105$), and Western Coastal and Eastern Piedmont sites ($p = 0.963$). Bromide was lowest in the Highlands and highest in the Western Coastal Plain and Eastern Piedmont.

Table 2 - Analysis of variance of water chemistry parameters by geographic region from 1995-2020 (bromide – 2013-2020, and magnesium, calcium, copper, and zinc – 2014-2020).

Parameter	Geographic Region	Difference in Means	95% CI Lower	95% CI Upper	p-value
Specific Conductance (µS/cm)	Highlands - Eastern Coastal	-4.478	-21.366	12.411	0.903
	Eastern Piedmont - Eastern Coastal	90.775	72.279	109.271	0
	Western Coastal - Eastern Coastal	-1.282	-19.700	17.136	0.998
	Eastern Piedmont - Highlands	95.253	77.864	112.642	0
	Western Coastal - Highlands	3.196	-14.111	20.503	0.964
	Western Coastal - Eastern Piedmont	-92.057	-110.936	-73.178	0
Acid Neutralizing Capacity (µeq/L)	Highlands - Eastern Coastal	97.473	27.380	167.566	0.002
	Eastern Piedmont - Eastern Coastal	365.648	288.883	442.413	0
	Western Coastal - Eastern Coastal	18.305	-58.136	94.747	0.927
	Eastern Piedmont - Highlands	268.175	196.003	340.347	0
	Western Coastal - Highlands	-79.168	-150.996	-7.340	0.024
	Western Coastal - Eastern Piedmont	-347.343	-425.695	-268.990	0
pH	Highlands - Eastern Coastal	1.246	1.098	1.393	0
	Eastern Piedmont - Eastern Coastal	1.160	0.998	1.322	0
	Western Coastal - Eastern Coastal	0.700	0.539	0.861	0
	Eastern Piedmont - Highlands	-0.086	-0.238	0.066	0.467
	Western Coastal - Highlands	-0.546	-0.697	-0.394	0
	Western Coastal - Eastern Piedmont	-0.460	-0.625	-0.295	0
Dissolved Organic Carbon (mg/L)	Highlands - Eastern Coastal	-16.742	-18.030	-15.454	0
	Eastern Piedmont - Eastern Coastal	-16.720	-18.130	-15.310	0
	Western Coastal - Eastern Coastal	-14.147	-15.552	-12.743	0

Parameter	Geographic Region	Difference in Means	95% CI Lower	95% CI Upper	p-value
	Eastern Piedmont - Highlands	0.022	-1.304	1.348	1
	Western Coastal - Highlands	2.595	1.275	3.914	< 0.001
	Western Coastal - Eastern Piedmont	2.572	1.133	4.012	< 0.001
Chloride (mg/L)	Highlands - Eastern Coastal	-1.424	-5.605	2.758	0.817
	Eastern Piedmont - Eastern Coastal	19.116	14.522	23.711	0
	Western Coastal - Eastern Coastal	1.566	-3.018	6.150	0.815
	Eastern Piedmont - Highlands	20.540	16.241	24.839	0
	Western Coastal - Highlands	2.990	-1.299	7.278	0.276
	Western Coastal - Eastern Piedmont	-17.550	-22.242	-12.859	0
Orthophosphate (mg/L)	Highlands - Eastern Coastal	-0.009	-0.011	-0.007	0
	Eastern Piedmont - Eastern Coastal	-0.010	-0.012	-0.008	0
	Western Coastal - Eastern Coastal	-0.005	-0.007	-0.003	0
	Eastern Piedmont - Highlands	-0.001	-0.003	0.001	0.409
	Western Coastal - Highlands	0.003	0.001	0.005	< 0.001
	Western Coastal - Eastern Piedmont	0.005	0.002	0.007	< 0.001
Total Nitrogen (mg/L)	Highlands - Eastern Coastal	-0.801	-1.063	-0.539	0
	Eastern Piedmont - Eastern Coastal	0.453	0.166	0.741	< 0.001
	Western Coastal - Eastern Coastal	-1.106	-1.392	-0.819	0
	Eastern Piedmont - Highlands	1.254	0.985	1.523	0
	Western Coastal - Highlands	-0.305	-0.573	-0.036	0.019
	Western Coastal - Eastern Piedmont	-1.559	-1.852	-1.265	0
Total Phosphorus (mg/L)	Highlands - Eastern Coastal	-0.051	-0.057	-0.044	0
	Eastern Piedmont - Eastern Coastal	-0.052	-0.059	-0.045	0
	Western Coastal - Eastern Coastal	-0.028	-0.035	-0.022	0
	Eastern Piedmont - Highlands	-0.001	-0.008	0.005	0.973
	Western Coastal - Highlands	0.022	0.016	0.029	0
	Western Coastal - Eastern Piedmont	0.023	0.016	0.031	0
Sulfate (mg/L)	Highlands - Eastern Coastal	0.493	-0.653	1.639	0.685
	Eastern Piedmont - Eastern Coastal	-4.113	-5.369	-2.858	0
	Western Coastal - Eastern Coastal	1.481	0.231	2.731	0.013
	Eastern Piedmont - Highlands	-4.606	-5.786	-3.426	0
	Western Coastal - Highlands	0.989	-0.186	2.163	0.133
	Western Coastal - Eastern Piedmont	5.595	4.314	6.876	0
Ammonia-Nitrogen (mg/L)	Highlands - Eastern Coastal	-0.052	-0.064	-0.041	0
	Eastern Piedmont - Eastern Coastal	-0.051	-0.063	-0.038	0
	Western Coastal - Eastern Coastal	-0.041	-0.054	-0.029	0
	Eastern Piedmont - Highlands	0.001	-0.010	0.013	0.987
	Western Coastal - Highlands	0.011	0	0.023	0.066
	Western Coastal - Eastern Piedmont	0.010	-0.003	0.022	0.206
Nitrite-Nitrogen (mg/L)	Highlands - Eastern Coastal	-0.004	-0.005	-0.004	0
	Eastern Piedmont - Eastern Coastal	-0.004	-0.005	-0.003	0
	Western Coastal - Eastern Coastal	-0.004	-0.005	-0.004	0
	Eastern Piedmont - Highlands	0	-0.001	0.001	0.83
	Western Coastal - Highlands	0	-0.001	0.001	0.988
	Western Coastal - Eastern Piedmont	0	-0.001	0.001	0.963
Nitrate-Nitrogen (mg/L)	Highlands - Eastern Coastal	-0.139	-0.401	0.123	0.518
	Eastern Piedmont - Eastern Coastal	1.097	0.810	1.384	0
	Western Coastal - Eastern Coastal	-0.546	-0.832	-0.260	< 0.001
	Eastern Piedmont - Highlands	1.236	0.966	1.506	0
	Western Coastal - Highlands	-0.407	-0.675	-0.138	0.001
	Western Coastal - Eastern Piedmont	-1.643	-1.936	-1.350	0
Bromide (mg/L)	Highlands - Eastern Coastal	-0.006	-0.012	-0.001	0.023
	Eastern Piedmont - Eastern Coastal	0.007	0	0.013	0.033
	Western Coastal - Eastern Coastal	0.005	-0.001	0.012	0.105
	Eastern Piedmont - Highlands	0.013	0.007	0.018	< 0.001

Parameter	Geographic Region	Difference in Means	95% CI Lower	95% CI Upper	p-value
	Western Coastal - Highlands	0.012	0.006	0.017	< 0.001
	Western Coastal - Eastern Piedmont	-0.001	-0.008	0.005	0.963
Magnesium (mg/L)	Highlands - Eastern Coastal	0.023	-0.531	0.577	1
	Eastern Piedmont - Eastern Coastal	3.122	2.492	3.752	0
	Western Coastal - Eastern Coastal	-0.305	-0.935	0.325	0.594
	Eastern Piedmont - Highlands	3.099	2.522	3.675	0
	Western Coastal - Highlands	-0.328	-0.905	0.249	0.455
	Western Coastal - Eastern Piedmont	-3.427	-4.077	-2.776	0
Calcium (mg/L)	Highlands - Eastern Coastal	1.736	-0.560	4.032	0.207
	Eastern Piedmont - Eastern Coastal	8.074	5.462	10.686	0
	Western Coastal - Eastern Coastal	0.492	-2.121	3.104	0.962
	Eastern Piedmont - Highlands	6.338	3.947	8.729	0
	Western Coastal - Highlands	-1.244	-3.636	1.147	0.534
	Western Coastal - Eastern Piedmont	-7.583	-10.279	-4.887	0
Copper (µg/L)	Highlands - Eastern Coastal	-1.061	-1.370	-0.753	0
	Eastern Piedmont - Eastern Coastal	-0.966	-1.315	-0.616	0
	Western Coastal - Eastern Coastal	-0.906	-1.252	-0.559	0
	Eastern Piedmont - Highlands	0.096	-0.225	0.416	0.866
	Western Coastal - Highlands	0.156	-0.163	0.474	0.584
	Western Coastal - Eastern Piedmont	0.060	-0.298	0.418	0.972
Zinc (µg/L)	Highlands - Eastern Coastal	-9.982	-11.532	-8.433	0
	Eastern Piedmont - Eastern Coastal	-9.044	-10.798	-7.290	0
	Western Coastal - Eastern Coastal	-5.559	-7.300	-3.817	0
	Eastern Piedmont - Highlands	0.938	-0.673	2.550	0.434
	Western Coastal - Highlands	4.424	2.826	6.022	0
	Western Coastal - Eastern Piedmont	3.486	1.689	5.282	< 0.001

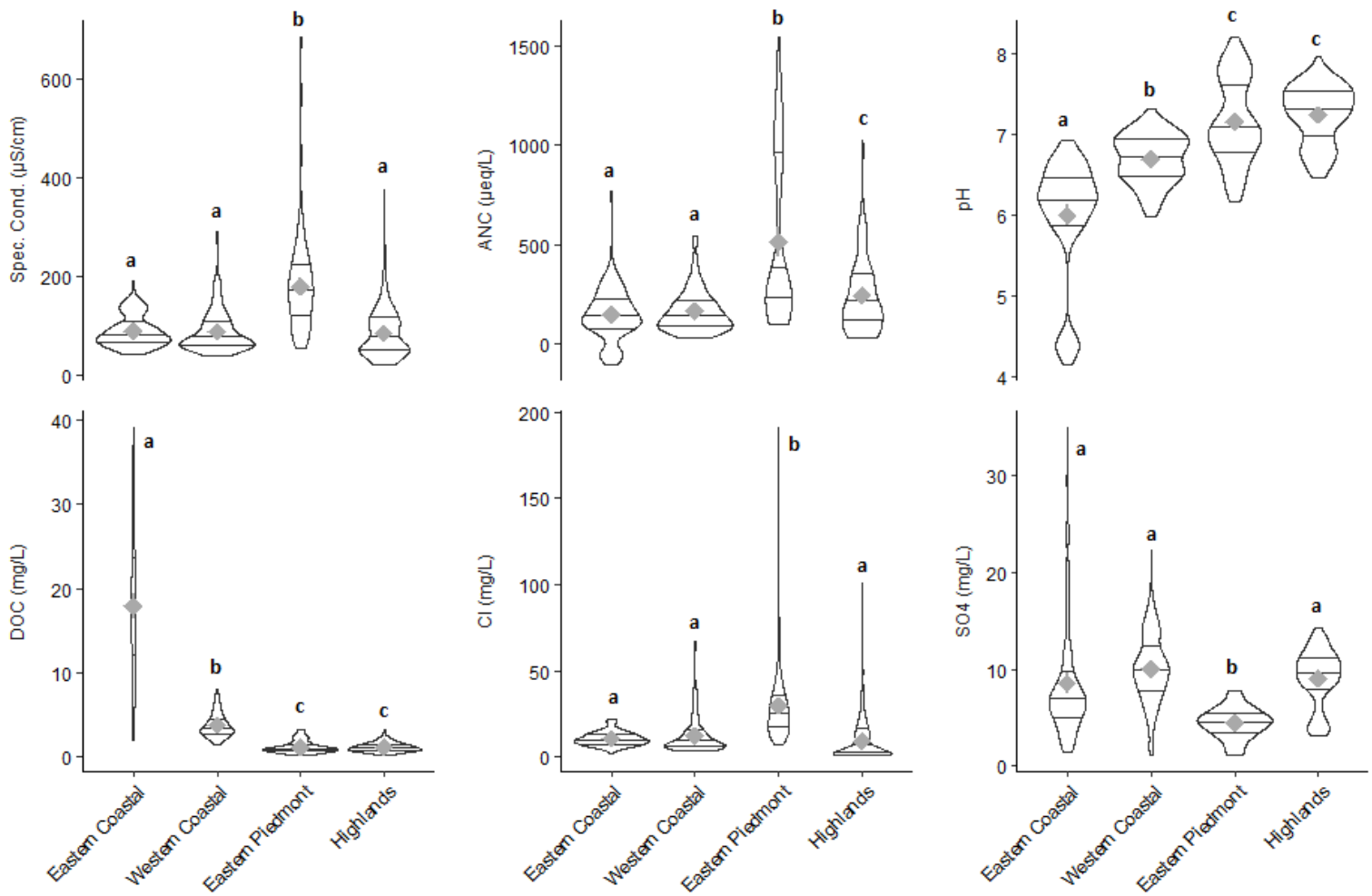


Figure 11 – Violin plots displaying specific conductivity (Spec. Cond.), acid neutralizing capacity (ANC), pH, dissolved organic carbon (DOC), chloride (Cl), and sulfate (SO4) measurement distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

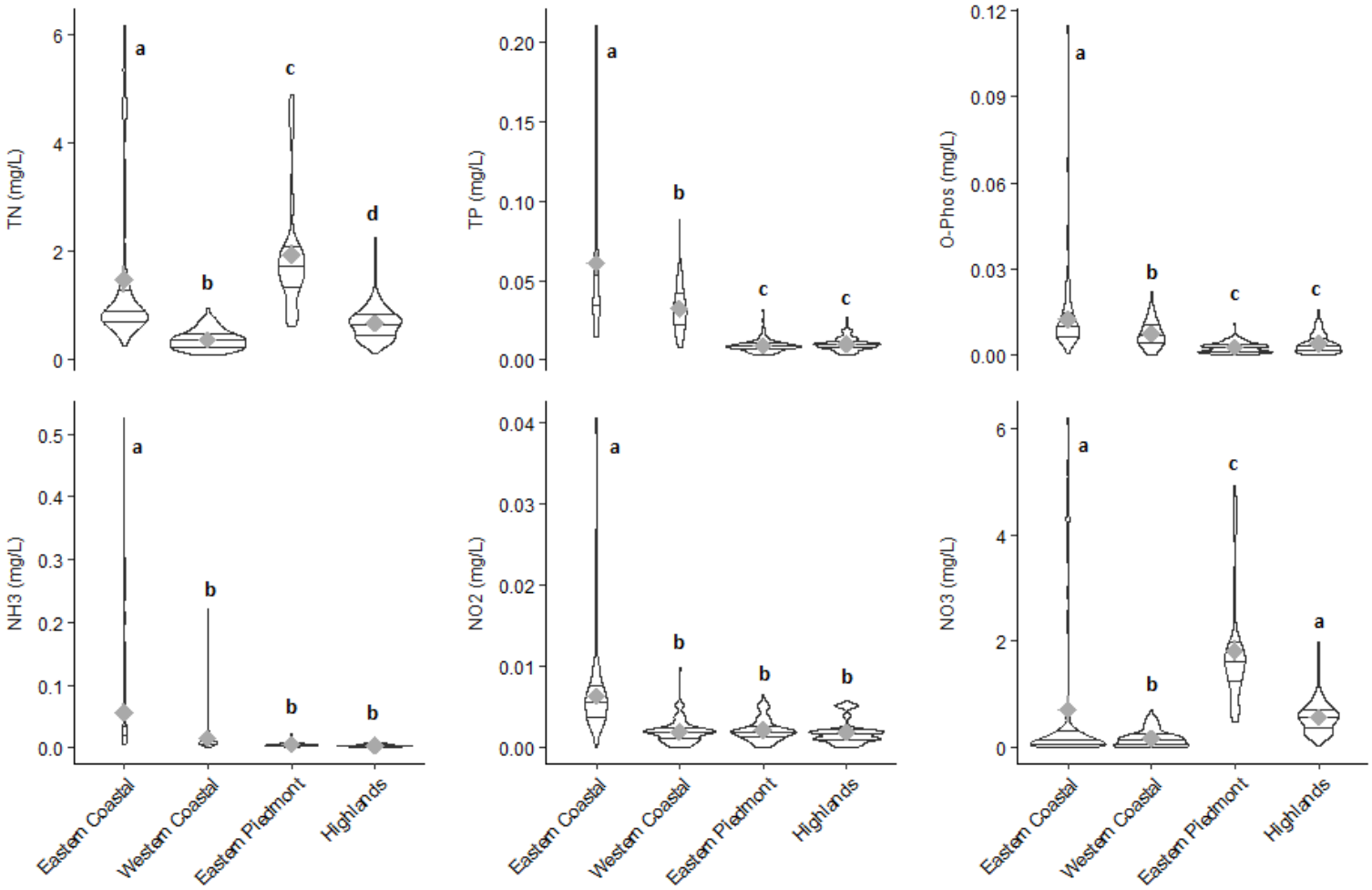


Figure 12 – Violin plots displaying total nitrogen (TN), total phosphorus (TP), orthophosphate (O-Phos), ammonia-nitrogen (NH3), nitrite-nitrogen (NO2), and nitrate-nitrogen (NO3) measurement distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

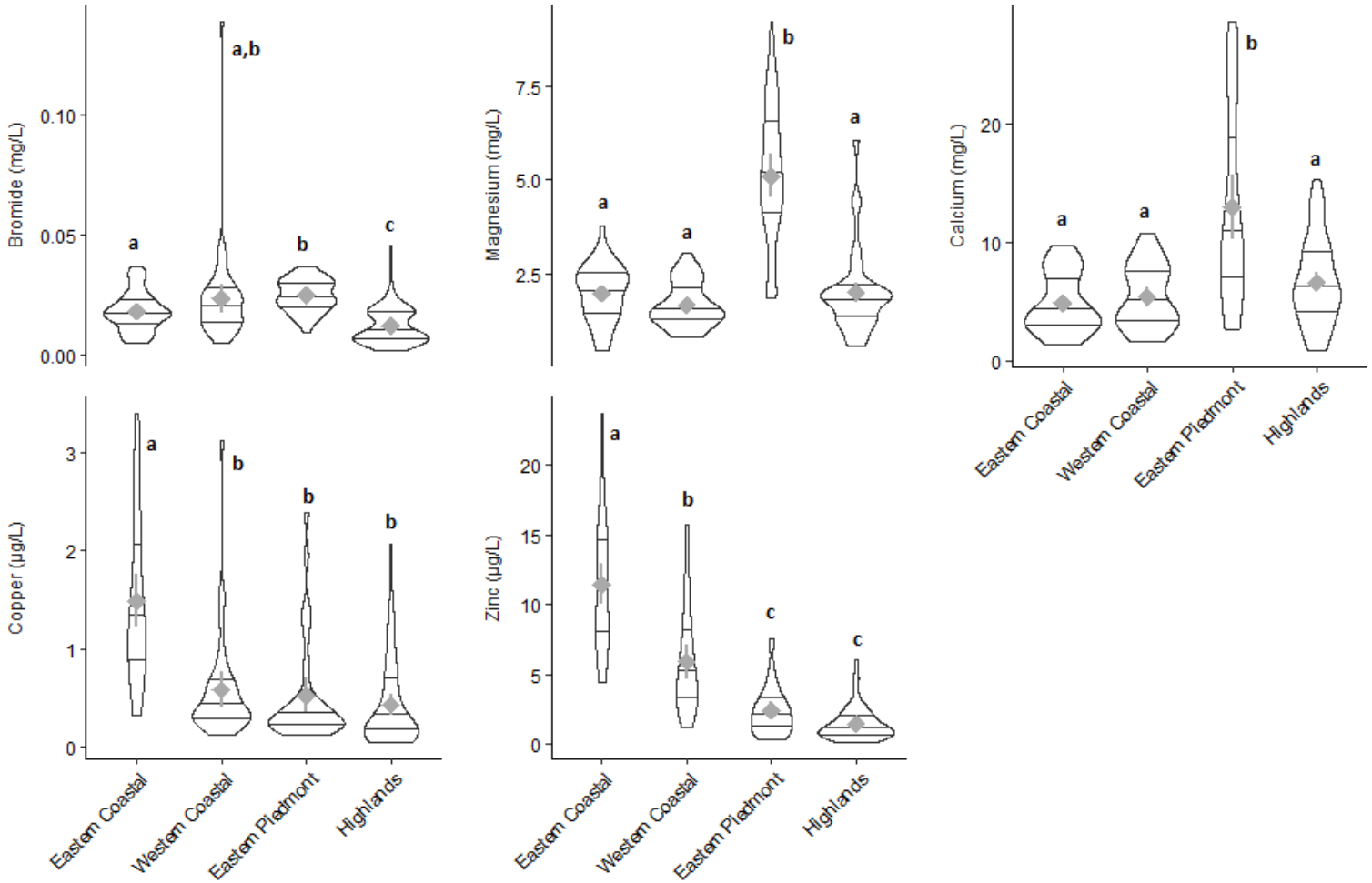


Figure 13 – Violin plots displaying bromide measurement distributions (Br; 2013-2020), and magnesium (Mg), calcium (Ca), copper (Cu), and zinc (Zn) measurement distributions (2014-2020) by region. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Physical Habitat Trends

One-way ANOVA tests and Tukey multiple pairwise-comparisons were performed to determine differences in physical habitat by region (Table 7). Distributions by region are displayed as violin plots (Figure 14).

Epifaunal substrate, riffle quality, and embeddedness differed among all regions ($p < 0.05$). Epifaunal substrate and riffle quality scores were lowest in the Eastern Coastal Plain and highest in the Highlands, while the opposite was the case for % embeddedness estimates. Velocity/depth diversity, differing among all regions except when comparing Western Coastal sites to Eastern Piedmont sites ($p = 0.995$), was also lowest in the Eastern Coastal Plain and highest in the Highlands. Pool quality was similar among all regions except when comparing Western Coastal sites, where pool quality was highest, to Eastern Piedmont sites ($p < 0.001$), where pool quality was lowest. Instream habitat differed among all regions except when comparing Eastern Piedmont sites to Highland sites ($p = 0.269$), and Eastern Piedmont sites to Western Coastal sites ($p = 0.154$). Instream habitat scores were lowest in the Eastern Coastal Plain and highest in the Highlands. Shading % was similar among all regions except when comparing Eastern Piedmont sites to Eastern Coastal sites ($p = 0.001$), and Eastern Piedmont sites to Highland sites ($p = 0.035$). Shading % was highest in the Eastern Piedmont and Western Coastal Plain. Discharge measurements taken once each summer were similar among all regions except when comparing Eastern Coastal sites to Eastern Piedmont sites ($p < 0.001$), and Eastern Coastal sites to Western Coastal sites ($p = 0.03$). These one-time summer discharge measurements were highest in the Eastern Coastal Plain and Highlands. As stated above, these samples are not representative of annual discharge at each site but allow for the investigation of general patterns in summer baseflow by site. Higher discharge measurements observed in the Eastern Coastal Plain and Highlands may be partially explained by stream size as similar patterns were observed when investigating stream site area.

Table 7 - Analysis of variance of physical habitat assessment metrics by geographic region from 1995-2020.

Parameter	Geographic Region	Difference in Means	95% CI Lower	95% CI Upper	p-value
Instream Habitat (0-20)	Highlands - Eastern Coastal	2.646	1.744	3.548	0
	Eastern Piedmont - Eastern Coastal	2.001	1.030	2.972	< 0.001
	Western Coastal - Eastern Coastal	1.201	0.234	2.167	0.008
	Eastern Piedmont - Highlands	-0.645	-1.563	0.272	0.269
	Western Coastal - Highlands	-1.446	-2.359	-0.532	< 0.001
	Western Coastal - Eastern Piedmont	-0.800	-1.782	0.181	0.154
Epifaunal Substrate (0-20)	Highlands - Eastern Coastal	4.489	3.622	5.356	0
	Eastern Piedmont - Eastern Coastal	3.233	2.300	4.166	0
	Western Coastal - Eastern Coastal	1.428	0.499	2.357	< 0.001
	Eastern Piedmont - Highlands	-1.256	-2.138	-0.374	0.002
	Western Coastal - Highlands	-3.061	-3.939	-2.183	0
	Western Coastal - Eastern Piedmont	-1.805	-2.749	-0.862	< 0.001
Velocity/Depth Diversity (0-20)	Highlands - Eastern Coastal	4.871	3.919	5.823	0
	Eastern Piedmont - Eastern Coastal	3.891	2.866	4.915	0
	Western Coastal - Eastern Coastal	3.796	2.776	4.816	0
	Eastern Piedmont - Highlands	-0.980	-1.949	-0.012	0.046
	Western Coastal - Highlands	-1.075	-2.039	-0.110	0.022
	Western Coastal - Eastern Piedmont	-0.094	-1.130	0.941	0.995

Parameter	Geographic Region	Difference in Means	95% CI Lower	95% CI Upper	p-value
Pool Quality (0-20)	Highlands - Eastern Coastal	0.115	-0.908	1.138	0.992
	Eastern Piedmont - Eastern Coastal	-0.718	-1.819	0.383	0.335
	Western Coastal - Eastern Coastal	0.998	-0.098	2.095	0.089
	Eastern Piedmont - Highlands	-0.833	-1.874	0.208	0.167
	Western Coastal - Highlands	0.884	-0.153	1.920	0.125
	Western Coastal - Eastern Piedmont	1.717	0.604	2.830	< 0.001
Riffle Quality (0-20)	Highlands - Eastern Coastal	10.961	9.817	12.105	0
	Eastern Piedmont - Eastern Coastal	9.082	7.851	10.313	0
	Western Coastal - Eastern Coastal	5.867	4.640	7.093	0
	Eastern Piedmont - Highlands	-1.879	-3.043	-0.715	< 0.001
	Western Coastal - Highlands	-5.095	-6.253	-3.936	0
	Western Coastal - Eastern Piedmont	-3.216	-4.460	-1.971	0
Embeddedness (%)	Highlands - Eastern Coastal	-69.444	-74.866	-64.022	0
	Eastern Piedmont - Eastern Coastal	-53.106	-58.940	-47.272	0
	Western Coastal - Eastern Coastal	-40.834	-46.645	-35.024	0
	Eastern Piedmont - Highlands	16.338	10.821	21.854	0
	Western Coastal - Highlands	28.610	23.118	34.101	0
	Western Coastal - Eastern Piedmont	12.272	6.373	18.171	< 0.001
Shading (%)	Highlands - Eastern Coastal	2.296	-2.020	6.613	0.518
	Eastern Piedmont - Eastern Coastal	6.921	2.277	11.566	0.001
	Western Coastal - Eastern Coastal	3.790	-0.836	8.416	0.151
	Eastern Piedmont - Highlands	4.625	0.234	9.017	0.035
	Western Coastal - Highlands	1.494	-2.878	5.866	0.815
	Western Coastal - Eastern Piedmont	-3.131	-7.827	1.564	0.315
Discharge (cfs)	Highlands - Eastern Coastal	-1.013	-2.319	0.293	0.19
	Eastern Piedmont - Eastern Coastal	-2.222	-3.637	-0.808	< 0.001
	Western Coastal - Eastern Coastal	-1.504	-2.907	-0.100	0.03
	Eastern Piedmont - Highlands	-1.209	-2.549	0.131	0.094
	Western Coastal - Highlands	-0.491	-1.819	0.838	0.777
	Western Coastal - Eastern Piedmont	0.718	-0.717	2.154	0.570
Stream Area (meters squared)	Highlands - Eastern Coastal	19.4	-39.7	78.5	0.833
	Eastern Piedmont - Eastern Coastal	-90.2	-153.9	-26.6	0.002
	Western Coastal - Eastern Coastal	-71.7	-135.1	-8.4	0.019
	Eastern Piedmont - Highlands	109.6	49.6	169.6	< 0.001
	Western Coastal - Highlands	-18.5	-82.7	45.7	0.880
	Western Coastal - Eastern Piedmont	91.1	31.4	150.8	0.001

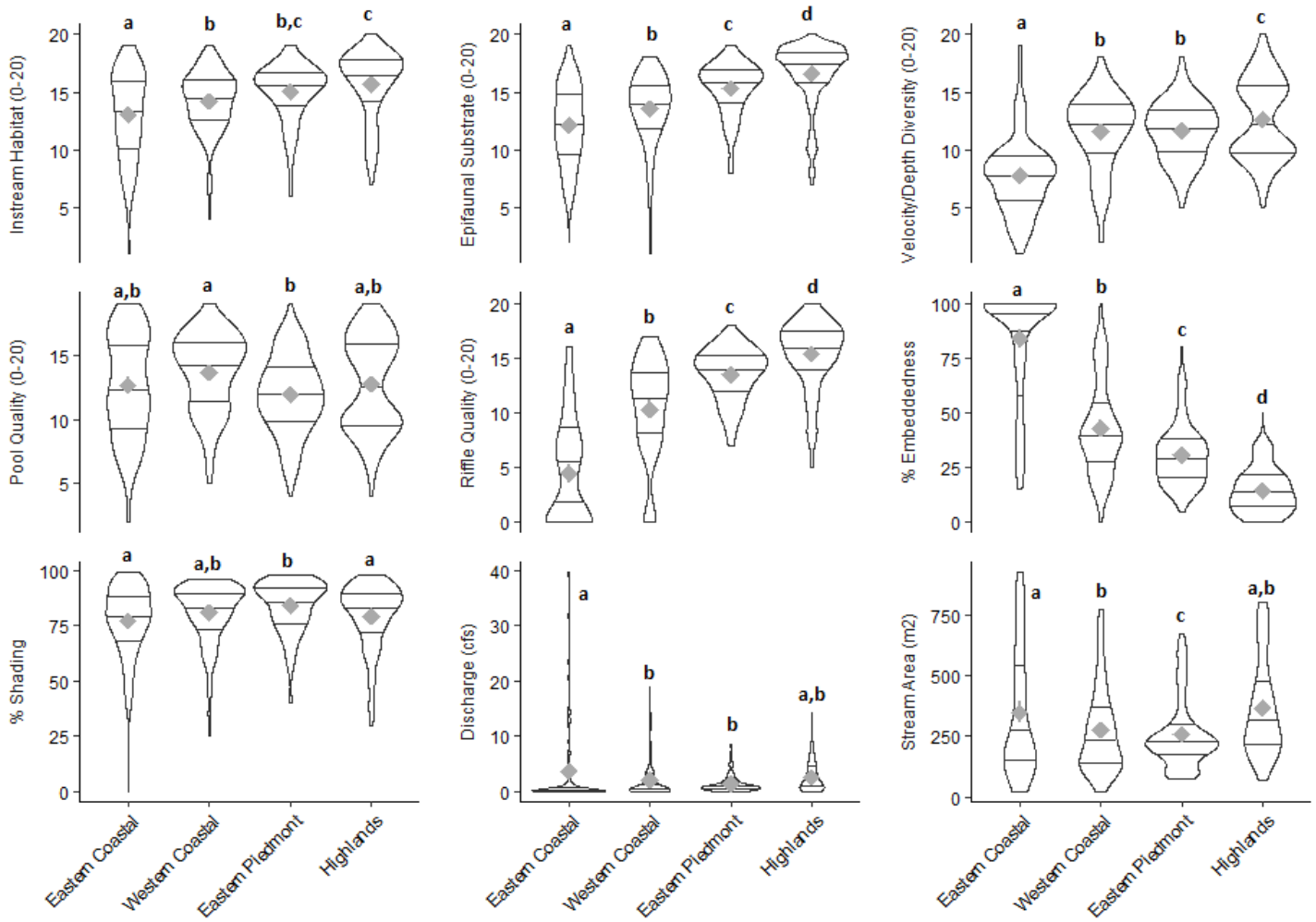


Figure 14 – Violin plots displaying physical habitat metric distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Water and Air Temperature

One-way ANOVA tests and Tukey multiple pairwise-comparisons were performed to determine differences in seasonal water and air temperature by region (Tables 8 through 15). Distributions by region are displayed as violin plots (Figures 15 through 18).

Average daily mean winter water temperatures differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.759$), and Eastern Piedmont and Western Coastal sites ($p = 0.322$). Average daily mean winter air temperatures differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.416$). The same was the case for average daily mean "warmest 7 days" winter water temperatures ($p = 0.626$). Average daily mean "warmest 7 days" winter air temperatures differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.938$), and Eastern Piedmont and Highland sites ($p = 0.500$).

Average daily mean spring water temperatures and "warmest 7 days" spring water temperatures differed among all regions ($p < 0.05$). Average daily mean spring air temperatures and "warmest 7 days" spring air temperatures differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.341$ and $p = 0.995$, respectively).

Average daily mean summer water temperatures, summer air temperatures, "warmest 7 days" summer water temperatures, and "warmest 7 days" summer air temperatures differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.093$, $p = 0.390$, $p = 0.064$, and $p = 0.246$, respectively). Average daily mean fall water temperatures, fall air temperatures, "warmest 7 days" fall water temperatures, and "warmest 7 days" fall air temperatures also differed among all regions except when comparing Eastern Coastal and Western Coastal sites ($p = 0.888$, $p = 0.096$, $p = 0.815$, and $p = 0.421$, respectively).

A strong west to east temperature gradient was observed for all seasons with the highest temperatures observed in the Coastal Plain regions and lowest temperatures observed in the Highlands and/or Eastern Piedmont regions.

Table 8 - Analysis of variance of average daily mean winter water and air temperature (December, January, February) by geographic region from 2011 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Winter Water Temperature (℃)	Western Coastal - Eastern Coastal	-0.224	-0.813	0.365	0.759
	Eastern Piedmont - Eastern Coastal	-0.649	-1.266	-0.033	0.035
	Highlands - Eastern Coastal	-1.776	-2.301	-1.251	0
	Eastern Piedmont - Western Coastal	-0.425	-1.070	0.219	0.322
	Highlands - Western Coastal	-1.552	-2.110	-0.994	0
	Highlands - Eastern Piedmont	-1.127	-1.713	-0.540	< 0.001
Average Daily Mean Winter Air Temperature (℃)	Western Coastal - Eastern Coastal	-0.399	-1.072	0.273	0.416
	Eastern Piedmont - Eastern Coastal	-2.212	-2.927	-1.496	0
	Highlands - Eastern Coastal	-3.850	-4.453	-3.247	0
	Eastern Piedmont - Western Coastal	-1.812	-2.569	-1.055	0
	Highlands - Western Coastal	-3.451	-4.102	-2.799	0
	Highlands - Eastern Piedmont	-1.638	-2.335	-0.942	0

Table 9 - Analysis of variance of average daily mean winter water and air temperature (warmest 7 days) by geographic region from 2011 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Winter Water Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.391	-1.232	0.451	0.626
	Eastern Piedmont - Eastern Coastal	-1.488	-2.368	-0.607	< 0.001
	Highlands - Eastern Coastal	-2.878	-3.627	-2.129	0
	Eastern Piedmont - Western Coastal	-1.097	-2.018	-0.176	0.012
	Highlands - Western Coastal	-2.487	-3.283	-1.691	0
	Highlands - Eastern Piedmont	-1.390	-2.227	-0.553	< 0.001
Average Daily Mean Winter Air Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.315	-1.722	1.093	0.938
	Eastern Piedmont - Eastern Coastal	-2.918	-4.416	-1.419	< 0.001
	Highlands - Eastern Coastal	-3.706	-4.969	-2.443	0
	Eastern Piedmont - Western Coastal	-2.603	-4.188	-1.018	< 0.001
	Highlands - Western Coastal	-3.391	-4.755	-2.027	0
	Highlands - Eastern Piedmont	-0.788	-2.246	0.669	0.500

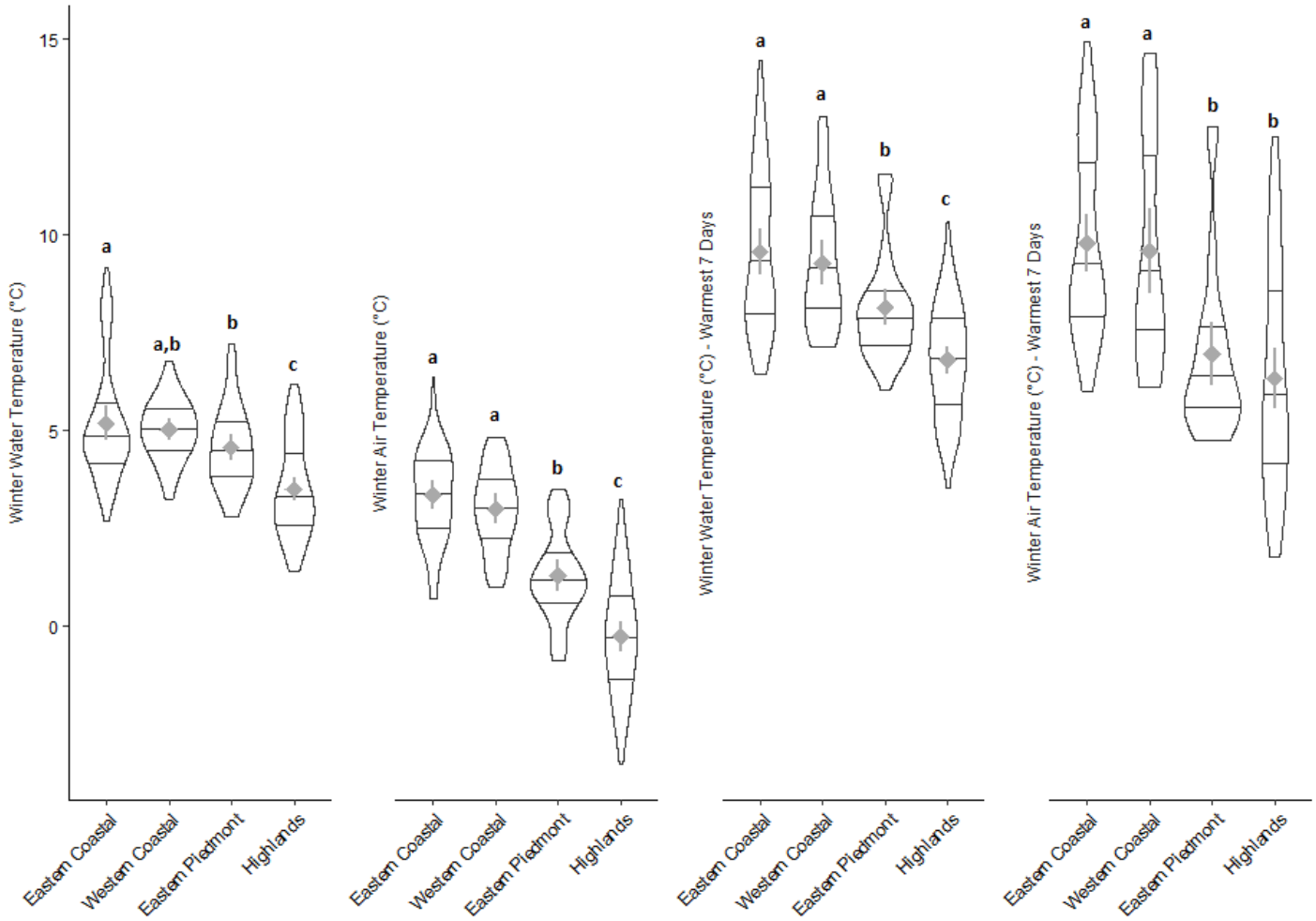


Figure 15 – Violin plots displaying winter temperature distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Table 10 - Analysis of variance of average daily mean spring water and air temperature (March, April, May) by geographic region from 2010 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Spring Water Temperature (℃)	Western Coastal - Eastern Coastal	-0.776	-1.212	-0.340	< 0.001
	Eastern Piedmont - Eastern Coastal	-2.374	-2.808	-1.940	0
	Highlands - Eastern Coastal	-4.175	-4.579	-3.771	0
	Eastern Piedmont - Western Coastal	-1.598	-2.049	-1.147	0
	Highlands - Western Coastal	-3.399	-3.821	-2.977	0
	Highlands - Eastern Piedmont	-1.801	-2.222	-1.381	0
Average Daily Mean Spring Air Temperature (℃)	Western Coastal - Eastern Coastal	0.365	-0.200	0.931	0.341
	Eastern Piedmont - Eastern Coastal	-0.998	-1.563	-0.432	< 0.001
	Highlands - Eastern Coastal	-2.775	-3.294	-2.256	0
	Eastern Piedmont - Western Coastal	-1.363	-1.954	-0.772	0
	Highlands - Western Coastal	-3.141	-3.687	-2.594	0
	Highlands - Eastern Piedmont	-1.778	-2.324	-1.231	0

Table 11 - Analysis of variance of average daily mean spring water and air temperature (warmest 7 days) by geographic region from 2010 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Spring Water Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-1.153	-1.847	-0.459	< 0.001
	Eastern Piedmont - Eastern Coastal	-3.823	-4.514	-3.132	0
	Highlands - Eastern Coastal	-5.296	-5.939	-4.653	0
	Eastern Piedmont - Western Coastal	-2.669	-3.387	-1.952	0
	Highlands - Western Coastal	-4.143	-4.814	-3.471	0
	Highlands - Eastern Piedmont	-1.473	-2.142	-0.804	< 0.001
Average Daily Mean Spring Air Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	0.062	-0.604	0.729	0.995
	Eastern Piedmont - Eastern Coastal	-1.091	-1.758	-0.425	< 0.001
	Highlands - Eastern Coastal	-2.387	-2.999	-1.776	0
	Eastern Piedmont - Western Coastal	-1.154	-1.850	-0.457	< 0.001
	Highlands - Western Coastal	-2.449	-3.093	-1.805	0
	Highlands - Eastern Piedmont	-1.296	-1.940	-0.652	< 0.001

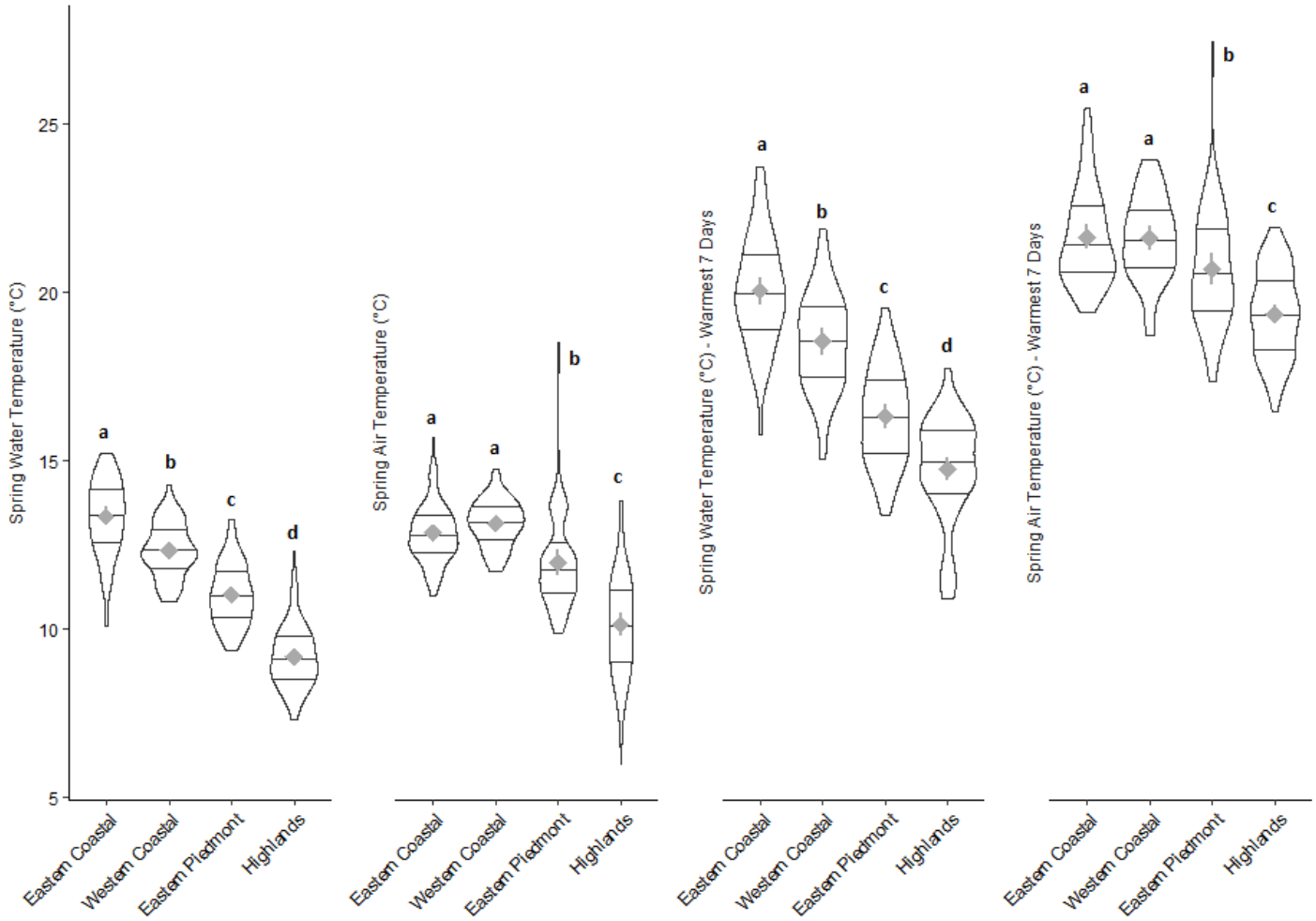


Figure 16 – Violin plots displaying spring temperature distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Table 12 - Analysis of variance of average daily mean summer water and air temperature (June, July, August) by geographic region from 2000 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Summer Water Temperature (℃)	Western Coastal - Eastern Coastal	-0.502	-1.057	0.053	0.093
	Eastern Piedmont - Eastern Coastal	-3.302	-3.838	-2.766	0
	Highlands - Eastern Coastal	-4.741	-5.253	-4.230	0
	Eastern Piedmont - Western Coastal	-2.800	-3.348	-2.252	0
	Highlands - Western Coastal	-4.240	-4.764	-3.715	0
	Highlands - Eastern Piedmont	-1.440	-1.943	-0.936	0
Average Daily Mean Summer Air Temperature (℃)	Western Coastal - Eastern Coastal	-0.315	-0.829	0.199	0.390
	Eastern Piedmont - Eastern Coastal	-1.555	-2.044	-1.065	0
	Highlands - Eastern Coastal	-3.305	-3.760	-2.850	0
	Eastern Piedmont - Western Coastal	-1.240	-1.749	-0.731	0
	Highlands - Western Coastal	-2.990	-3.466	-2.515	0
	Highlands - Eastern Piedmont	-1.751	-2.200	-1.302	0

Table 13 - Analysis of variance of average daily mean summer water and air temperature (warmest 7 days) by geographic region from 2000 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Summer Water Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.696	-1.418	0.026	0.064
	Eastern Piedmont - Eastern Coastal	-3.797	-4.494	-3.100	0
	Highlands - Eastern Coastal	-5.049	-5.714	-4.383	0
	Eastern Piedmont - Western Coastal	-3.101	-3.813	-2.389	0
	Highlands - Western Coastal	-4.353	-5.035	-3.671	0
	Highlands - Eastern Piedmont	-1.252	-1.907	-0.597	< 0.001
Average Daily Mean Summer Air Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.491	-1.171	0.189	0.246
	Eastern Piedmont - Eastern Coastal	-1.798	-2.446	-1.150	0
	Highlands - Eastern Coastal	-3.357	-3.959	-2.755	0
	Eastern Piedmont - Western Coastal	-1.307	-1.980	-0.633	< 0.001
	Highlands - Western Coastal	-2.866	-3.495	-2.237	0
	Highlands - Eastern Piedmont	-1.559	-2.153	-0.965	0

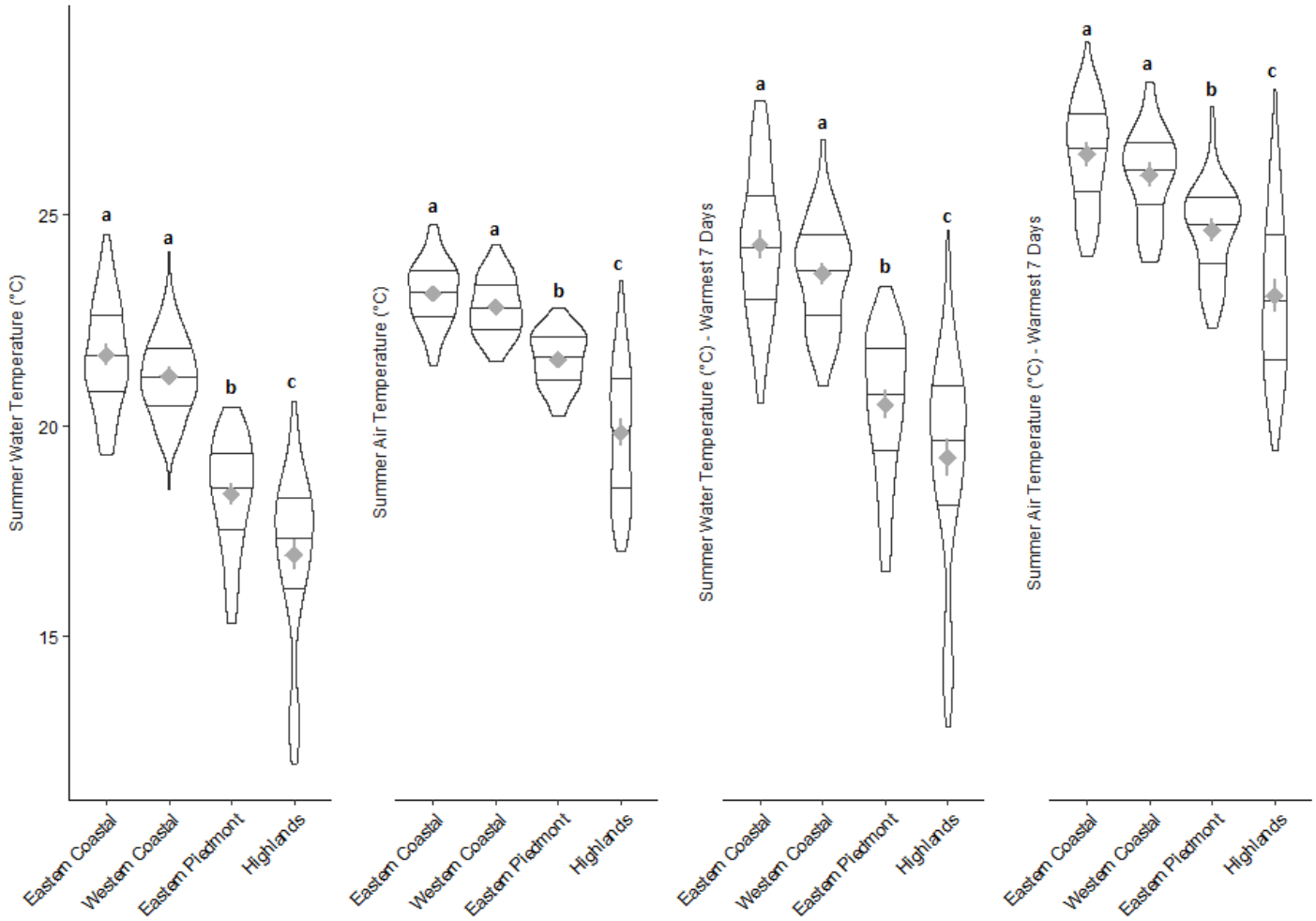


Figure 17 – Violin plots displaying summer temperature distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Table 14 - Analysis of variance of average daily mean fall water and air temperature (September, October, November) by geographic region from 2010 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Fall Water Temperature (℃)	Western Coastal - Eastern Coastal	-0.127	-0.579	0.326	0.888
	Eastern Piedmont - Eastern Coastal	-1.598	-2.044	-1.152	0
	Highlands - Eastern Coastal	-3.181	-3.585	-2.777	0
	Eastern Piedmont - Western Coastal	-1.471	-1.935	-1.008	0
	Highlands - Western Coastal	-3.054	-3.477	-2.632	0
	Highlands - Eastern Piedmont	-1.583	-1.999	-1.167	0
Average Daily Mean Fall Air Temperature (℃)	Western Coastal - Eastern Coastal	-0.505	-1.068	0.058	0.096
	Eastern Piedmont - Eastern Coastal	-1.715	-2.268	-1.162	0
	Highlands - Eastern Coastal	-3.252	-3.748	-2.756	0
	Eastern Piedmont - Western Coastal	-1.210	-1.797	-0.623	0
	Highlands - Western Coastal	-2.747	-3.280	-2.213	0
	Highlands - Eastern Piedmont	-1.537	-2.060	-1.013	0

Table 15 - Analysis of variance of average daily mean fall water and air temperature (warmest 7 days) by geographic region from 2010 to 2020.

Parameter	Geographic Region	Difference in means	95% CI Lower	95% CI Upper	p-value
Average Daily Mean Fall Water Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.268	-1.055	0.519	0.815
	Eastern Piedmont - Eastern Coastal	-2.505	-3.281	-1.729	0
	Highlands - Eastern Coastal	-3.762	-4.464	-3.060	0
	Eastern Piedmont - Western Coastal	-2.237	-3.043	-1.431	0
	Highlands - Western Coastal	-3.494	-4.230	-2.759	0
	Highlands - Eastern Piedmont	-1.257	-1.980	-0.534	< 0.001
Average Daily Mean Fall Air Temperature (℃) - Warmest 7 days	Western Coastal - Eastern Coastal	-0.453	-1.218	0.313	0.421
	Eastern Piedmont - Eastern Coastal	-1.543	-2.295	-0.791	< 0.001
	Highlands - Eastern Coastal	-2.803	-3.478	-2.128	0
	Eastern Piedmont - Western Coastal	-1.091	-1.889	-0.292	0.003
	Highlands - Western Coastal	-2.351	-3.076	-1.625	0
	Highlands - Eastern Piedmont	-1.260	-1.972	-0.548	< 0.001

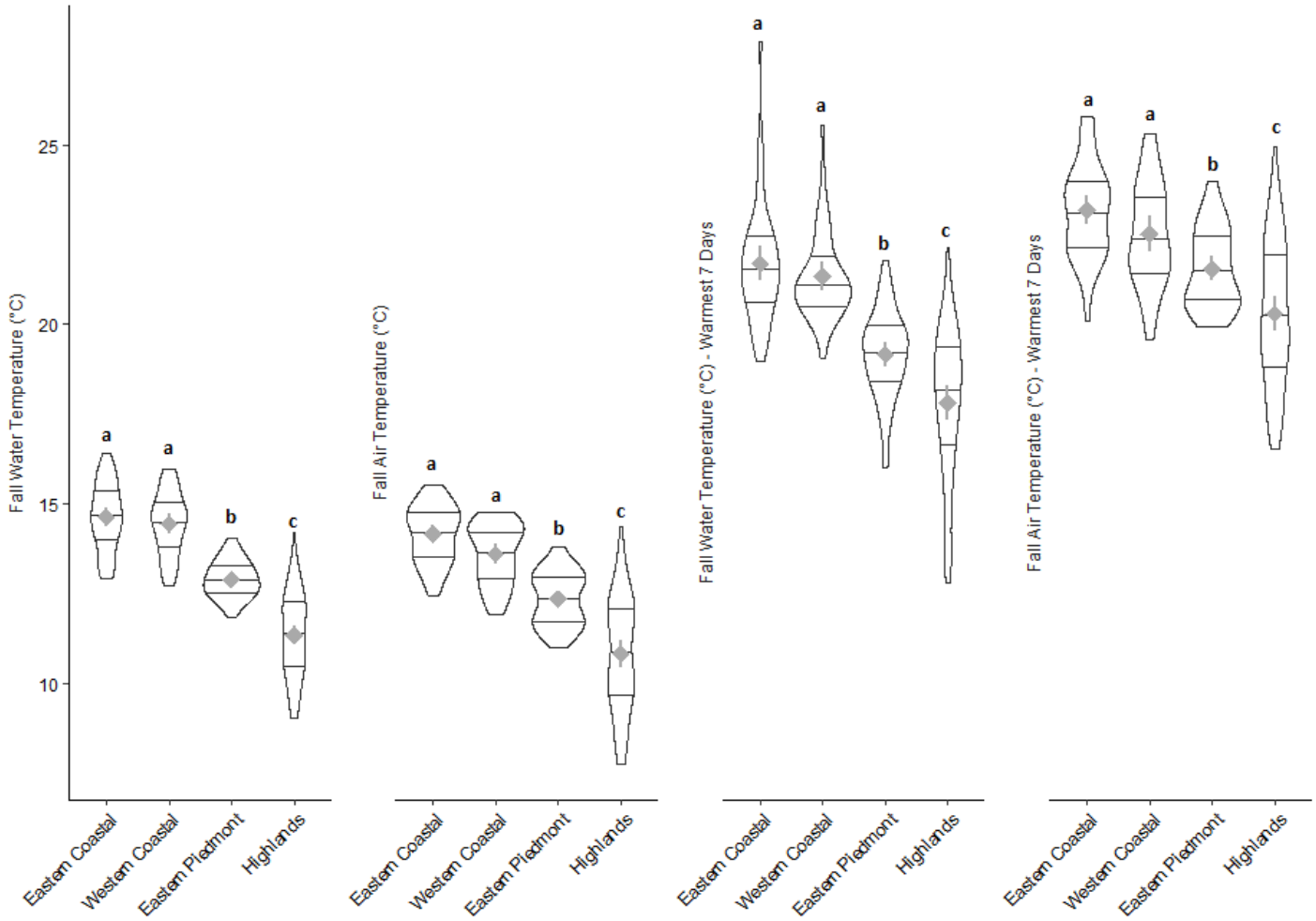


Figure 18 – Violin plots displaying fall temperature distributions by region from 1995 to 2020. Violin width represents relative frequency, horizontal lines represent 25th, 50th, and 75th percentiles, and gray symbols represent the mean and 95% confidence intervals. Distributions are labeled (a,b,c,d) based on analysis of variance and Tukey test results.

Temporal Patterns

Index of Biotic Integrity Trends

Changes in biological communities over time were determined through correlating sampling year with IBI scores and other potential influencing variables. All significant results from Pearson's correlation analyses are listed below in Tables 16 and 17. Correlations considered significant had a coefficient > 0.4 and a p-value < 0.05.

Significant negative correlations between sampling year and BIBI score were only observed at three out of thirty sentinel sites (JONE-109-S and JONE-315-S in the Eastern Piedmont; UPCK-113-S in the Eastern Coastal Plain). Lower BIBI scores at JONE-109-S in recent years were likely influenced by the "number of Ephemeroptera taxa" metric as a significant negative correlation between this metric and sampling year was observed. Lower BIBI scores in recent years at JONE-315-S were likely influenced by negative correlations observed between sampling year and two BIBI metrics: % clingers and % intolerant to urbanization, as well as a positive correlation observed between sampling year and % Chironomidae. Lower BIBI scores in recent years at UPCK-113-S were likely due to negative correlations observed between sampling year and three BIBI metrics: number of Ephemeroptera taxa, number of EPT taxa, and % Ephemeroptera.

Significant positive correlations between sampling year and BIBI score were only observed at one out of thirty sentinel sites (LOCH-120-S in the Eastern Piedmont). Higher BIBI scores in recent years at this site were likely due to positive correlations observed between sampling year and two BIBI metrics: number of taxa and number of EPT taxa.

Significant negative correlations were observed between sampling year and FIBI score at two highland sites (FIMI-207-S and SAVA-225-S) and one piedmont site (JONE-315-S). Lower FIBI scores in recent years at FIMI-207-S were likely influenced by negative correlations observed between sampling year and two FIBI metrics: abundance per square meter and % tolerant, as well as a positive correlation between sampling year and % generalists/omnivores/invertivores. It is difficult to determine which metrics influenced the lower FIBI scores in recent years at SAVA-225-S as no significant correlations between sampling year and FIBI metrics were observed at this site. Lower FIBI scores observed at JONE-315-S in recent years were likely influenced by the negative correlation observed between sampling year and fish abundance per square meter.

Significant positive correlations were observed between sampling year and FIBI score at one Eastern Piedmont site (JONE-109-S) and one Eastern Coastal Plain site (WIRH-220-S). Higher FIBI scores in recent years at JONE-109-S were likely due to a positive correlation observed between sampling year and % lithophilic spawners as well as significant negative correlations observed between sampling year and two other FIBI metrics: % generalists/omnivores/invertivores and % tolerant. It is difficult to understand why FIBI scores in recent years at WIRH-220-S were higher than in previous years as no significant correlations between sampling year and any of the influencing FIBI metrics were observed that would have contributed to this result.

Common patterns in significant correlation (occurring at five or more sites) between sampling year and various IBI metrics are as follows. Significant negative correlations between sampling year and % intolerant benthic macroinvertebrate taxa (% intolerant to urbanization) were observed at seven out of thirty sites. Four of these sites were in the Eastern Piedmont (LOCH-120-S, RKGR-119-S, LIBE-102-S, and JONE-315-S), two in the Highlands (UMON-288-S and SAVA-225-S), and one in the Western Coastal Plain (PAXL-294-S). Change in % intolerant benthic macroinvertebrate taxa at these sites from the first year of sampling to the most recent appeared to range from -72.1% to -7.1%.

Significant negative correlations between sampling year and fish abundance per square meter were observed at five out of thirty sites. Four of these sites were in the Highlands (SAVA-204-S, SAVA-276-S, FIMI-207-S, and PRLN-626-S) and one in the Eastern Piedmont (RKGR-119-S). Change in fish abundance per square meter at these sites from the first year of sampling to the most recent year ranged from -1.62 to 0.16 fish per square meter. Since the upper end of this range is positive, additional years of sampling may be required to determine if these correlations remain significantly negative.

Significant positive correlations were observed between sampling year and number of benthic macroinvertebrate taxa at six out of thirty sites. Two of these sites were in the Highlands (FIMI-207-S and UMON-288-S), three were in the Eastern Piedmont (JONE-315-S, LIBE-102-S, and LOCH-120-S), and one was in the Eastern Coastal Plain (NASS-302-S). Change in number of benthic macroinvertebrate taxa at these sites from the first year of sampling to the most recent year ranged from 10 to 16 taxa.

Significant positive correlations were observed between sampling year and number of EPT taxa at five out of thirty sites. Three of these sites were in the Highlands (FIMI-207-S, PRLN-626-S, and UMON-288-S), one in the Eastern Piedmont (LOCH-120-S), and one in the Western Coastal Plain (ZEKI-012-S). Change in number of EPT taxa at these sites from the first year of sampling to the most recent ranged from 3 to 12 taxa.

As increases in number of taxa over time are unexpected, even in minimally disturbed streams, future analysis exploring any slight variations in sampling technique or sample processing may be required to determine if these increases truly exist. It is important to note that ZEKI-012-S was not sampled after 2013 for benthic macroinvertebrates. Therefore correlations observed between sampling year and benthic macroinvertebrate IBI metrics at this site may be misleading.

Table 16. Significant correlations observed between sampling year and BIBI score/influencing metrics.

Metric	Site	R	p-value	Direction
BIBI Score	JONE-109-S	-0.600	0.004	Decrease
	JONE-315-S	-0.440	0.043	Decrease
	UPCK-113-S	-0.520	0.013	Decrease
	LOCH-120-S	0.460	0.036	Increase
# Ephemeroptera Taxa	JONE-109-S	-0.770	< 0.001	Decrease
	STCL-051-S	-0.430	0.049	Decrease
	UPCK-113-S	-0.560	0.007	Decrease
	UMON-288-S	0.476	0.029	Increase
# EPT Taxa	UPCK-113-S	-0.440	0.041	Decrease
	FIMI-207-S	0.514	0.017	Increase
	LOCH-120-S	0.502	0.020	Increase
	PRLN-626-S	0.608	0.003	Increase
	UMON-288-S	0.686	0.001	Increase
	ZEKI-012-S	0.557	0.048	Increase
# Scraper Taxa	MATT-033-S	0.428	0.047	Increase
	NANJ-331-S	0.543	0.011	Increase
	UPCR-208-S	0.572	0.032	Increase
# Taxa	FIMI-207-S	0.563	0.008	Increase
	JONE-315-S	0.479	0.024	Increase
	LIBE-102-S	0.438	0.047	Increase
	LOCH-120-S	0.537	0.012	Increase
	NASS-302-S	0.596	0.007	Increase
	UMON-288-S	0.689	0.001	Increase
% Chironomidae	JONE-315-S	0.538	0.010	Increase
	LOCH-120-S	0.557	0.009	Increase
% Climbers	CORS-102-S	-0.450	0.039	Decrease
	JONE-315-S	-0.480	0.023	Decrease
	LOCH-120-S	-0.450	0.040	Decrease
% Diptera	FIMI-207-S	0.495	0.022	Increase
	UMON-288-S	0.445	0.043	Increase
% Ephemeroptera	PAXL-294-S	-0.540	0.010	Decrease
	UPCK-113-S	-0.470	0.029	Decrease
% Intolerant Urban Taxa	JONE-315-S	-0.680	< 0.001	Decrease
	LIBE-102-S	-0.460	0.038	Decrease
	LOCH-120-S	-0.530	0.014	Decrease
	PAXL-294-S	-0.470	0.028	Decrease
	RKGR-119-S	-0.550	0.009	Decrease
	SAVA-225-S	-0.470	0.031	Decrease
	UMON-288-S	-0.700	< 0.001	Decrease
	CORS-102-S	0.543	0.011	Increase
% Swimmers	UMON-119-S	-0.500	0.028	Decrease
	UMON-288-S	-0.560	0.008	Decrease

Table 17. Significant correlations observed between sampling year and FIBI score/influencing metrics.

Metric	Site	R	p-value	Direction
FIBI	FIMI-207-S	-0.670	0.001	Decrease
	JONE-315-S	-0.420	0.050	Decrease
	SAVA-225-S	-0.510	0.019	Decrease
	JONE-109-S	0.530	0.013	Increase
	WIRH-220-S	0.483	0.026	Increase
Abundance per m2	FIMI-207-S	-0.720	< 0.001	Decrease
	PRLN-626-S	-0.710	< 0.001	Decrease
	RKGR-119-S	-0.520	0.012	Decrease
	SAVA-204-S	-0.650	0.002	Decrease
	SAVA-276-S	-0.520	0.016	Decrease
Biomass per m2	JONE-315-S	-0.450	0.038	Decrease
	LIBE-102-S	-0.550	0.010	Decrease
# Benthic Sp. (Adjusted)	UPCK-113-S	0.515	0.017	Increase
% Abundance of Dominant Species	WIRH-220-S	-0.66	0.001	Decrease
% Brook Trout	ANTI-101-S	-0.680	0.011	Decrease
	SAVA-276-S	-0.470	0.030	Decrease
	UMON-119-S	-0.760	< 0.001	Decrease
	YOUG-432-S	0.475	0.040	Increase
% Generalists/ Omnivores/Invertivores	MATT-033-S	-0.530	0.010	Decrease
	JONE-109-S	-0.470	0.031	Decrease
	LOCH-120-S	-0.490	0.023	Decrease
	FIMI-207-S	0.629	0.002	Increase
% Lithophilic Spawners	JONE-109-S	0.471	0.031	Increase
% Round-bodied Suckers	PTOB-002-S	0.807	< 0.001	Increase
% Sculpins	SAVA-276-S	0.473	0.030	Increase
% Tolerant	FURN-101-S	-0.580	0.006	Decrease
	JONE-109-S	-0.470	0.031	Decrease
	STCL-051-S	-0.570	0.006	Decrease
	WIRH-220-S	-0.790	< 0.001	Decrease
	ANTI-101-S	0.675	0.011	Increase
	FIMI-207-S	0.609	0.003	Increase
	PRMT-177-S	0.848	0.004	Increase
	UMON-119-S	0.774	< 0.001	Increase

Coldwater Taxa Trends

Becker et al. (2010) examined water temperature data and biological data collected at 1,094 one-time MBSS sites and determined the following list of coldwater benthic macroinvertebrate taxa: *Tallaperla, Sweltsa, Cinygmula, Wormaldia, Diphetor, Bittacomorpha, Prodiamesa, Paraleptophlebia, Dixa, Habrophlebia, Alloperla, Diplectrona, Epeorus, Ephemera, Leuctra*, and *Heleniella.* Percent abundance of coldwater benthic taxa by site from 1995 to 2020 are displayed in Figure 19. Sites displayed are those with years where less than 10% of summer water temperature readings were above 20°C and daily maximum temperatures did not exceed 23.8°C (MDE 2019). Pearson's correlation coefficients and corresponding p-values (Table 18) were calculated to determine if significant correlations exist between sampling year and %

abundance of coldwater benthic macroinvertebrate taxa at these sites. The only significant correlation observed between sampling year and % abundance of coldwater benthic macroinvertebrate taxa was a negative correlation observed at JONE-315-S. Percent abundance of coldwater benthic macroinvertebrate taxa at this site from the first year of sampling to the most recent appeared to decrease by 3.4% (almost the entire starting percentage).

Percent abundances of brook trout by site from 2000 to 2020 are also displayed in Figure 19. Pearson's correlation coefficients and corresponding p-values (Table 19) were calculated to determine if significant correlations exist between sampling year and % abundance of brook trout at these sites. Significant negative correlations were observed between sampling year and % abundance of brook trout at four out the ten sites containing brook trout: ANTI-101-S, LIBE-102-S, SAVA-276-S, and UMON-119-S. Brook trout have not been observed at LIBE-102-S since 2006. It should be noted that ANTI-101-S was not sampled from 2002 to 2009 which may have affected the correlation between sampling year and % abundance of brook trout at this site. Change in % abundance of brook trout at these four sites from the first year of sampling to the most recent year ranged from -34.4% to -4.4%. Significant positive correlations were observed between sampling year and % abundance of brook trout at two of the ten sites containing brook trout: SAVA-225-S and YOUG-432-S. Change in % abundance of brook trout at these two sites from the first year of sampling to the most recent year ranged from 6.0% to 10.6%

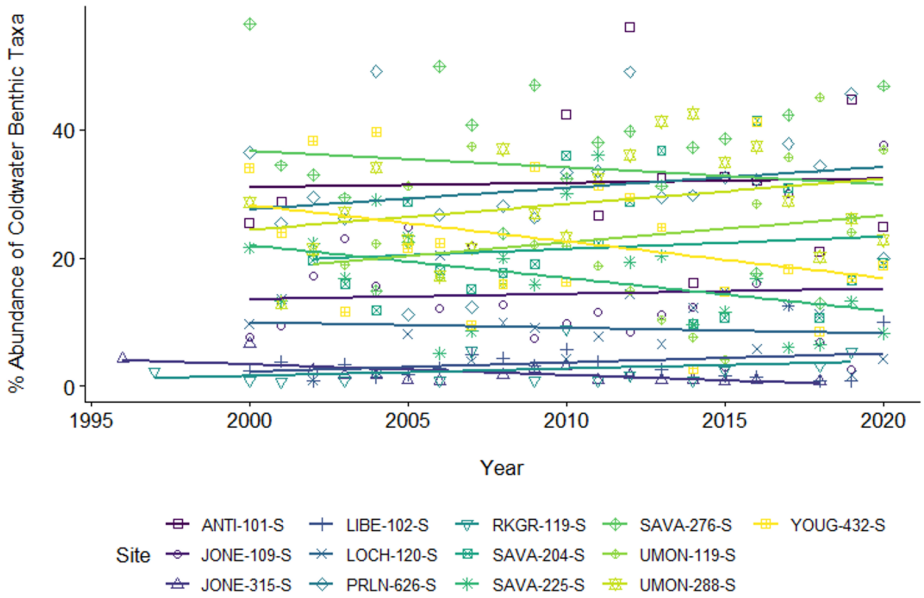


Table 18 – Correlations by site between sampling year and % abundance of coldwater benthic macroinvertebrate taxa.

Pearson's Correlation Coefficients		
Site	R	p-value
ANTI-101-S	0.039	0.900
JONE-109-S	0.058	0.804
JONE-315-S	**-0.666**	**0.004**
LIBE-102-S	0.295	0.221
LOCH-120-S	-0.105	0.669
PRLN-626-S	0.208	0.366
RKGR-119-S	0.314	0.255
SAVA-204-S	0.114	0.643
SAVA-225-S	-0.377	0.092
SAVA-276-S	-0.138	0.551
UMON-119-S	0.220	0.365
UMON-288-S	0.307	0.176
YOUG-432-S	-0.325	0.151

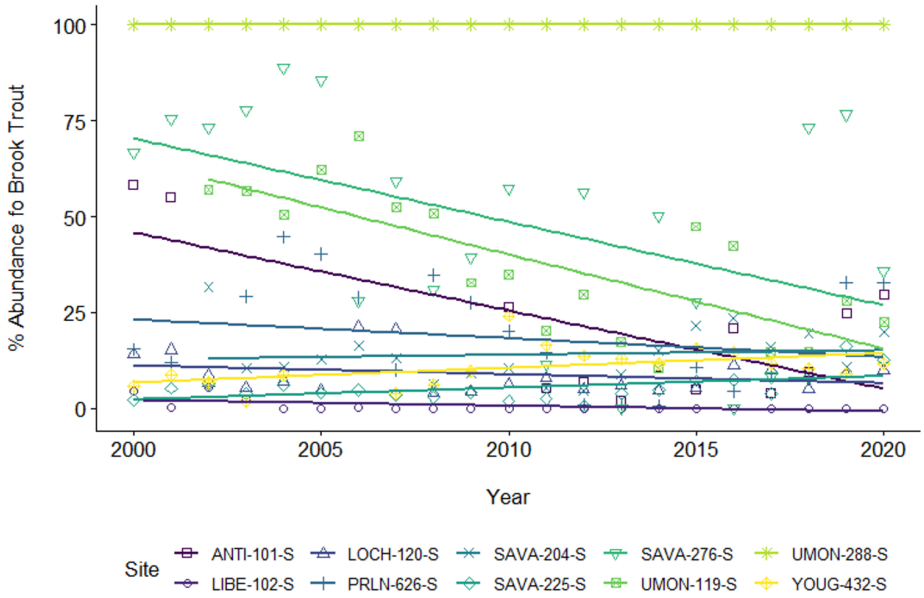


Table 19 – Correlations by site between sampling year and % abundance of brook trout.

Pearson's Correlation Coefficients		
Site	R	p-value
ANTI-101-S	**-0.675**	**0.011**
LIBE-102-S	**-0.576**	**0.006**
LOCH-120-S	-0.276	0.227
PRLN-626-S	-0.219	0.340
SAVA-204-S	0.096	0.694
SAVA-225-S	**0.523**	**0.015**
SAVA-276-S	**-0.473**	**0.030**
UMON-119-S	**-0.752**	**< 0.001**
UMON-288-S	-	-
YOUG-432-S	**0.475**	**0.040**

Figure 19 – Scatter plots displaying % abundance of coldwater benthic macroinvertebrate taxa (1995-2020) and % abundance of brook trout (2000-2020) observed at sentinel sites in the Eastern Piedmont and Highlands of Maryland.

Water Chemistry Trends

Changes in water chemistry over time were examined through correlating sampling year with water chemistry parameters measured at sentinel sites annually. All significant results from Pearson's correlation analyses are listed below in Table 20. Correlations considered significant had a coefficient > 0.4 and a p-value < 0.05. Common patterns in significant correlation (occurring at five sites or more) between sampling year and various water chemistry parameters are as follows.

Significant positive correlations between sampling year and chloride concentration (one-time spring grab samples) were observed at all six sites in the Eastern Piedmont along with two sites in the Highlands (UMON-119-S and ANTI-101-S), one site in the Western Coastal Plain (PAXL-294-S), and one site in the Eastern Coastal Plain. Change in chloride concentration at these sites from the first year of sampling to the most recent year ranged from 5.19 to 50.24 mg/L. Specific conductivity correlated with sampling year at eight out of nine of these sites and acid neutralizing capacity positively correlated with sampling year at seven out of nine of these sites. Change in specific conductivity at these sites from the first year of sampling to the most recent year ranged from 12.4 to 179.5 µS/cm. Change in acid neutralizing capacity from the first year of sampling to the most recent year ranged from 31.8 to 262.0 µeq/L. pH positively correlated with sampling year at only two of the nine sites and change in pH at these sites from the first year of sampling to the most recent year ranged from -0.06 to 0.04. Since the lower end of this range is negative, additional years of sampling may be required to determine if these correlations remain significantly positive.

Significant positive correlations between sampling year and nitrite-nitrogen were observed at fourteen out of thirty sentinel sites. Three of these sites were in the Western Coastal Plain (PTOB-002-S, NANJ-331-S, and STCL-051-S), three were in the Eastern Piedmont (LOCH-120-S, JONE-109-S, and LIBE-102-S) and eight were in the Highlands (YOUG-432-S, UMON-119-S, SAVA-204-S, SAVA-276-S, ANTI-101-S, FIMI-207-S, UMON-288-S, and SAVA-225-S). Significant positive correlations between sampling year and ammonia-nitrogen were observed at five out of thirty sites. Four of these sites were in the Highlands (SAVA-225-S, UMON-288-S, ANTI-101-S, and SAVA-276-S) and one site was in the Eastern Piedmont (LOCH-120-S). At these sites, however, levels of nitrite and ammonia were often below detection limits (DL), which in these cases were recorded rather than the actual nitrite and ammonia measurements. DLs are used when analyte concentrations are so low that it is difficult to distinguish between the actual concentration and instrument noise, therefore a DL is the concentration of an analyte that can be considered reliable above this noise. DLs for both nitrite and ammonia were different for each year of MBSS sampling and DLs in more recent years appeared to be slightly higher than in years past, implying that increases in DLs over time may have influenced the positive correlations observed between sampling year and nitrite and ammonia concentrations. Increases observed appeared to be no more than 0.0052 mg/L for nitrite-nitrogen and no more than 0.0084 mg/L for ammonia-nitrogen.

Significant positive correlations were observed between sampling year and nitrate-nitrogen, and sampling year and total nitrogen at five out of thirty sentinel sites (JONE-109-S, JONE-315-S, LIBE-102-S, and RKGR-119-S in the Eastern Piedmont, and UMON-119-S in the Highlands). Change in total nitrogen at these sites from the first year of sampling to the most recent year

ranged from 0.27 to 2.11 mg/L, while change in nitrate-nitrogen at these sites ranged from 0.30 to 1.83 mg/L.

Significant positive correlations between sampling year and orthophosphate were observed at fourteen of the thirty sentinel sites. Six of these sites were in the Western Coastal Plain (MATT-033-S, NANJ-331-S, PAXL-294-S, PTOB-002-S, STCL-051-S, and PRMT-177-S), three in the Eastern Piedmont (FURN-101-S, JONE-190-S, and LOCH-120-S), and five in the Highlands (SAVA-225-S, UMON-119-S, UMON-288-S, YOUG-432-S, and FIMI-207-S). At seven of these sites (PRMT-177-S, LOCH-120-S, FURN-101-S, YOUG-432-S, UMON-119-S, FIMI-207-S, and SAVA-225-S), orthophosphate levels were below DLs during several years and DLs were recorded instead of the actual orthophosphate measurements, implying that increases in DLs over time may have influenced the positive correlations observed between orthophosphate and sampling year. Increases in orthophosphate measurements at these sites appeared to be no more than 0.016 mg/L.

Significant negative correlations between sampling year and sulfate were observed at eight of the thirty sentinel sites. Seven of these sites were in the Highlands (ANTI-101-S, FIMI-207-S, PRLN-626-S, SAVA-204-S, SAVA-225-S, SAVA-276-S, and UMON-119-S) and one was in the Eastern Piedmont (JONE-315-S). Change in sulfate at these sites from the first year of sampling to the most recent year ranged from -3.93 to -1.68 mg/L.

Significant positive correlations between sampling year and bromide were observed at seven of the thirty sentinel sites. Five of these sites were in the Highlands (ANTI-101-S, FIMI-207-S, PRLN-626-S, SAVA-276-S, and YOUG-432-S) and two of these sites were in the Western Coastal Plain (NANJ-331-S and PRMT-177-S). It should be noted that bromide has only been included in MBSS water chemistry sample analysis since 2013. Increases in bromide at these sites appeared to be no more than 0.0319 mg/L. It should be noted that at the five Highland sites, bromide levels were below DLs during several years and DLs were recorded instead of actual bromide measurements, implying that increases in DLs over time may have influenced the positive correlations observed between bromide and sampling year.

It is also important to note that ANTI-101-S was not sampled between 2002 and 2009 and PRMT-177-S was not sampled until 2012. Therefore, correlations observed between sampling year and water chemistry at these sites may be misleading.

Table 20. Significant correlations observed between sampling year and water chemistry parameters.

Parameter	Site	R	p-value	Direction
Acid Neutralizing Capacity (µeq/L)	FURN-101-S	0.573	0.008	Increase
	JONE-109-S	0.543	0.013	Increase
	LIBE-102-S	0.571	0.007	Increase
	LOCH-120-S	0.503	0.024	Increase
	MATT-033-S	0.760	< 0.001	Increase
	PAXL-294-S	0.569	0.007	Increase
	RKGR-119-S	0.551	0.010	Increase
	UMON-119-S	0.714	0.001	Increase
	WIRH-220-S	0.674	0.001	Increase
	YOUG-432-S	0.603	0.003	Increase
Ammonia-Nitrogen (mg/L)	PTOB-002-S	-0.470	0.043	Decrease
	ANTI-101-S	0.726	0.005	Increase
	LOCH-120-S	0.498	0.025	Increase
	SAVA-225-S	0.634	0.002	Increase
	SAVA-276-S	0.444	0.044	Increase
	UMON-288-S	0.608	0.003	Increase
Bromide (mg/L)	ANTI-101-S	0.771	0.025	Increase
	FIMI-207-S	0.778	0.023	Increase
	NANJ-331-S	0.781	0.038	Increase
	PRLN-626-S	0.840	0.009	Increase
	PRMT-177-S	0.930	0.002	Increase
	SAVA-276-S	0.830	0.011	Increase
	YOUG-432-S	0.749	0.020	Increase
Calcium (mg/L)	NASS-108-S	-0.860	0.029	Decrease
	FURN-101-S	0.849	0.033	Increase
Chloride (mg/L)	MATT-102-S	-1.000	0.036	Decrease
	PRLN-626-S	-0.840	< 0.001	Decrease
	SAVA-276-S	-0.910	< 0.001	Decrease
	UMON-288-S	-0.670	0.001	Decrease
	ANTI-101-S	0.580	0.038	Increase
	FURN-101-S	0.455	0.044	Increase
	JONE-109-S	0.514	0.020	Increase
	JONE-315-S	0.766	< 0.001	Increase
	LIBE-102-S	0.971	< 0.001	Increase
	LOCH-120-S	0.610	0.004	Increase
	PAXL-294-S	0.604	0.005	Increase
	RKGR-119-S	0.981	< 0.001	Increase
	UMON-119-S	0.763	< 0.001	Increase
	WIRH-220-S	0.491	0.028	Increase
Copper (µg/L)	FIMI-207-S	-0.770	0.042	Decrease
	UPCR-208-S	-0.820	0.044	Decrease
Dissolved Organic Carbon (mg/L)	NANJ-331-S	0.482	0.032	Increase
	SAVA-276-S	0.532	0.011	Increase
Magnesium (mg/L)	NASS-108-S	-0.860	0.027	Decrease
	FURN-101-S	0.877	0.022	Increase
Nitrate-Nitrogen (mg/L)	MATT-033-S	-0.440	0.044	Decrease
	NASS-108-S	-0.590	0.005	Decrease

Parameter	Site	R	p-value	Direction
	UPCK-113-S	-0.650	0.001	Decrease
	JONE-109-S	0.850	< 0.001	Increase
	JONE-315-S	0.432	0.050	Increase
	LIBE-102-S	0.809	< 0.001	Increase
	LOCH-120-S	0.496	0.026	Increase
	RKGR-119-S	0.735	< 0.001	Increase
	UMON-119-S	0.504	0.028	Increase
Nitrite-Nitrogen (mg/L)	ANTI-101-S	0.668	0.013	Increase
	FIMI-207-S	0.717	< 0.001	Increase
	JONE-109-S	0.548	0.012	Increase
	LIBE-102-S	0.641	0.002	Increase
	LOCH-120-S	0.567	0.009	Increase
	NANJ-331-S	0.565	0.009	Increase
	PTOB-002-S	0.636	0.003	Increase
	SAVA-204-S	0.558	0.011	Increase
	SAVA-225-S	0.611	0.003	Increase
	SAVA-276-S	0.730	< 0.001	Increase
	STCL-051-S	0.634	0.003	Increase
	UMON-119-S	0.617	0.005	Increase
	UMON-288-S	0.626	0.002	Increase
	YOUG-432-S	0.628	0.002	Increase
Ortho-phosphate (mg/L)	MATT-102-S	-1.000	0.037	Decrease
	FIMI-207-S	0.912	< 0.001	Increase
	FURN-101-S	0.884	< 0.001	Increase
	JONE-109-S	0.617	0.004	Increase
	LOCH-120-S	0.761	< 0.001	Increase
	MATT-033-S	0.636	0.003	Increase
	NANJ-331-S	0.720	< 0.001	Increase
	PAXL-294-S	0.703	0.001	Increase
	PRMT-177-S	0.872	0.005	Increase
	PTOB-002-S	0.568	0.011	Increase
	SAVA-225-S	0.876	< 0.001	Increase
	STCL-051-S	0.559	0.010	Increase
	UMON-119-S	0.860	< 0.001	Increase
	UMON-288-S	0.651	0.001	Increase
	YOUG-432-S	0.717	< 0.001	Increase
pH	JONE-109-S	-0.460	0.043	Decrease
	MATT-102-S	-1.000	0.028	Decrease
	MATT-033-S	0.692	0.001	Increase
	PAXL-294-S	0.483	0.027	Increase
	RKGR-119-S	0.447	0.042	Increase
	YOUG-432-S	0.560	0.007	Increase
Specific Conductance(µS/cm)	MATT-102-S	-1.000	0.038	Decrease
	SAVA-276-S	-0.730	< 0.001	Decrease
	ANTI-101-S	0.570	0.042	Increase
	LIBE-102-S	0.965	< 0.001	Increase
	FURN-101-S	0.445	0.050	Increase
	JONE-109-S	0.544	0.013	Increase
	LOCH-120-S	0.611	0.004	Increase

Parameter	Site	R	p-value	Direction
	PAXL-294-S	0.491	0.024	Increase
	RKGR-119-S	0.831	< 0.001	Increase
	UMON-119-S	0.716	0.001	Increase
Sulfate (mg/L)	ANTI-101-S	-0.810	0.001	Decrease
	FIMI-207-S	-0.730	< 0.001	Decrease
	JONE-315-S	-0.480	0.028	Decrease
	PRLN-626-S	-0.640	0.002	Decrease
	SAVA-204-S	-0.890	< 0.001	Decrease
	SAVA-225-S	-0.800	< 0.001	Decrease
	SAVA-276-S	-0.820	< 0.001	Decrease
	UMON-119-S	-0.500	0.030	Decrease
Total Nitrogen (mg/L)	FURN-101-S	0.501	0.025	Increase
	JONE-109-S	0.823	< 0.001	Increase
	LIBE-102-S	0.750	< 0.001	Increase
	RKGR-119-S	0.672	0.001	Increase
	UMON-119-S	0.536	0.018	Increase
Total Phosphorus (mg/L)	LOCH-120-S	0.502	0.024	Increase
	STCL-051-S	0.456	0.043	Increase
Zinc (µg/L)	SAVA-204-S	-0.790	0.033	Decrease
	MATT-102-S	0.999	0.031	Increase

Physical Habitat Trends

Changes in stream physical habitat over time were determined through correlating sampling year with scores/measurements for physical habitat assessment metrics recorded at sentinel sites annually. All significant results from Pearson's correlation analyses are listed below in Table 21. Correlations considered significant had a coefficient > 0.4 and a p-value < 0.05. Common patterns in significant correlation (occurring at five or more sites) between sampling year and various physical habitat metrics are as follows. As stated in the methods, variations observed over time in habitat metrics presented below may partially be due to variation in scoring by different habitat assessors as the role of habitat assessor has changed hands at most sites in the SSN over the past 20+ years. Efforts to increase consistency among habitat assessors over the years may have influenced these results as well.

Significant negative correlations between sampling year and % shading were observed at twenty-one out of thirty sentinel sites. This included three sites in the Eastern Coastal Plain (CORS-102-S, UPCK-113-S, and WIRH-220-S), six in the Western Coastal Plain (MATT-033-S, NANJ-331-S, PAXL-294-S, PTOB-002-S, STCL-051-S, and ZEKI-012-S), all six sites in the Eastern Piedmont, and six sites in the Highlands (FIMI-207-S, PRLN-626-S, SAVA-204-S, SAVA-225-S, SAVA-276-S, and YOUG-432-S). Although annual training was conducted to improve the consistency of habitat scoring from year to year, it should be noted that there is still variability among assessors when scoring % shading and other habitat assessment metrics. Change in % shading at these sites from the first year of sampling to the most recent ranged from -35 to 0%. Decreases in % shading ranging from 25 to 35% were observed but uncommon (observed at four sites).

Significant negative correlations between sampling year and % embeddedness were observed at seven out of thirty sites. All seven of these sites were in the Highlands (FIMI-207-S, PRLN-626-S, SAVA-204-S, SAVA-225-S, UMON-119-S, UMON-288-S, and YOUG-432-S). Change in % embeddedness at these sites from the first year of sampling to the most recent year ranged from -20 to 10%. Because the upper end of this range is positive, additional years of sampling may be required at these sites to determine if these negative correlations between sampling year and % embeddedness are truly significant.

Significant positive correlations between sampling year and stream area were observed at six out of thirty sites. Two of these sites were in the Highlands (PRLN-626-S and SAVA-204-S), three in the Eastern Piedmont (JONE-315-S, LIBE-102-S, and RKGR-119-S), and one in the Western Coastal Plain (STCL-051-S). Change in stream area at these sites from the first year of sampling to the most recent year ranged from -5.63 to 382.5 meters squared. Since the lower end of this range is negative, additional years of sampling may be required to determine if this pattern of increasing stream area will remain consistent.

Significant negative correlations between sampling year and instream habitat scores were observed at twelve out of thirty sentinel sites. Five of these sites were in the Eastern Piedmont (FURN-101-S, JONE-315-S, LIBE-102-S, LOCH-120-S, and RKGR-119-S), six were in the Highlands (ANTI-101-S, PRLN-626-S, SAVA-225-S, SAVA-276-S, UMON-119-S, and UMON-288-S), and one site was on the Eastern Coastal Plain (WIRH-220-S). At ten of these twelve sites, instream habitat appeared to decrease enough to change categories (e.g. change from optimal to sub-optimal, sub-optimal to marginal, etc.).

Significant negative correlations between sampling year and pool quality scores were observed at six out of thirty sentinel sites. Three of these sites were in the Highlands (PRLN-626-S, SAVA-225-S, and SAVA-276-S), two were in the Eastern Piedmont (FURN-101-S and JONE-315-S), and one was in the Eastern Coastal Plain (LOCR-102-S). Pool quality at five of these sites appeared to decrease enough to change categories.

Instream habitat, epifaunal substrate, pool quality, and riffle quality all significantly correlated with sampling year (negatively) at FURN-101-S and LOCH-120-S. Only instream habitat appeared to decrease enough to change categories at FURN-101-S and only instream habitat and riffle quality appeared to decrease enough to change categories at LOCH-120-S. Instream habitat, epifaunal substrate, and riffle quality significantly correlated (negatively) with sampling year at RKGR-119-S but only instream habitat and epifaunal substrate appeared to decrease enough to change categories at this site.

It is important to note that ANTI-101-S was not sampled between 2002 and 2009 and ZEKI-012-S was not sampled after 2012 for physical habitat. Therefore correlations observed between sampling year and physical habitat at these sites may be misleading.

Table 21. Significant correlations observed between sampling year and physical habitat assessment metrics.

Metric	Site	R	p-value	Direction
Discharge	UMON-119-S	0.604	0.006	Increase
	UMON-288-S	0.647	0.002	Increase
% Embeddedness	FIMI-207-S	-0.492	0.023	Decrease
	PRLN-626-S	-0.434	0.049	Decrease
	SAVA-204-S	-0.640	0.003	Decrease
	SAVA-225-S	-0.722	< 0.001	Decrease
	UMON-119-S	-0.517	0.023	Decrease
	UMON-288-S	-0.667	0.001	Decrease
	YOUG-432-S	-0.514	0.024	Decrease
	FURN-101-S	0.498	0.022	Increase
	PAXL-294-S	0.536	0.010	Increase
	RKGR-119-S	0.454	0.034	Increase
Epifaunal Substrate	FURN-101-S	-0.610	0.003	Decrease
	LIBE-102-S	-0.437	0.048	Decrease
	LOCH-120-S	-0.480	0.028	Decrease
	RKGR-119-S	-0.703	< 0.001	Decrease
	NANJ-331-S	0.558	0.009	Increase
	YOUG-432-S	0.610	0.006	Increase
Instream Habitat	ANTI-101-S	-0.647	0.023	Decrease
	FURN-101-S	-0.669	0.001	Decrease
	JONE-315-S	-0.565	0.006	Decrease
	LIBE-102-S	-0.648	0.001	Decrease
	LOCH-120-S	-0.516	0.017	Decrease
	PRLN-626-S	-0.652	0.001	Decrease
	RKGR-119-S	-0.618	0.002	Decrease
	SAVA-225-S	-0.690	0.001	Decrease
	SAVA-276-S	-0.642	0.002	Decrease
	UMON-119-S	-0.693	0.001	Decrease
	UMON-288-S	-0.553	0.009	Decrease
	WIRH-220-S	-0.554	0.009	Decrease
Pool Quality	FURN-101-S	-0.540	0.011	Decrease
	JONE-315-S	-0.565	0.006	Decrease
	LOCR-102-S	-0.455	0.034	Decrease
	PRLN-626-S	-0.687	0.001	Decrease
	SAVA-225-S	-0.625	0.002	Decrease
	SAVA-276-S	-0.733	< 0.001	Decrease
	ANTI-101-S	0.588	0.044	Increase
	YOUG-432-S	0.605	0.006	Increase
Riffle Quality	FURN-101-S	-0.563	0.008	Decrease
	LOCH-120-S	-0.560	0.008	Decrease
	RKGR-119-S	-0.552	0.008	Decrease
	WIRH-220-S	-0.547	0.010	Decrease
	NANJ-331-S	0.458	0.037	Increase
	PRMT-177-S	0.693	0.039	Increase
% Shading	CORS-102-S	-0.662	0.001	Decrease
	FIMI-207-S	-0.495	0.022	Decrease
	FURN-101-S	-0.649	0.001	Decrease

Metric	Site	R	p-value	Direction
	JONE-109-S	-0.760	< 0.001	Decrease
	JONE-315-S	-0.671	0.001	Decrease
	LIBE-102-S	-0.782	< 0.001	Decrease
	LOCH-120-S	-0.755	< 0.001	Decrease
	MATT-033-S	-0.539	0.010	Decrease
	NANJ-331-S	-0.769	< 0.001	Decrease
	PAXL-294-S	-0.459	0.032	Decrease
	PRLN-626-S	-0.652	0.001	Decrease
	PTOB-002-S	-0.620	0.006	Decrease
	RKGR-119-S	-0.666	0.001	Decrease
	SAVA-204-S	-0.588	0.008	Decrease
	SAVA-225-S	-0.557	0.009	Decrease
	SAVA-276-S	-0.634	0.002	Decrease
	STCL-051-S	-0.613	0.002	Decrease
	UPCK-113-S	-0.485	0.026	Decrease
	WIRH-220-S	-0.532	0.013	Decrease
	YOUG-432-S	-0.534	0.019	Decrease
	ZEKI-012-S	-0.608	0.036	Decrease
Stream Area	PRMT-177-S	-0.860	0.003	Decrease
	UPCK-113-S	-0.446	0.043	Decrease
	JONE-315-S	0.656	0.001	Increase
	LIBE-102-S	0.472	0.031	Increase
	PRLN-626-S	0.447	0.042	Increase
	RKGR-119-S	0.532	0.011	Increase
	SAVA-204-S	0.620	0.005	Increase
	STCL-051-S	0.450	0.036	Increase
Velocity/Depth Diversity	FURN-101-S	-0.496	0.022	Decrease
	SAVA-276-S	-0.549	0.010	Decrease
	WIRH-220-S	-0.726	< 0.001	Decrease

Water and Air Temperature Trends

Changes in water and air temperature over time were determined through correlating sampling year with seasonal temperature measurements recorded at sentinel sites annually. All significant results from Pearson's correlation analyses are listed below in Table 22. Correlations considered significant had a coefficient > 0.4 and a p-value < 0.05. Common patterns in significant correlation (occurring at five or more sites) between sampling year and seasonal water and air temperatures are as follows.

Significant positive correlations between sampling year and average daily mean summer water temperature were observed at fourteen out of thirty sentinel sites. Four of these sites were in the Eastern Coastal Plain (UPCR-208-S, WIRH-220-S, NASS-302-S, and UPCK-113-S), four were in the Western Coastal Plain (MATT-033-S, NANJ-331-S, STCL-051-S, and ZEKI-012-S), four in the Eastern Piedmont (JONE-109-S, RKGR-119-S, FURN-101-S, and JONE-315-S), and two in the Highlands (SAVA-204-S and ANTI-101-S). Change in average daily mean summer water temperatures at these sites from the first year of sampling to the most recent year ranged from 1.57 to 2.55 degrees. Significant positive correlations between sampling year and average daily

mean summer water temperature from the warmest 7 days of summer were observed at six out of thirty sentinel sites. Three of these sites were in the Eastern Coastal Plain (NASS-302-S, UPCK-119-S, and WIRH-220-S), two in the Western Coastal Plain (MATT-033-S and ZEKI-012-S), and one in the Eastern Piedmont (JONE-109-S). Change in average daily mean summer water temperatures (warmest 7 days of summer) at these sites from the first year of sampling to the most recent year ranged from 1.26 to 2.95 degrees.

Significant positive correlations between sampling year and average daily mean fall water temperature were observed at seven out of thirty sentinel sites. Two of these sites were in the Eastern Coastal Plain (NASS-302-S and WIRH-220-S), two in the Western Coastal Plain (PRMT-177-S and PAXL-294-S), two in the Highlands (FIMI-207-S and PRLN-626-S), and one in the Eastern Piedmont (JONE-315-S). Change in average daily mean fall water temperatures at these sites from the first year of sampling to the most recent year ranged from 0.61 to 1.65 degrees. Significant positive correlations between sampling year and average daily mean fall air temperature were observed at six out of thirty sentinel sites. Three of these sites were in the Western Coastal Plain (MATT-033-S, PRMT-177-S, and PAXL-294-S), two in the Eastern Coastal Plain (NASS-302-S and LOCR-102-S), and one in the Eastern Piedmont (JONE-315-S). Change in average daily mean fall air temperatures at these sites from the first year of sampling to the most recent ranged from 0.76 to 2.72 degrees.

Significant positive correlations were observed between sampling year and % summer water temperatures above 20°C at two Eastern Coastal Plain sites (NASS-302-S and WIRH-220-S), four Western Coastal Plain sites (MATT-033-S, NANJ-331-S, STCL-051-S, and ZEKI-012-S), and four Eastern Piedmont sites (FURN-101-S, JONE-109-S, JONE-315-S, and RKGR-119-S). Change in percentages of summer water temperatures above 20°C at these sites from the first year of sampling to the most recent year ranged from 1.93 to 55.89%. Significant positive correlations were observed between sampling year and % summer water temperatures above 24°C at four Eastern Coastal Plain sites (NASS-302-S, UPCK-113-S, UPCR-208-S, and WIRH-220-S) and three Western Coastal Plain sites (MATT-033-S, NANJ-331-S, and ZEKI-012-S). Change in percentages of summer water temperatures above 24°C at these sites from the first year of sampling to the most recent year ranged from 9.72 to 52.58%.

It is important to note that ANTI-101-S was not sampled between 2002 and 2009, PRMT-177-S was not sampled until 2012, and ZEKI-012-S was not sampled after 2012 for temperature. Therefore correlations observed between sampling year and temperature at these sites may be misleading.

Table 22. Significant correlations observed between sampling year and temperature.

Metric	Site	R	p-value	Direction
% Summer Water Temperatures Above 20°C	FURN-101-S	**0.571**	**0.013**	**Increase**
	JONE-109-S	**0.604**	**0.008**	**Increase**
	JONE-315-S	**0.533**	**0.041**	**Increase**
	MATT-033-S	**0.821**	**0.007**	**Increase**
	NANJ-331-S	**0.737**	**0.004**	**Increase**
	NASS-302-S	**0.866**	**0.001**	**Increase**
	RKGR-119-S	**0.535**	**0.018**	**Increase**

Metric	Site	R	p-value	Direction
	STCL-051-S	0.521	0.022	Increase
	WIRH-220-S	0.622	0.008	Increase
	ZEKI-012-S	0.677	0.022	Increase
% Summer Water Temperatures Above 24°C	MATT-033-S	0.823	0.006	Increase
	NANJ-331-S	0.617	0.025	Increase
	NASS-302-S	0.840	0.001	Increase
	UPCK-113-S	0.697	0.004	Increase
	UPCR-208-S	0.702	0.024	Increase
	WIRH-220-S	0.643	0.005	Increase
	ZEKI-012-S	0.717	0.013	Increase
Average Daily Mean Fall Air Temperature	JONE-315-S	0.803	0.009	Increase
	LOCR-102-S	0.706	0.033	Increase
	MATT-033-S	0.843	0.035	Increase
	NASS-302-S	0.890	0.017	Increase
	PRMT-177-S	0.854	0.031	Increase
Average Daily Mean Fall Water Temperature	FIMI-207-S	0.710	0.049	Increase
	JONE-315-S	0.789	0.011	Increase
	NASS-302-S	0.707	0.033	Increase
	PAXL-294-S	0.834	0.005	Increase
	PAXL-294-S	0.686	0.041	Increase
	PRLN-626-S	0.644	0.032	Increase
	PRMT-177-S	0.833	0.010	Increase
	WIRH-220-S	0.746	0.021	Increase
Average Daily Mean Spring Air Temperature	YOUG-432-S	-0.764	0.016	Decrease
Average Daily Mean Spring Water Temperature (Warmest Week)	ZEKI-012-S	0.997	0.047	Increase
Average Daily Mean Summer Air Temperature	NANJ-331-S	0.715	0.046	Increase
Average Daily Mean Summer Air Temperature (Warmest Week)	FIMI-207-S	0.999	0.001	Increase
Average Daily Mean Summer Water Temperature	ANTI-101-S	0.587	0.045	Increase
	FURN-101-S	0.592	0.010	Increase
	JONE-109-S	0.746	< 0.001	Increase
	JONE-315-S	0.515	0.049	Increase
	MATT-033-S	0.871	0.002	Increase
	NANJ-331-S	0.672	0.012	Increase
	NASS-302-S	0.873	< 0.001	Increase
	RKGR-119-S	0.583	0.009	Increase
	SAVA-204-S	0.703	0.023	Increase
	STCL-051-S	0.614	0.005	Increase
	UPCK-113-S	0.574	0.025	Increase
	UPCR-208-S	0.698	0.025	Increase
	WIRH-220-S	0.712	0.001	Increase
	ZEKI-012-S	0.699	0.017	Increase
Average Daily Mean Summer Water Temperature (Warmest Week)	JONE-109-S	0.631	0.005	Increase
	MATT-033-S	0.696	0.037	Increase
	NASS-302-S	0.721	0.012	Increase

Metric	Site	R	p-value	Direction
	UPCK-113-S	**0.690**	**0.004**	**Increase**
	WIRH-220-S	**0.564**	**0.018**	**Increase**
	ZEKI-012-S	**0.694**	**0.018**	**Increase**
Average Daily Mean Winter Air Temperature (Warmest Week)	NASS-302-S	**0.998**	**0.041**	**Increase**

Annual Rainfall

Differences in statewide annual precipitation by sampling year are presented in Figure 20. Mean annual precipitation was 45.66 inches. Maryland rainfall from the past 20+ years was highly variable in that it differed between years by more than 20 inches in some comparisons. Drought years in Maryland included 1995, 1997, 2001, 2007, and 2012 while flood years included 1996, 2003, 2009, 2011, 2018, and 2020 (NOAA National Centers for Environmental Information). Annual rainfall above 45.66 inches was more common in Maryland in recent years compared to years past.

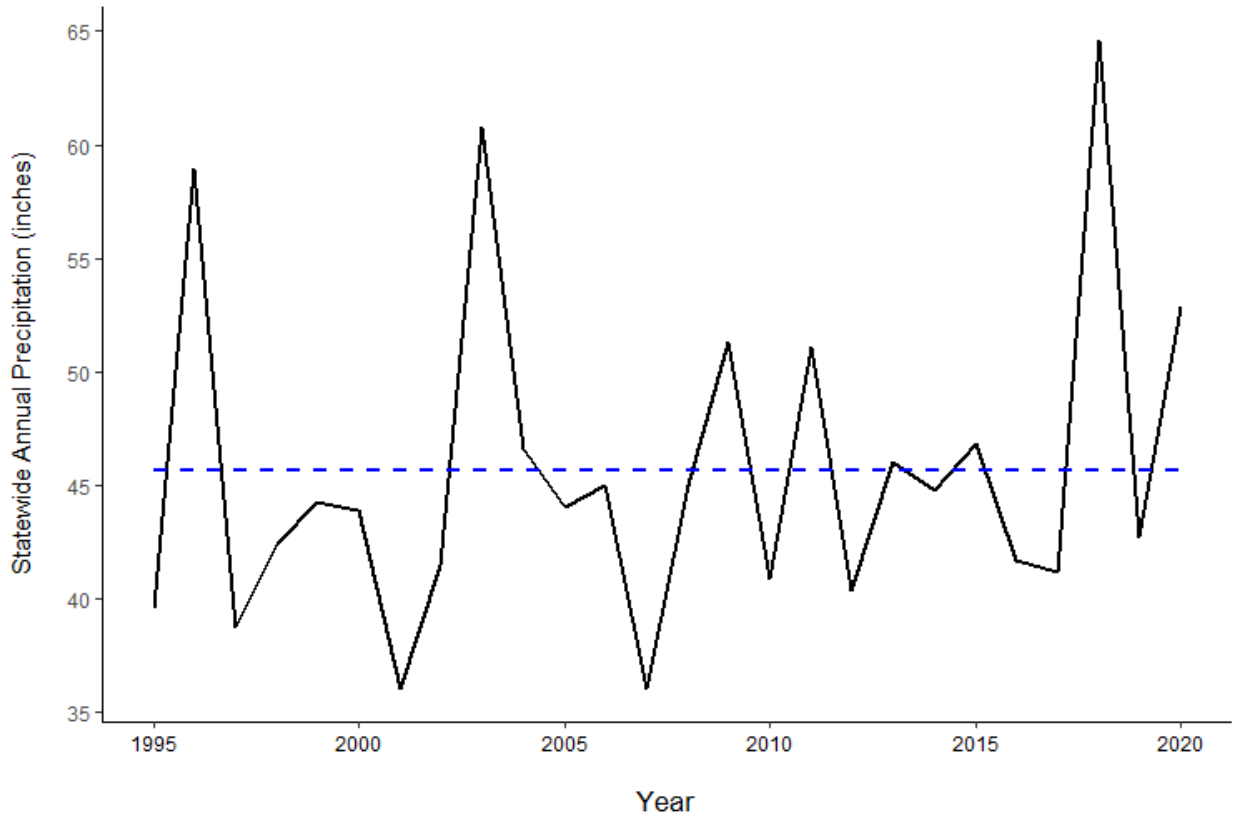


Figure 20 – Maryland statewide annual precipitation (1995-2020). Mean precipitation (45.66 inches) is represented by a blue dashed line.

Change in Land Cover

Differences in land cover from 2001 to 2016 at all sites in the SSN are displayed in Table 23 (NLCD; Homer et al. 2020). Forest loss has occurred in varying degrees at 11 out of 30 sites, the

greatest losses being 17.24% at FURN-101-S, 7.03% at MATT-033-S, 3.38% at PRMT-177-S, and 2.02% at LIBE-102-S. Changes in land cover over time should be considered when analyzing ecological data of sites within the SSN as these changes will likely influence stream condition and confound attempts to document natural, annual variation in biological, physical, and chemical stream characteristics as well as the effects of climate change.

Table 23 – Change in forest, urban, agriculture, and other land cover at each site from 2001 to 2016.

Site	Region	Upstream Catchment in Acres	Change in Forest Cover		Change in Urban Cover		Change in Agricultural Cover		Change in Other Cover	
			%	Acres	%	Acres	%	Acres	%	Acres
CORS-102-S	Eastern Coastal Plain	638.55	0.07	0.45	0.00	0.00	0.00	0.00	-0.07	-0.45
LOCR-102-S		430.51	-0.36	-1.55	0.00	0.00	0.00	0.00	0.36	1.55
NASS-108-S		2847.58	4.61	131.35	0.00	0.00	-0.03	-0.89	-4.58	-130.47
NASS-302-S		19605.50	5.89	1155.28	0.02	4.67	-0.53	-104.08	-5.39	-1055.87
UPCK-113-S		471.44	0.09	0.44	0.00	0.00	0.00	0.00	-0.09	-0.44
UPCR-208-S		10628.60	0.16	16.90	0.00	0.00	-0.05	-5.34	-0.11	-11.56
WIRH-220-S		13674.90	3.61	494.11	2.03	277.07	-2.02	-276.41	-3.62	-494.77
MATT-033-S	Western Coastal Plain	40503.20	-7.03	-2846.73	5.00	2026.58	-0.49	-197.70	2.51	1017.85
MATT-102-S		591.80	1.69	10.02	0.00	0.00	0.00	0.00	-1.69	-10.02
NANJ-331-S		6272.04	-0.52	-32.68	0.02	1.11	-0.10	-6.00	0.60	37.58
PAXL-294-S		3723.26	-0.01	-0.22	0.18	6.67	-0.17	-6.23	-0.01	-0.22
PRMT-177-S		271.86	-3.38	-9.18	0.08	0.22	0.00	0.00	3.29	8.96
PTOB-002-S		1177.93	0.28	3.33	0.43	5.11	0.00	0.00	-0.72	-8.45
STCL-051-S		252.35	0.09	0.22	0.00	0.00	0.00	0.00	-0.09	-0.22
ZEKI-012-S	Eastern Piedmont	398.35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FURN-101-S		716.72	-17.24	-123.57	1.27	9.11	-0.06	-0.44	16.03	114.90
JONE-109-S		162.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
JONE-315-S		3805.42	-0.54	-20.46	1.01	38.47	-0.64	-24.46	0.17	6.45
LIBE-102-S		584.09	-2.02	-11.78	0.00	0.00	0.00	0.00	2.02	11.78
LOCH-120-S		896.68	0.02	0.22	0.00	0.00	-0.02	-0.22	0.00	0.00
RKGR-119-S		673.43	0.26	1.78	0.59	4.00	-1.62	-10.88	0.76	5.11
ANTI-101-S	Highlands	1402.27	-1.35	-18.91	0.00	0.00	-0.25	-3.56	1.60	22.47
FIMI-207-S		12930.10	-1.42	-183.46	0.00	0.00	0.41	52.70	1.01	130.76
PRLN-626-S		495.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SAVA-204-S		10850.10	-0.96	-104.51	0.04	4.00	-0.31	-33.13	1.23	133.64
SAVA-225-S		6549.17	0.04	2.89	0.00	0.00	-0.83	-54.04	0.78	51.15
SAVA-276-S		401.87	1.99	8.01	0.00	0.00	-1.83	-7.34	-0.17	-0.67
UMON-119-S		1147.60	0.02	0.22	0.00	0.00	0.00	0.00	-0.02	-0.22
UMON-288-S		825.85	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
YOUG-432-S		5606.99	0.16	8.90	0.31	17.58	-0.73	-41.17	0.26	14.69

DISCUSSION

The Maryland Sentinel Site Network (SSN) provides a representation of currently available stream ecological conditions that closely resembles natural habitats in Maryland and is documented by the Maryland Biological Stream Survey (MBSS). Variations in biological, physical, and chemical characteristics documented at Maryland SSN sites can be used by scientists leading Maryland stream monitoring programs to potentially isolate effects resulting from climate change at their monitoring sites, begin to differentiate natural annual variation in stream condition from variations likely caused by anthropogenic activity, and support informed decisions to help prevent further degradation to Maryland streams (Prochaska 2005, Becker et al. 2007, Becker et al. 2008, Becker et al. 2010, Saville et al. 2014).

Spatial Patterns

Biological Community Composition

Benthic macroinvertebrate and fish communities can differ substantially by stream site; however, similarities can be observed at sites by geographic region due to regional similarities in habitat availability.

"Clinger" was a common habit in benthic macroinvertebrate communities in all 4 regions, but most common in the Eastern Piedmont and Highlands. Clingers are benthic macroinvertebrates with adaptations that allow them to attach to coarse substrates in fast-moving waters (Merritt et al. 2019, Poff et al. 2006). Some are dorsoventrally flattened to maximize this ability. More clinger taxa observed at Eastern Piedmont and Highlands sites can be partially explained by the lower % embeddedness and higher riffle quality observed at these sites compared to sites in the Coastal Plain. It was also observed that many of the taxa most often observed in the Coastal Plain region were sprawlers. These organisms have appendages that allow them to sit on top of soft substrate; such as the silt and sand common in the Coastal Plain region (higher % embeddedness) compared to other Maryland regions.

EPT taxa and Ephemeroptera were observed to be more common in the Eastern Piedmont and Highland benthic macroinvertebrate communities compared to Coastal Plain communities. A high number of taxa in orders Ephemeroptera, Plecoptera, and Trichoptera is often a sign of good stream health as many genera in these orders have a low tolerance. Benthic macroinvertebrate taxa intolerant to urbanization were also observed in higher numbers in the Eastern Piedmont and Highlands compared to the Coastal Plain. "Number of EPT taxa", "Number of Ephemeroptera taxa", and "Percent intolerant urban" are all metrics used in Combined Highlands, Eastern Piedmont, and Coastal Plain BIBI score calculations. Each region has specific thresholds for each BIBI metric. The Coastal Plain has lower thresholds for the number of EPT taxa, number of Ephemeroptera taxa, and percent intolerant to urbanization compared to the Eastern Piedmont and Highlands, likely due to these taxa being present but less common in the Coastal Plain region due to natural differences in habitat (Southerland et al. 2007).

Looking at fish communities, higher % lithophilic spawners and % brook trout were observed in the Highlands and Eastern Piedmont compared to the Coastal Plain. Lithophilic spawners prefer

the coarse substrate found in Eastern Piedmont and Highland streams to lay their eggs rather than the fine substrate (silt and sand) common in Coastal Plain streams. Brook trout do not often occur in the Coastal Plain region mainly due to the high water temperatures (see Coldwater Taxa Trends section below).

Higher tolerant benthic macroinvertebrate and fish taxa observed in the Coastal Plain region compared to other regions do not mean sentinel sites on the Coastal Plain are more degraded than Eastern Piedmont and Highland sites. This simply means that Coastal Plain stream habitats may be naturally less preferable to taxa designated as "intolerant".

Indices of Biotic Integrity

Comparing IBI scores by region provided important information regarding differences in biological integrity potentially influenced by regional differences in water chemistry. IBI scores below 3 (considered poor) at sites in the Eastern Coastal Plain tended to be more common than sites in any other Maryland region. Many of the sites in this region exhibited the high dissolved organic carbon concentrations and low pH levels characteristic of blackwater streams. According to sentinel site criteria, mean IBI scores below 3 are acceptable at sites located in blackwater streams (Prochaska 2005, Becker et al. 2007, Becker et al. 2008, Becker et al. 2010, Saville et al. 2014).

Some of the extreme drops in IBI scores observed at various sites in all 4 regions investigated can be linked to drought and/or flood conditions. Drought conditions in streams can reduce available habitat for fish and benthic macroinvertebrates while prolonged flooding and high stream velocities can damage both stream organisms and their preferred habitat structures. Variation in IBI scores were most common in the Coastal Plain regions and drought conditions appeared to have the greatest influence, especially on fish communities. These results suggest that as influences of climate change continue and as periods of drought and flood become more prolonged, stream benthic macroinvertebrate and fish communities in the Coastal Plain regions may be the first to be affected. From an analysis of statewide annual rainfall data, it appears that flood conditions are becoming more common than drought conditions. However, additional years of data collection will be required to determine the consistency of this pattern.

IBI scores appeared to remain the most consistent from year to year in the Eastern Piedmont and Highlands regardless of drought/flood conditions. Only a few sites had low BIBI or FIBI scores most years. JONE-109-S in the Eastern Piedmont received poor FIBI scores most years of sampling, however, this was likely the result of a small upstream catchment (Southerland et al. 2005). LOCH-120-S received poor FIBI scores most years, likely due to the high % tolerant and % generalists/omnivores/invertivores recorded at this site. ANTI-101-S in the Highlands (only sampled in 2000-2001 and 2010-2020) received poor FIBI scores during several sampling years. Upon examination of fish species counts for this site, lower brook trout abundance during certain years appeared to coincide with these drops in FIBI score. The greatest change in IBI score at any of the Highlands sites occurred at UMON-119-S from 2013 to 2015, when the BIBI score dropped below 3. The benthic macroinvertebrate samples from these years at this site were dominated by blackfly larvae, which likely confounded results.

Water Chemistry

One-time grab sample measurements provide MBSS with a general idea of how water chemistry differs annually at spring baseflow by region, but they do not necessarily provide information related to all water chemistry parameters year-round. Weller and Jordan (2020) observed that certain parameters including total nitrogen and nitrate can be effectively represented using one-time spring baseflow samples as most nitrogen in a stream moves as dissolved nitrate in subsurface flow, making these parameters less variable throughout the year than parameters such as phosphorus which bind to particulates making their transport through a system more variable. MBSS water chemistry samples are analyzed for dissolved nutrients, so phosphorus concentrations measured in these samples may be smaller than what is actually present. Phosphorus and other parameters that bind to sediment particles may be better quantified by sampling the sediment.

Sentinel sites in the Coastal Plain were more acidic and had higher concentrations of ammonia and dissolved organic carbon likely due to the accumulation and breakdown of organic matter (Boward et al. 1999). Low gradients resulting in slow-moving water in the Coastal Plain region allow organic matter to build up rather than wash downstream. Phosphorus may have been found in higher concentrations in the Coastal Plain because the substrate of most Coastal Plain streams is majorly composed of phosphorus-carrying sediment (Weller and Jordan 2020). The Maryland Coastal Plain has the highest % agricultural land cover in the state and therefore, fertilizer application in agricultural areas could be another reason phosphorus levels at Coastal Plain sites are higher compared to other regions (Ator et al. 2011). The Eastern Piedmont had the highest specific conductivity, acid neutralizing capacity, chloride, total nitrogen, nitrate-nitrogen, magnesium, and calcium levels of the four regions. These differences in water chemistry could be the result of higher % urbanization present in the upstream catchments of Eastern Piedmont sites compared to other regions studied.

Physical Habitat

Moving from the Highlands to the Coastal Plain, lower instream habitat, epifaunal substrate, velocity/depth diversity, and riffle quality scores were observed, along with higher % embeddedness. Pool quality, % shading, and one-time summer discharge measurements lacked this west to east trend. These observations are understandable considering that low water velocities and silt/sand substrate are more characteristic of Maryland Coastal Plain streams, while Highland and Piedmont streams contain more riffles with larger substrate particles. These differences in physical habitat by region help partially explain the differences in benthic macroinvertebrate and fish communities observed by region.

Results from analysis of variance tests suggest that summer discharge measurements collected once annually may be partially influenced by stream size (area in meters squared) and therefore may not be useful in analyzing differences in habitat by region.

Water and Air Temperature

Highland streams are located further west and at higher elevations, while the opposite is the case for Maryland Coastal Plain streams, explaining the difference in water and air temperatures observed moving east from the Highlands to the Coastal Plain.

Temporal Patterns

Index of Biotic Integrity Trends

Both negative and positive correlations between sampling year and IBI score were observed at sites within the Sentinel Site Network. These observations, however, were minimal and occurred at less than a fourth of the sites, most of which were in the Eastern Piedmont and Highlands.

Decreases in intolerant benthic macroinvertebrate taxa (23% of sites) and fish abundance per square meter (17% of sites) were observed between 1995 and 2020 and mostly in the Eastern Piedmont and Highlands. These IBI metrics influence IBI scores in all regions of Maryland. Although sites in the SSN are meant to represent Maryland streams under minimal disturbance, changes due to anthropogenic influence and/or climatic variation are still occurring and it appears that Eastern Piedmont and Highland biological communities are likely being influenced the most over time by these changes.

Increases in the number of benthic macroinvertebrate taxa (20% of sites) and the number of EPT taxa (17% of sites) were also observed. These results are difficult to explain as it is more likely that taxa richness in streams decreases over time with increased anthropogenic influence and climatic variation. Several factors including slight variation in sampling and sample processing could potentially influence these richness metrics. Additional research looking into these factors may be necessary.

Coldwater Taxa Trends

Potential climate change influences (e.g. rising water temperatures) on biological communities at sites in the SSN can be investigated by looking at changes in % abundance of coldwater benthic macroinvertebrate taxa over time.

Of the thirteen "coldwater" sites investigated, only one significant negative correlation between sampling year and % abundance of coldwater benthic macroinvertebrate taxa was observed (JONE-315-S, an Eastern Piedmont site). Significant positive correlations between sampling year and average daily mean summer and fall water temperatures were also observed at this site. These results suggest that any change in water temperature that occurred during the years investigated here has not yet influenced coldwater taxa abundance in the Highlands region but may be starting to affect sites in the Eastern Piedmont region. As stream temperatures continue to increase over time due to climate change, coldwater benthic macroinvertebrate taxa loss may become more evident in both regions.

The brook trout is Maryland's only native trout species and brook trout that reside in Maryland are located on the southeastern edge of their species distribution. These fish prefer streams with summer water temperatures that rarely exceed 24℃ (MacCrimmon and Campbell 1969), therefore any change in water temperature due to climate change and/or land cover change has the potential to affect Maryland brook trout populations. Significant negative correlations were observed between sampling year and % abundance of brook trout at several sentinel sites in the Highlands and Eastern Piedmont. Potential influences for these correlations are likely site specific. Higher summer water temperatures in recent years, as well as a 1.35% forest loss (~19 acres) at ANTI-101-S, could potentially be affecting % brook trout at this site. It should also be

noted that ANTI-101-S was not sampled from 2002 to 2009 so the negative correlation observed may be falsely significant. Brook trout have not been observed at LIBE-102-S since 2006. This loss was correlated with increased impervious surface cover that occurred at this site during that time (Stranko et al 2008, Homer et al. 2007, and Fry et al. 2011). Explanations for lower % abundances of brook trout at SAVA-276-S and UMON-119-S are unknown as forest loss and temperature increases were not observed between 2001 and 2016. Wagner et al. (2014) found high between-year variability in brook trout density looking at data collected from 291 sites over a 37 year period. Such variability in brook trout annual densities could partially explain results observed at sentinel sites with brook trout populations, including those from sites where significant positive correlations between sampling year and brook trout were observed (SAVA-225-S and YOUG-432-S). Predatory fish including brown trout and largemouth bass have been observed at UMON-119-S along with brook trout. This may partially explain brook trout declines observed at this site. Additional years of sampling may help elucidate patterns observed in brook trout abundance at SSN sites.

Water Chemistry Trends

Patterns of increasing chloride, specific conductivity, pH, and acid neutralizing capacity (ANC) were most evident at sentinel sites in the Eastern Piedmont. Recent studies have discovered links between these parameters (Kaushal et al. 2018). Sources of higher conductivity, chloride, pH, and ANC include increased road salt application, concrete weathering from impervious surfaces, soil cation exchange, mining, and agricultural lime application (Kaushal et al. 2013, Kaushal et al. 2017, Kaushal et al. 2018). Concrete weathering from impervious surfaces can be accelerated by acid deposition from anthropogenically enhanced carbon dioxide (Kaushal et al. 2017). This partially explains why these increases were observed mostly in the Eastern Piedmont as sites in this region have higher % urbanization cover and therefore, higher impervious cover in their upstream catchments. Other reasons for higher pH and ANC may be the result of amendments to the Clean Air Act made in 1990 to reduce the effects of acid deposition through reductions in annual sulfur dioxide and nitrogen oxide emissions (Clean Air Act, 2011). It should be noted that most increases in pH were relatively small.

Small increases in nitrate-nitrogen and total nitrogen were evident at 17% of sites in the SSN over time, all of which were located in the Eastern Piedmont and Highlands. Both nitrite and nitrate result from the breakdown of ammonia which enters streams through the decomposition of animal waste and other organic material. These three forms of nitrogen make up the parameter "total nitrogen". Nitrate is highly water soluble (Craig et al. 2008, Weller and Jordan 2020) and is normally observed at higher concentrations compared to nitrite and ammonia in MBSS water chemistry samples. Groundwater and/or annual variation in runoff could be contributing to higher levels of total nitrogen and nitrate being observed over time.

Small increases in nitrite-nitrogen and ammonia-nitrogen were also observed at many sites in the SSN, however, it should be noted that these increases may have been partially influenced by increasing detection limits over time. A detection limit (DL) is the lowest concentration of a particular analyte that can be detected above instrument noise. These values change annually for each water chemistry parameter analyzed by MBSS. Many of the nitrite and ammonia measurements collected at sites in the SSN were below DL values. When this occurred, DLs for

these two analytes were recorded rather than their actual concentrations. If a DL was recorded instead of an actual value, then the actual value was between 0 and the DL recorded. DLs were not normalized when analyzing these water chemistry parameters as this could falsely reduce and potentially mask true variation in these parameters present over time. Additional years of sampling may be required to determine the validity of correlations observed between sampling year and the analytes ammonia and nitrite.

Higher orthophosphate levels were also observed at about 47% of sites in the SSN over time. These increases were relatively small but should still be noted. Positive correlations between sampling year and orthophosphate were observed at sites in the Western Coastal Plain, Eastern Piedmont, and Highlands. Orthophosphate is a mobile form of phosphorus that is released from sediments deposited in stream reaches (Harrison et al. 2014) suggesting that bank erosion and/or sediment deposition may be becoming more common at these sites. It should be noted that, at about half of the sites where higher orthophosphate levels were observed over time, many of the orthophosphate measurements recorded were actually at or below DLs. This may have influenced the positive correlations observed between sampling year and orthophosphate at these sites.

This same issue presented itself when analyzing change in bromide concentrations over time. At most sites where significant positive correlations were observed between sampling year and bromide, DLs were recorded in place of actual values for most years. Due to this issue and the fact that bromide has only been analyzed by MBSS since 2013, additional years of sampling may be required to determine the validity of these correlations. That aside, bromide is a water soluble anion that does not occur freely in nature and will often exist as salts or acids (WHO 2018). In inland groundwaters and fresh surface waters of the United States, bromide will occur in low concentrations (0.014-0.2 mg/L; VanBriesen 2014). Because bromide concentrations observed at sentinel sites are within a similar range, it is likely that sources of these concentrations are natural rather than anthropogenic. Anthropogenic sources of bromide include auto emissions, fertilizers, pesticides, and road salt (Andreasen and Fleck 1997, Lundstrom and Olin 1986, Wilde 1994).

Lower sulfate levels were observed at 27% of sites in the SSN over time. Most of these sites were in the Highlands region. These changes were small but are still important to note. Sulfate enters streams through atmospheric deposition and in Maryland, higher concentrations of sulfate are often observed in Highland streams due to the presence of acid mine drainage (Boward et al. 1999). Any influence of acid mine drainage is less likely at sites in the SSN as “no evidence of acid mine drainage in the upstream catchment” is criteria that must be met by all sites within the network. As stated above, amendments to the Clean Air Act were made in 1990 to reduce annual sulfur dioxide and nitrogen oxide emissions (Clean Air Act, 2011). It is possible that lower sulfate levels that occurred in recent years at several sites in the SSN were due to these amendments. It is also possible that lime treatments conducted in the Highlands to counteract acid mine drainage are becoming more common and therefore, have increased pH and decreased sulfate levels at stream sites in this region.

Physical Habitat Trends

Stream physical habitat appears to have changed at sites in the SSN over the past 20+ years with lower instream habitat scores, in particular, observed in recent years at 40% of these sites and mostly in the Eastern Piedmont and Highlands, similar to patterns observed in biological and chemical data.

Changes in habitat quality observed at these sites may partially be due to annual variation observed in rainfall. Flood conditions, which appear to be more common in recent years (Figure 20), can be both beneficial and detrimental to stream habitat as they can alter a stream channel and erode stream banks, as well as deposit and/or remove sediment and habitat structures from a reach. Drought conditions can dewater preferable benthic macroinvertebrate and fish habitat. Land cover change may have also played a role in reduced habitat quality at some of these sites. Land cover alterations from forest to urban land cover can alter the way stormwater enters a stream, in turn altering the stream channel, stream banks, and available habitat. It should also be noted that the role of habitat assessor has changed hands at these sites several times over the past 20+ years. Although MBSS habitat assessors are all trained to follow the same protocols, slight variation in scoring between assessors may still exist and thus potentially affect variation in habitat quality at sites in the SSN over time.

Climate change will likely lead to more frequent flood and drought conditions (Trenberth 2005), therefore physical habitat at sites within the SSN will inevitably continue to be altered. Land cover changes that occur in sentinel site catchments could confound results as well. If minimal land cover changes occur, it will facilitate tracking natural annual variability in sentinel site physical habitat and other data types and provide reference sites for comparing conditions of other streams throughout the state with minimal influence from confounding variables.

Negative correlations between sampling year and % shading were observed at 70% of sites in the SSN. This would imply that loss of tree canopy also occurred at most sites over time. Upon further examination of the data collected, this was not observed to be the best explanation for % shading loss. Only three sites (FIMI-207-S, PRLN-626-S, and RKGR-119-S) appeared to have smaller riparian buffers (average loss on both banks of ~10 meters or more) in recent years compared to years past and logging was observed at only three sites (FURN-101-S in 2008, UMON-119-S in 2014 and 2015, and STCL-051-S in 2020) over the duration of sampling sites within the SSN. The majority of sites with significant negative correlations between sampling year and % shading appeared to have decreases in % shading of no more than 15%. Only a few sites had decreases between 25 and 35%. A better explanation for these negative correlations observed would be variation in riparian buffer vegetation types. Dominant vegetation types (mature trees, young trees, shrubs, etc.) can vary between sampling years affecting % shading. It should also be noted that this metric is an estimation of % shading recorded in the field at each site annually and estimations may vary from year to year among different habitat assessors. All MBSS staff conducted habitat assessments at test sites during years 2021 and 2022 to help quantify variability in scoring among habitat assessors. It was observed through the examination of % shading estimations that values varied by no more than ~ 25%. It is therefore reasonable to state that some of these changes in % shading of 15% or less at sites in the SSN over time may partially be due to variability in scoring among MBSS habitat assessors.

Negative correlations between sampling year and % embeddedness were observed at 23% of sites in the SSN, all of which were in the Highlands. Changes from the first year of sampling to the most recent year at these sites were small and ranged from -20 and 10%. The habitat assessments conducted at test sites by MBSS staff in 2021 and 2022 showed that % embeddedness estimations varied by no more than 50%. It is then reasonable to state that changes in % embeddedness observed at these highland sites were, like % shading, partially due to variability in scoring among MBSS habitat assessors.

Positive correlations observed between sampling year and stream area were observed at 20% of sites in the SSN. Considering that above average rainfall appeared to be more common in more recent years compared to years past, this result is understandable. These results could have influenced IBI scores, especially FIBI scores, from year to year as greater stream area provides more habitat availability and more space for biological communities to thrive.

Water and Air Temperature Trends

Higher summer and fall water and air temperatures were observed in recent years at various sites in all four Maryland regions. Higher summer water temperatures were observed at about 47% of sites in the SSN. In recent years, higher percentages of summer water temperatures above specific biological success thresholds (>20°C, >24°C; MDE 2019) were observed at several sites in the Coastal Plain and Eastern Piedmont, but not the Highlands.

These observations fall in line with what others have observed locally. For example, Rice and Jastram (2015) saw significant increases in water and air temperatures across the U.S. Mid-Atlantic region in a study that included over 50 years of data, 1960 to 2010 specifically. With continued monitoring of water and air temperature at sites within the SSN, higher temperatures may be observed at additional sites within the network in the near future and effects on coldwater preference taxa may become more evident.

Changes in Land Cover

Streams in the Maryland Sentinel Site Network (SSN) are minimally influenced by anthropogenic activity; however, urban and agricultural land cover are still present in their upstream catchments and they are not fully protected from future disturbances that may occur. Including land cover percentages and change in land cover over time in the analysis of these data assisted in identifying changes in ecological condition likely due to natural causes versus those that may partially be due to anthropogenic influence. These data also assisted in better understanding spatial patterns in biological, physical, and chemical data. Forest loss occurred in varying degrees at several sites in the SSN, however, not every site in the SSN that experienced forest loss displayed observable loss of biological integrity and/or changes in water chemistry, physical habitat, and temperature. These changes in land cover, however, are still important to record as ecological change at SSN sites continues to be observed.

Sentinel Site Criteria

With more than 20 years of monitoring data collected at sites within the SSN, patterns of degradation are evident, however, the majority of sites in the SSN continue to meet sentinel site criteria. Two sites within the network are no longer meeting certain criteria. WIRH-220-S in the

Eastern Coastal Plain and JONE-109-S in the Eastern Piedmont have had nitrate levels exceeding 4 mg/L in several sampling years and JONE-109-S has had mean BIBI/FIBI scores < 3 most sampling years. However, as noted before, JONE-109-S has a catchment size that may be insufficient for calculating a reliable FIBI score (Southerland et al. 2005). It appears that neither site experienced land cover change between 2001 and 2016, however, WIRH-220-S has had forest cover < 50% in its upstream catchment since the start of sampling and both sites have urban or agricultural cover > 35%, all of which could be contributing factors to the patterns observed. Removal of these sites from the SSN is not necessarily advised, however, it is important to note which sites no longer meet the criteria as those using SSN sites as references may want to exclude certain sites from their studies.

REFERENCES

Andreasen, D.C and W.B. Fleck. 1997. Use of bromide:chloride ratios to differentiate potential sources of chloride in a shallow, unconfined aquifer affected by brackish-water intrusion. *Hydrogeology Journal 5*(2): 17-26.

Ator, S.W., J.W. Brakebill, and J.D. Blomquist. 2011. Sources, fate, and transport of nitrogen and phosphorus in the Chesapeake Bay watershed - An Empirical Model: U.S. Geological Survey Scientific Investigations Report 2011-5167, 27 p.

Becker, A., A. Prochaska, M. Depew, and J. Kilian. 2007. A report on the long-term monitoring site network from the Maryland Biological Stream Survey. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Becker, A., A. Prochaska, G. Graves, and J. Schuster. 2008. An update on the long-term monitoring site network from the Maryland Biological Stream Survey, 2008. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Becker, A.J., S.A. Stranko, R.J. Klauda, A.P. Prochaska, J.D. Schuster, M.T. Kashiwagi, and P.H. Graves. 2010. Maryland Biological Stream Survey's Sentinel Site Network: A multi-purpose monitoring program. Prepared by the Maryland Department of Natural Resources Monitoring and Non-tidal Assessment Division. Prepared for the Maryland Department of Natural Resources Natural Heritage Program.

Boward, D. and E. Friedman. 2019. Maryland Biological Stream Survey laboratory methods for benthic macroinvertebrate processing and taxonomy. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Boward, D., P. Kazyak, S. Stranko, M. Hurd, and A. Prochaska. 1999. From the mountains to the sea: the state of Maryland's freshwater streams. Maryland Department of Natural Resources, Monitoring and NonTidal Assessment Division, Annapolis, MD.

Clean Air Act, 42 U.S.C. § 7651 (2011). https://www.govinfo.gov/content/pkg/USCODE-2011-title42/html/USCODE-2011-title42-chap85-subchapIV-A-sec7651.htm

Craig, L.S., M.A. Palmer, D.C. Richardson, S. Filoso, E.S. Bernhardt, B.P. Bledsoe, M.W. Doyle, P.M. Groffman, B.A. Hassett, S.S. Kaushal, P.M. Mayer, S.M. Smith, and P.R. Wilcock. 2008. Stream restoration strategies for reducing river nitrogen loads. *Frontiers in Ecology and the Environment 6*(10):529-538.

Fry, J., G. Xian, S. Jin, J. Dewitz, C. Homer, L. Yang, C. Barnes, N. Herold, and J. Wickham. 2011. Completion of the 2006 National Land Cover Database for the conterminous United States. *Photogrammetric Engineering and Remote Sensing 77*(9):858-864.

Harrison, M.D., A.J. Miller, P.M. Groffman, P.M. Mayer, and S.S. Kaushal. 2014. Hydrologic controls on nitrogen and phosphorus dynamics in relict oxbow wetlands adjacent to an urban restored stream. *Journal of the American Water Resources Association 50*(6):1365-1382.

Homer, C., J. Dewitz, J. Fry, M. Coan, N. Hossain, C. Larson, N. Herold, A. McKerrow, J.N. VanDriel, and J. Wickham. 2007. Completion of the 2001 National Landcover Database for the conterminous United States. *Photogrammetric Engineering and Remote Sensing 73*(4):337-341.

Homer, C., J. Dewitz, S. Jin, G. Xian, C. Costello, P. Danielson, L. Gass, M. Funk, J. Wickham, S. Stehman, R. Auch, and K. Riitters. 2020. Conterminous United States land cover change patterns 2001-2016 from the 2016 National Land Cover Database. *ISPRS Journal of Photogrammetry and Remote Sensing 162*:184-199.

Kaushal, S. S., G. E. Likens, R. M. Utz, M. L. Pace, M. Grese, and M. Yepsen. 2013. Increased river alkalinization in the eastern U.S. *Environmental Science & Technology 47*: 10302−10311.

Kaushal, S. S., S. Duana, T. R. Doody, S. Haq, R. M. Smith, T. A. Newcomer Johnson, K. Delaney Newcomb, J. Gorman, N. Bowman, P. M. Mayer, K. L. Wood, K. T. Belt, and W. P. Stacke. 2017. Human-accelerated weathering increases salinization in fresh water across land use. *Applied Geochemistry 83*: 121-135.

Kaushal, S. S., G. E. Likens, M. L. Pace, R. M. Utz , S. Haq , J. Gorman , and M. Grese. 2018. Freshwater salinization syndrome on a continental scale. *PNAS 115*(4), E574-E583.

Lundstrom, U. and A. Olin. 1986. Bromide concentration in Swedish precipitation, surface and groundwater. *Water Resources Research 20*(6): 751-756.

MacCrimmon, H. R. and J. C. Campbell. 1969. World distribution of brook trout, Salvelinus fontinalis. *Journal of the Fisheries Research Board of Canada 26*:1699–1725.

MDE. 2019. Temperature assessment methodology for Use III(-P) streams in Maryland. Retrieved on January 26, 2023 from

https://mde.maryland.gov/programs/water/TMDL/Integrated303dReports/Documents/Assessment_Methodologies/Temp_AM_UCIII_2019.pdf

Merrit, R., K. Cummins, and M.B. Berg (2019). *An introduction to the Aquatic Insects of North America*. Kendall Hunt Publishing.

NOAA National Centers for Environmental Information, Climate at a glance: statewide time series, published January 2023, retrieved on January 11, 2023 from https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/statewide/time-series

Poff, N.L., J.D. Olden, N.K.M. Vieira, D.S. Finn, M.P. Simmons, B.C. Kondratieff. 2006. Functional trait niches of North American lotic insects: Traits-based ecological applications in light of phylogenetic relationships. *J. N. Am. Benthol. Soc. 25*(4):730-755.

Prochaska, T. 2005. Maryland Biological Stream Survey 2000-2004. Volume XI: Sentinel Site Network. Maryland Department of Natural Resources, Monitoring and NonTidal Assessment Division, Annapolis, MD.

Roth, N., M. Southerland, J. Chaillou, R. Klauda, P. Kazyak, S. Stranko, S. Weisberg, L. Hall, Jr., and R. Morgan II. 1998. Maryland Biological Stream Survey: Development of an index of biotic integrity for fishes in Maryland streams. Third EMAP Symposium, Albany, NY. *Environmental Monitoring and Assessment 51*:89-106.

Rice, K.C. and J.D. Jastram. 2015. Rising air and stream-water temperatures in Chesapeake Bay region, USA. *Climatic Change 128*: 127-138.

Saville, J., M.T. Kashiwagi, A.J. Becker, and P.H. Graves. 2014. A multi-year update (2011 – 2014) to Maryland Biological Stream Survey's Sentinel Site Network. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Southerland, M., G. Rogers, M. Kline, R. Morgan, D. Boward, P. Kazyak, and S. Stranko. 2005. Development of new fish and benthic macroinvertebrate indices of biotic integrity for Maryland streams. Report to Monitoring and Non-Tidal Assessment Division, Maryland Department of Natural Resources, Annapolis, MD.

Southerland, M.T., G.M. Rogers, M.J. Kline, R.P. Morgan, D.M. Boward, P.F. Kazyak, R.J. Klauda, and S.A. Stranko. 2007. Improving biological indicators to better assess the condition of streams. *Ecological Indicators 7*:751-767.

Stranko, S.A., R.H. Hilderbrand, R.P. Morgan II, M.W. Staley, A.J. Becker, and A. Roseberry-Lincoln. 2008. Brook Trout declines with land cover and temperature changes in Maryland. *North American Journal of Fisheries Management 28*:1223-1232.

Stranko, S., D. Boward, J. Kilian, A. Becker, R. Gauza, A. Schenk, A. Roseberry-Lincoln, M. Ashton, and P. Kazyak. 2009. Maryland Biological Stream Survey, round three field sampling

manual. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Stranko, S., D. Boward, J. Kilian, A. Becker, M. Ashton, M. Southerland, B. Franks, W. Harbold, and J. Cessna. 2019. Maryland Biological Stream Survey, round four field sampling manual. Maryland Department of Natural Resources, Monitoring and Non-tidal Assessment Division, Annapolis, MD.

Trenberth, K. E. 2005. The impact of climate change and variability on heavy precipitation, floods, and droughts. *Encyclopedia of hydrological sciences 17*:1-11.

VanBriesen, J. M. 2014. Potential drinking water effects of bromide discharges from coal-fired electric power plants. EPA NPDES Comments:1–38.

Wagner, T., J.T. Deweber, J. Detar, D. Kristine, and J.A. Sweka. 2014. Spatial and temporal dynamics in brook trout density: Implications for population monitoring. *North American Journal of Fisheries Management 34*:258-269.

Weller, D. E., and T. E. Jordan. 2020. Inexpensive spot sampling provides unexpectedly effective indicators of watershed nitrogen status. *Ecosphere 11*(8):e03224. 10.1002/ecs2.3224

WHO. 2018. Alternative drinking-water disinfectants: Bromine, iodine and silver. World Health Organization, Geneva, Switzerland.

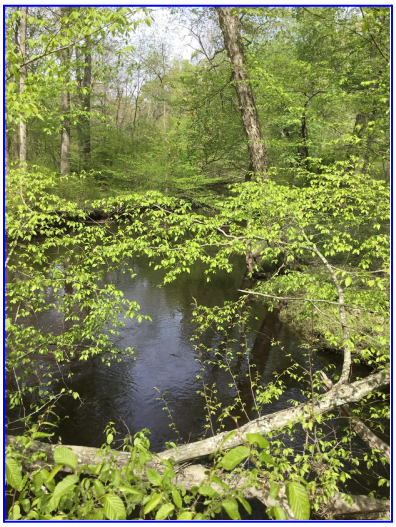
Wilde, F.D. 1994. Geochemistry and factors affecting ground-water quality at three storm-water-management sites in Maryland: Maryland Geological Survey Report of Investigations No. 59, 201 p.

Appendix A
Sentinel Sites in the Coastal Plain – Eastern Shore Region

Cypress Branch (UPCR-208-S)
Unnamed Tributary to Emory Creek (CORS-102-S)
Leonard Pond Run (WIRH-220-S)
Millville Creek (NASS-108-S)
Nassawango Creek (NASS-302-S)
Unnamed Tributary to Skeleton Creek (UPCK-113-S)
Swan Creek (LOCR-102-S)

Cypress Branch (UPCR-208-S)

Site UPCR-208-S is located on Cypress Branch in the Coastal Plain – eastern shore region of Maryland. It is in the upper Chester River watershed in Kent County. This site was sampled in 2004 and from 2008 to 2020.



Cypress Branch in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	65.64	65.66	65.66	65.61	65.75	65.77	65.79
Urban	3.99	3.99	3.99	3.99	3.99	3.99	3.99
Agriculture	29.81	29.80	29.78	29.77	29.77	29.74	29.76
Other	0.56	0.54	0.56	0.62	0.49	0.50	0.46

Water Chemistry

Water chemistry measurements collected at Cypress Branch (2004 and 2008 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	R = 0.483, p = 0.094	6.17	5.91	5.76	6.08	6.02	6.21	6.14	6.17	6.20	6.16	6.30	6.16	6.13	
Specific Conductance (µS/cm)	R = -0.133, p = 0.665	75.5	100.3	142.3	67.3	100.1	77.5	85.2	112.1	82.1	87.7	95.3	95.6	69.5	
Acid Neutralizing Capacity (µeq/L)	R = 0.257, p = 0.398	114.4	60.2	40.3	108.7	77.3	166.9	96.1	101.1	70.7	111.0	151.9	105.4	98.0	
Dissolved Organic Carbon (mg/L)	R = 0.382, p = 0.197	12.200	10.942	7.609	20.105	15.283	17.854	10.289	9.358	13.027	16.464	16.558	18.192	15.973	
Chloride (mg/L)	R = 0.122, p = 0.691	11.08	12.81	20.84	8.72	19.45	12.04	15.40	20.52	14.56	15.01	16.25	15.54	11.04	
Sulfate (mg/L)	R = -0.408, p = 0.166	6.43	17.15	21.50	4.83	9.63	5.22	8.64	8.86	6.95	6.25	7.19	7.38	4.87	
Total Nitrogen (mg/L)	R = 0.467, p = 0.108	0.813	0.690	0.586	1.097	0.931	0.998	0.783	0.880	0.836	0.845	1.013	1.251	0.897	
Nitrate-Nitrogen (mg/L)	R = 0.453, p = 0.120	0.3500	0.2033	0.1802	0.2270	0.2743	0.1366	0.2170	0.4009	0.2420	0.2355	0.3125	0.6300	0.4096	
Nitrite-Nitrogen (mg/L)	R = 0.133, p = 0.665	0.0070	0.0025	0.0019*	0.0070	0.0050	0.0058	0.0032	0.0039	0.0032	0.0033*	0.0055	0.0064	0.0074	Not sampled due to COVID-19 Pandemic
Ammonia-Nitrogen (mg/L)	R = 0.040, p = 0.898	0.0815	0.0119	0.0148	0.0549	0.0161	0.0335	0.0247	0.0404	0.0262	0.0188	0.0578	0.0646	0.0517	
Total Phosphorus (mg/L)	R = 0.056, p = 0.857	0.0750	0.0343	0.0283	0.0983	0.0475	0.0884	0.0469	0.0420	0.0542	0.0604	0.0819	0.0583	0.0615	
Ortho-phosphate (mg/L)	R = 0.465, p = 0.109	0.0083	0.0053	0.0063	0.0190	0.0094	0.0106	0.0062	0.0063	0.0100	0.0144	0.0151	0.0122	0.0159	
Bromide (mg/L)	R = 0.540, p = 0.210							0.0092	0.0162	0.0088	0.0140	0.0233	0.0136	0.0179*	
Magnesium (mg/L)	R = -0.125, p = 0.814			3.141					2.376	1.667	2.048	2.592	2.329	1.692	
Calcium (mg/L)	R = -0.069, p = 0.896			6.647					4.288	3.126	3.805	4.651	4.116	3.376	
Copper (µg/L)	**R = -0.824, p = 0.044**								2.081	1.800	1.260	1.322	1.428	1.232	
Zinc (µg/L)	R = -0.613, p = 0.196								12.442	20.429	15.056	11.775	10.802	10.082	

Physical Habitat

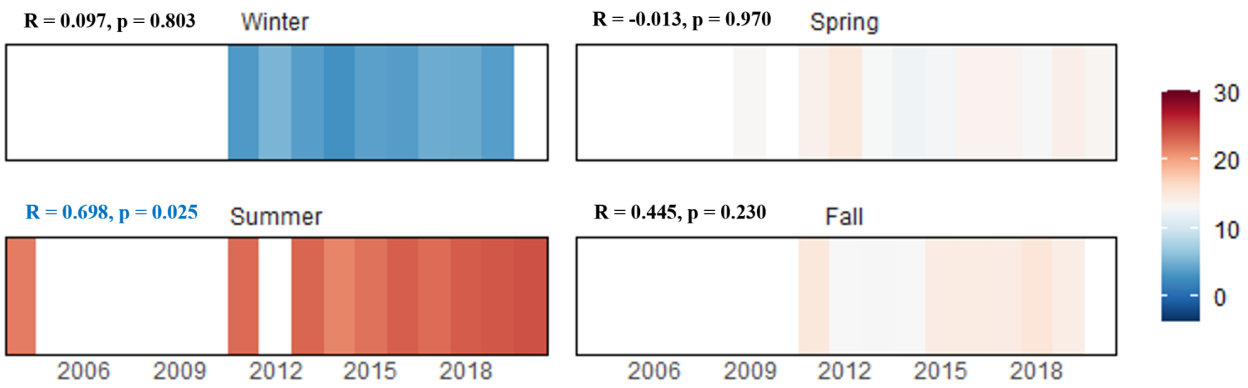
Physical habitat measurements collected at Cypress Branch (2004 and 2008 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.387, p = 0.171	13	12	18	16	17	1	17	12	8	10	8	12	11	8
Epifaunal substrate (0-20)	R = -0.526, p = 0.053	11	13	17	14	18	6	13	15	7	11	7	11	8	6
Velocity/Depth Diversity (0-20)	R = -0.253, p = 0.383	14	6	9	8	7	1	9	8	6	5	8	8	12	5
Pool Quality (0-20)	R = -0.429, p = 0.126	15	13	17	16	11	3	15	12	7	8	12	12	13	7
Riffle Quality (0-20)	R = -0.530, p = 0.051	16	0	16	4	8	0	11	2	6	6	6	0	0	4
Shading (%)	R = -0.262, p = 0.365	90	95	80	80	75	85	95	90	50	75	80	70	90	85
Embeddedness (%)	R = 0.135, p = 0.646	100	85	100	100	30	85	100	90	100	100	100	100	100	85
Discharge (cfs)	R = -0.135, p = 0.646	2.35	0	1.53	0.19	0.42	0	0.73	0	0	0.26	3.82	0.85	0.07	0.28
Stream Area (m2)	R = -0.042, p = 0.886	446.3	440.6	431.3	373.1	333.8	22.7	410.6	339.4	309.4	322.5	543.8	487.5	348.8	326.3

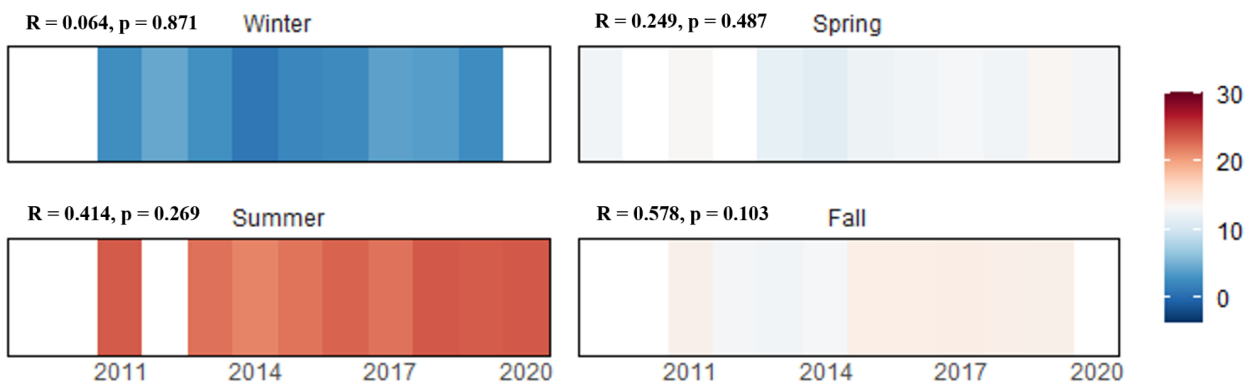
Temperature

Percentage of summer water temperature readings falling above 20°C/above 24°C at Cypress Branch (only calculated for summers missing no less than 2 weeks of data).

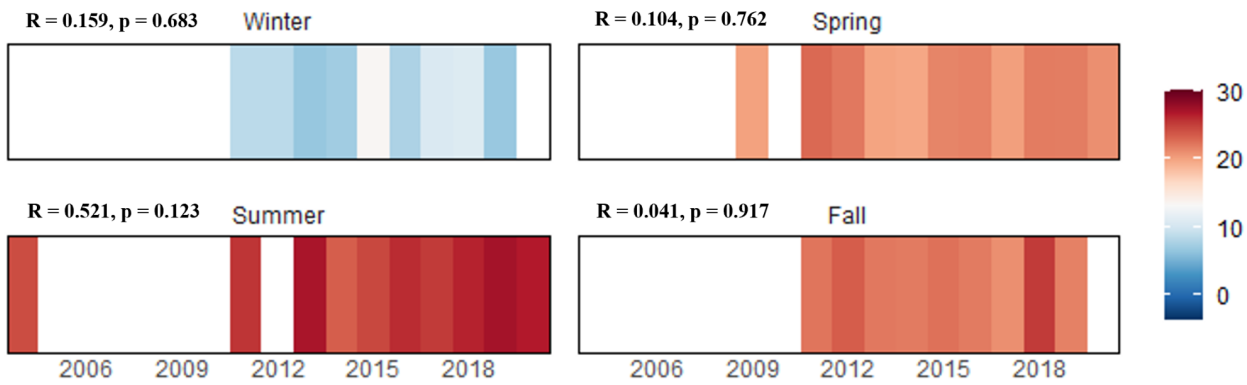
Parameter	*Pearson's Correlation Coefficients*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.619, p = 0.056	83.4	-	-	-	93.7	-	90.7	83.0	88.3	93.7	88.4	92.9	93.7	95.0
% above 24°C	**R = 0.702, p = 0.024**	18.3	-	-	-	26.6	-	33.2	8.2	25.1	41.2	30.0	45.4	54.0	60.0



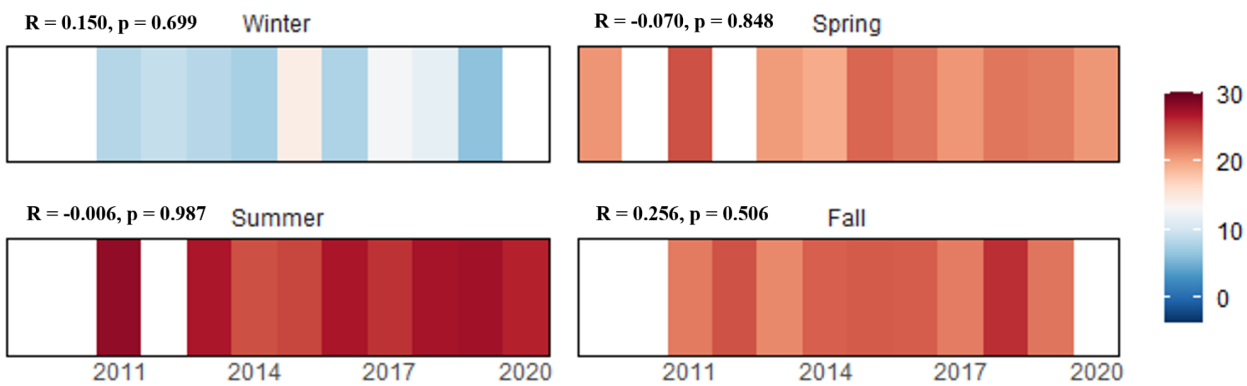
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Cypress Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Cypress Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Cypress Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily air temperatures (℃) from the warmest week of each season calculated using data collected annually at Cypress Branch (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.247, p = 0.394	4.14	2.14	1.86	3.57	1.86	2.71	2.14	3.00	3.00	2.43	3.00	3.29	4.43	3.57
# Taxa	R = 0.337, p = 0.239	25	13	10	25	9	17	12	24	18	19	27	23	37	16
# Ephemeroptera Taxa	R = -0.249, p = 0.391	2	0	0	1	0	0	0	0	0	0	0	0	1	1
# EPT Taxa	R = 0.005, p = 0.987	6	4	1	4	3	3	3	3	4	3	4	3	7	3
# Scraper Taxa	**R = 0.572, p = 0.032**	1	1	1	1	0	0	1	1	3	2	1	2	5	2
% Climbers	R = 0.191, p = 0.514	8.1	0	0	3.4	0.9	24.8	0	2.6	5.0	1.9	3.2	5.8	22.2	4.1
% Ephemeroptera	R = 0.163, p = 0.577	1.8	0	0	0.8	0	0	0	0	0	0	0	0	4.6	0.8
% Intolerant Urban Taxa	R = 0.209, p = 0.474	20.7	47.6	55.0	35.3	70.5	31.9	47.2	38.3	40.0	6.6	34.7	55.8	34.3	81.8

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.223, p = 0.444	4.00	3.00	4.00	4.00	3.33	3.33	4.33	3.33	3.33	4.00	4.00	4.00	4.33	3.67
Abundance per m^2	R = -0.118, p = 0.688	0.5	0.14	0.21	0.11	0.21	4.81	0.45	0.38	0.13	0.12	0.15	0.31	0.13	0.18
# Benthic Sp. (Adjusted)	R = 0.338, p = 0.237	0.86	0.29	0.58	0.29	0.58	0.58	0.86	0.58	0.58	0.58	0.86	0.86	0.58	0.86
% Abundance of Dominant Species	R = -0.237, p = 0.415	17.4	45.9	28.3	29.3	18.3	48.6	18.3	34.1	36.6	22.5	16.1	25.7	20.0	20.7
% Generalists/ Omnivores/ Invertivores	R = 0.266, p = 0.359	92.9	52.5	68.5	85.4	94.4	98.2	89.3	89.9	87.8	75.0	92.6	90.1	86.7	87.9
% Round-bodied Suckers	R = 0.219, p = 0.452	0.9	0	5.4	2.4	1.4	0	0.5	0	0	2.5	4.9	2.0	6.7	0
% Tolerant	R = -0.492, p = 0.074	64.3	90.2	80.4	87.8	91.6	87.2	67.2	70.5	87.8	75.0	46.9	66.5	60.0	60.3

Fish

Cumulative list of fish species (with abundance) collected in Cypress Branch by sampling year.

Species	*Tolerance*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	13	-	2	1	-	5	15	4	-	3	12	11	1	6
Bluegill	T	1	-	7	-	13	1	20	-	-	4	13	39	-	12
Bluespotted Sunfish	M	4	1	2	2	1	1	1	2	-	-	1	-	-	-
Brown Bullhead	T	-	2	-	-	-	-	-	-	-	2	-	-	-	-
Chain Pickerel	M	-	1	-	-	-	-	1	-	-	-	-	1	-	-
Creek Chubsucker	M	2	-	5	1	1	-	1	-	-	1	4	3	3	-
Eastern Mudminnow	T	38	15	18	12	10	22	4	14	3	-	3	6	7	3
Golden Shiner	T	11	-	8	3	1	6	2	4	4	-	2	17	-	-
Green Sunfish	T	21	-	3	8	12	53	23	9	7	5	1	3	4	2
Largemouth Bass	T	-	-	3	-	-	-	4	3	2	1	2	2	1	2
Lepomis Hybrid	M	-	-	-	-	-	-	-	-	-	2	-	1	-	-
Margined Madtom	I	5	-	1	-	-	-	-	-	-	-	2	2	-	1
Mud Sunfish	M	3	2	3	-	-	-	-	-	-	-	1	-	-	-
Pirate Perch	T	18	10	5	5	9	5	19	7	2	9	5	11	1	1
Pumpkinseed	T	6	-	4	1	7	2	13	-	-	-	1	2	-	2
Redbreast Sunfish	M	4	-	1	1	1	2	2	-	1	-	7	5	5	6
Redfin Pickerel	T	16	28	26	6	4	2	15	10	3	7	4	11	5	5
Swallowtail Shiner	M	-	-	-	-	-	-	-	-	-	-	-	-	-	1

Species	*Tolerance*	*2004*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Swamp Darter	I	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Tadpole Madtom	M	39	1	3	-	1	4	34	25	4	4	10	10	8	8
Tessellated Darter	T	33	-	-	1	9	4	25	44	15	2	7	10	9	8
Yellow Bullhead	M	10	1	1	-	2	2	6	7	-	-	6	18	1	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Cypress Branch by sampling year.

Species	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Faxonius limosus	D	N	N	N	N	N	N	N	N	N	N	N	N
Lacunicambarus diogenes	N	N	D	D	N	N	N	N	N	N	N	N	N
Procambarus clarkii	N	N	N	N	N	N	N	N	N	N	N	N	D
Procambarus sp.	D	D	D	D	N	D	D	D	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Cypress Branch by sampling year.

Species	*2008*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Corbicula fluminea	N	N	N	N	N	N	N	N	N	D
Elliptio complanata	D	D	N	N	N	D	D	N	D	D

Species	*2008*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Elliptio fisheriana	D	D	N	N	N	N	N	N	N	N

Herpetofauna

Cumulative list of herpetofauna species collected in or near Cypress Branch.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Eastern cricket frog, Eastern Spadefoot Toad, Fowler's toad, Gray treefrog, New Jersey chorus frog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard Frog, Wood frog
Caudata (Salamanders and Newts)	Marbled salamander
Squamata (Snakes and Lizards)	Eastern gartersnake, Eastern ratsnake, Northern watersnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the Cypress Branch by sampling year, RA = % Relative Abundance.

					2004	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	0.8	0.9	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Annelida	Rhynchobdellida	Erpobdellidae	Erpobdella		0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Rhynchobdellida	Glossiphoniidae	Helobdella	M	0.9	-	-	8.4	-	-	-	3.5	-	-	4.8	4.2	5.6	57.0

					2004	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	0.8	-	-	-	-	-	-	-	-	-	0.8
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	11.0	-	-	1.7	-	1.8	-	1.7	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	2.9	2.7	-	8.0	6.2	31.2	16.5	17.5	-	3.2	-	-	0.8
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	0.9	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	2.8	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	0.9	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Sminthuridae	na		2.8	-	-	-	-	-	-	-	-	-	-	2.5	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	3.6	-	-	0.9	-	2.6	-	4.7	2.4	0.8	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	0.8	-	-	-	-	-	-	-	-	0.9	1.7
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-	2.5	-	-	-	1.9	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-

					2004	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	1.7	-	4.7	0.8	0.8	2.8	0.8
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	1.0	8.1	-	-	-	7.2	7.8	16.7	26.4	1.6	5.8	3.7	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.7
Arthropoda	Diptera	Chironomidae	Limnophyes	T	1.8	2.9	-	6.7	-	2.7	0.8	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	1.0	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Diptera	Chironomidae	Parachironomus	M	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	0.9	-	-	0.9	0.8	-	-	1.7	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	1.7	-	-	-	-	-	-	-	-	-	-

					2004	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	0.8	0.9	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	3.4	-	-	-	0.9	-	-	0.8	-	1.9	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-	-	-	4.6	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	0.9	-	-	0.8	-	-	-	0.9	0.8	3.8	0.8	-	1.9	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	5.5	-	5.4	2.5	1.8	5.3	0.8	-	10.0	-	1.6	3.3	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	-	-	0.8	0.8	4.6	0.8
Arthropoda	Diptera	Chironomidae	Symposiocladius	M	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-	0.8	-	1.9	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.9	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.9	1.0	2.7	2.5	0.9	2.7	2.4	2.6	5.8	-	4.0	1.7	1.9	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	1.8	-	3.6	4.2	2.7	6.2	6.4	7.8	3.3	21.7	4.8	3.3	5.6	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	1.9	2.4	-	2.8	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	-	-	-	0.9	-

					2004	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	-	-	-	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	-	-	-	-	-	-	-	-	-	0.9	1.7
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	3.5	-	0.9	-	-	1.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-	2.4	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-	-	2.5	0.9	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	1.0	-	-	-	-	-	-	-	0.9	-	-	0.9	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	0.9	-	0.9	0.8	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	1.9	-	-	-	-	-	-	2.5	-	-	-	-	1.7
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	1.7	-	-	2.4	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	3.7	-	-	0.8	-	22.1	-	-	-	-	-	-	0.9	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	9.2	13.3	37.8	8.4	33.0	17.7	33.6	27.0	19.2	0.9	23.4	46.7	13.9	-
Arthropoda	Lepidoptera	na	na	M	5.5	11.4	-	-	-	-	0.8	-	-	-	-	-	-	-

					2004	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	0.9	-	-	-	-	-	-	-	2.5	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	-	0.8	-	-	-	1.9	-
Arthropoda	Odonata	Corduliidae	Somatochlora	I	4.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	0.9	-	-	-	-	-	-	7.4	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	0.9	-	-	-	-	0.9	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	22.9	-	1.7	-	-	-	-	-	-	8.9	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	21.1	1.9	-	17.6	-	-	-	2.6	-	17.0	12.1	10.0	3.7	3.3
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	0.8	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	3.7	32.4	10.8	14.3	33.9	8.0	11.2	3.5	10.0	2.8	0.8	1.7	-	-
Arthropoda	Trichoptera	Hydroptilidae	Oxyethira	I	1.8	-	-	-	-	-	-	0.9	0.8	3.8	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	0.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	0.9	1.0	0.9	-	0.9	-	0.8	3.5	-	-	-	-	-	19.8

					2004	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	1.0	-	-	-	-	2.4	0.9	2.5	0.9	-	5.8	-	5.0
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.9	-	-	3.4	-	-	-	1.7	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	2.8	-	-	1.7	-	2.7	-	-	-	-	1.6	-	9.3	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	0.9	-	-	-	-	-	-	-	-
Mollusca	Mesogastropoda	Hydrobiidae	na	T	11.0	-	-	8.4	-	2.7	-	3.5	-	0.9	0.8	0.8	2.8	-
Mollusca	Neotaenioglossa	Hydrobiidae	Amnicola	T	-	-	-	-	-	-	-	0.9	0.8	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	0.9	-	-	-	-	-	-	-	-	-	3.2	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	0.9	-	-	-	4.7	7.3	1.7	1.9	0.8
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	4.8	23.4	3.4	17.0	16.8	-	-	-	0.9	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Emory Creek (CORS-102-S)

Site CORS-102-S is located on an unnamed tributary to Emory Creek in the Coastal Plain – eastern shore region of Maryland. It is in the Corsica River watershed in Queen Anne's County. This site was sampled from 2000 to 2020.

Unnamed tributary to Emory Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	85.08	85.08	85.04	85.15	85.15	85.15	85.15
Urban	3.35	3.35	3.35	3.35	3.35	3.35	3.35
Agriculture	10.95	10.95	10.95	10.95	10.95	10.95	10.95
Other	0.63	0.63	0.66	0.56	0.56	0.56	0.56

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Emory Creek (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
pH	R = 0.120, p = 0.614	6.35	6.56	6.80	6.44	6.02	6.58	6.62	6.55	6.62	6.63	6.46	6.44	6.66
Specific Conductance (µS/cm)	R = -0.254, p = 0.281	63.4	76.8	138.5	60.0	52.1	70.9	90.7	71.0	100.9	100.9	59.9	65.6	75.1
Acid Neutralizing Capacity (µeq/L)	R = 0.117, p = 0.623	183.0	193.3	266.4	115.2	84.5	212.8	319.1	194.4	197.4	209.6	145.8	170.5	295.4
Dissolved Organic Carbon (mg/L)	R = 0.374, p = 0.104	17.400	8.700	6.500	14.200	16.500	14.959	16.562	14.242	7.540	8.502	21.353	20.454	17.207
Chloride (mg/L)	R = -0.142, p = 0.550	6.52	7.11	10.96	6.11	4.67	6.17	9.03	6.99	8.89	8.74	5.66	6.42	1.74
Sulfate (mg/L)	R = -0.366, p = 0.112	5.44	8.24	27.51	8.80	6.61	6.90	7.59	7.36	17.69	15.80	5.95	6.79	5.34
Total Nitrogen (mg/L)	R = 0.430, p = 0.059	0.846	0.453	0.432	0.563	0.657	0.765	0.835	0.741	0.575	0.510	0.946	0.874	1.084
Nitrate-Nitrogen (mg/L)	R = -0.170, p = 0.473	0.1640	0.4400	0.2330	0.1660	0.2220	0.3410	0.2118	0.2598	0.1919	0.1655	0.2103	0.2155	0.3260
Nitrite-Nitrogen (mg/L)	R = -0.095, p = 0.690	0.0108	0.0030	0.0022	0.0035	0.0049	0.0044	0.0038	0.0043	0.0019*	0.0025	0.0057	0.0056	0.0065
Ammonia-Nitrogen (mg/L)	R = -0.150, p = 0.527	0.0484	0.0175	0.0117	0.0144	0.0598	0.0230	0.0383	0.0174	0.0147	0.0161	0.0132	0.0165	0.0346
Total Phosphorus (mg/L)	R = 0.325, p = 0.162	0.0320	0.0270	0.0220	0.0230	0.0490	0.0481	0.0585	0.0321	0.0164	0.0204	0.0463	0.0333	0.0508
Ortho-phosphate (mg/L)	R = 0.338, p = 0.145	0.0065	0.0061	0.0037	0.0048	0.0067	0.0079	0.0103	0.0050	0.0061	0.0070	0.0085	0.0087	0.0103
Bromide (mg/L)	R = 0.423, p = 0.344													
Magnesium (mg/L)	R = 0.398, p = 0.435										2.490			
Calcium (mg/L)	R = 0.360, p = 0.484										8.163			
Copper (µg/L)	R = -0.710, p = 0.114													
Zinc (µg/L)	R = -0.705, p = 0.118													

Water Chemistry continued

Parameter	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.16	6.60	6.42	6.22	6.84	6.68	6.59	
Specific Conductance (µS/cm)	43.8	67.3	51.7	53.0	87.2	85.2	60.5	
Acid Neutralizing Capacity (µeq/L)	105.4	160	126.2	136.1	364.1	269.6	186.8	
Dissolved Organic Carbon (mg/L)	17.441	11.834	13.384	22.656	19.611	14.760	15.504	
Chloride (mg/L)	4.24	7.28	4.80	5.85	9.16	9.05	5.91	Not sampled due to COVID-19 Pandemic
Sulfate (mg/L)	4.80	7.26	6.44	4.74	5.82	7.90	5.25	
Total Nitrogen (mg/L)	1.058	0.758	0.684	0.864	0.916	4.594	0.761	
Nitrate-Nitrogen (mg/L)	0.1127	0.2937	0.1916	0.1083	0.1737	0.2554	0.3051	
Nitrite-Nitrogen (mg/L)	0.0063	0.0034	0.0011*	0.0056	0.0044	0.0028	0.0058	
Ammonia-Nitrogen (mg/L)	0.0842	0.0153	0.0131	0.0240	0.0148	0.0108	0.0206	
Total Phosphorus (mg/L)	0.0947	0.0279	0.0308	0.0535	0.0628	0.038	0.0379	
Ortho-phosphate (mg/L)	0.0253	0.0067	0.0076	0.0094	0.0088	0.0082	0.0076	
Bromide (mg/L)	0.0096	0.0217	0.0120	0.0140	0.0338	0.0203	0.0180	
Magnesium (mg/L)		1.806	1.562	1.42	2.537	2.317	1.778	
Calcium (mg/L)		4.504	3.875	3.562	8.259	6.482	4.444	
Copper (µg/L)		3.127	1.24	1.632	1.203	1.128	1.229	
Zinc (µg/L)		11.659	12.432	11.521	6.268	7.85	8.964	

Physical Habitat

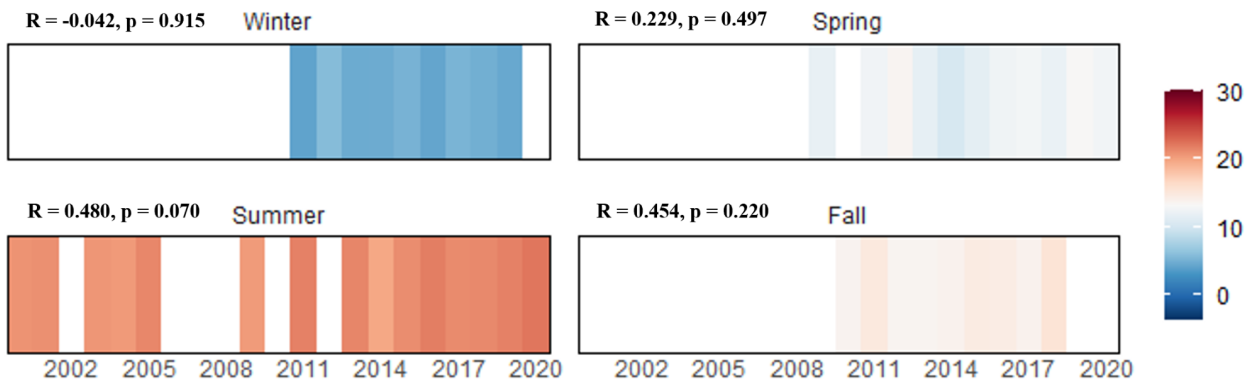
Physical habitat measurements collected at the unnamed tributary to Emory Creek (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.022, p = 0.928	10	8		14	8	7	12	10	6	14	10	9	15	16	8	14	10	9	13	5	7
Epifaunal substrate (0-20)	R = -0.017, p = 0.942	8	9		12	9	8	10	8	6	14	9	9	11	18	10	10	6	10	12	7	6
Velocity/Depth Diversity (0-20)	R = -0.252, p = 0.284	8	9		16	8	7	5	2	2	12	8	7	10	9	9	12	6	8	6	3	4
Pool Quality (0-20)	R = -0.239, p = 0.309	9	13	Not sampled in summer (dry)	16	11	11	10	6	8	12	8	11	15	12	14	11	11	11	8	9	6
Riffle Quality (0-20)	R = -0.117, p = 0.623	12	8		16	6	0	0	0	0	15	0	0	6	8	4	12	7	6	8	0	7
Shading (%)	**R = -0.662, p = 0.001**	80	92		95	93	95	95	70	80	70	90	75	75	55	55	70	95	65	70	65	50
Embeddedness (%)	R = 0.376, p = 0.102	40	60		20	20	25	70	100	100	100	45	20	95	75	85	100	40	50	100	80	65
Discharge (cfs)	R = -0.155, p = 0.501	0.58	0.02		4.13	0.02	0	0	0	0	0.88	0	0	0.02	0.26	0.15	0.93	0.11	0.07	1.33	0	0
Stream Area (m2)	R = -0.189, p = 0.426	163.1	217.5		238.1	174.4	52.5	121.9	34.5	27.0	191.3	88.1	133.2	123.8	163.1	172.5	178.1	101.3	138.8	195.0	68.2	95.6

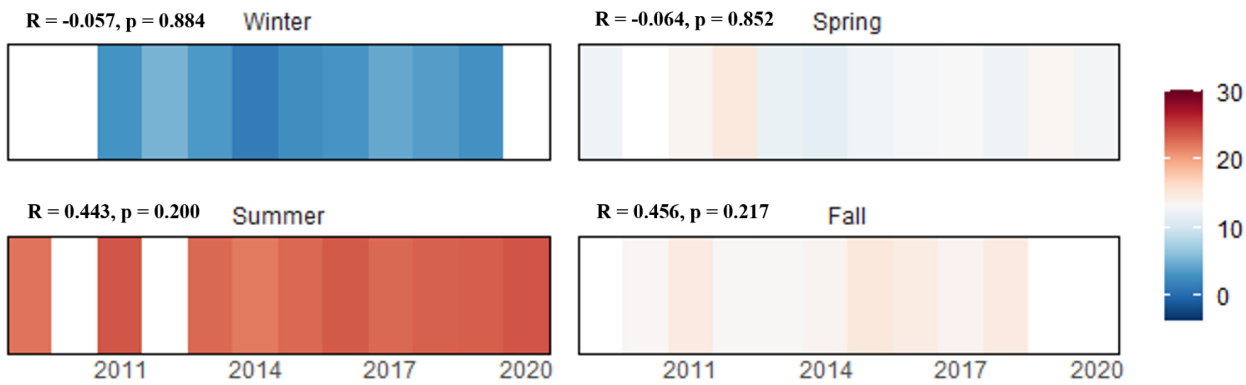
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Emory Creek (only calculated for summers missing no less than 2 weeks of data).

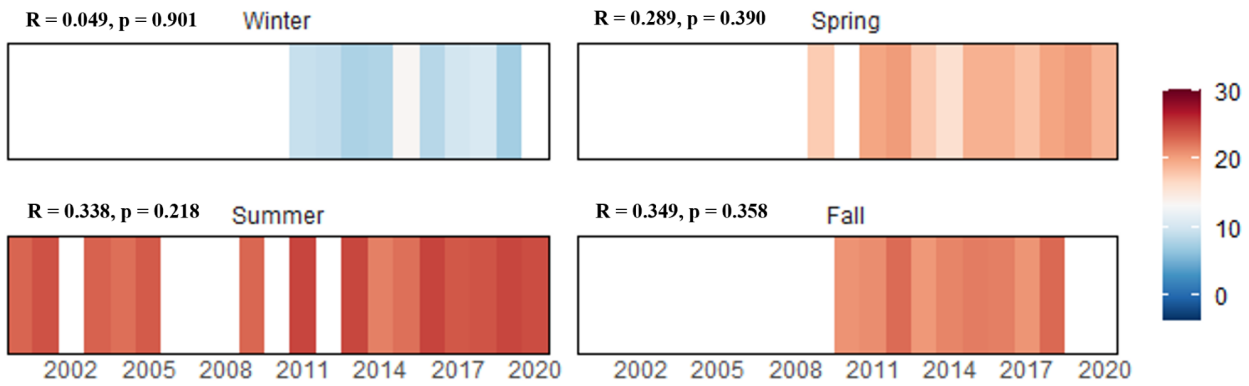
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.340, p = 0.215	66.7	71.4	-	-	69.4	64.8	79.7	-	-	58.5	-	81.9	-	72.8	45.8	82.5	78.3	74.5	74.5	81.5	85.6
% above 24°C	R = 0.446, p = 0.096	5.8	5.6	-	-	2.3	0.2	7.7	-	-	0.8	-	12.3	-	11.7	0	0.8	18.3	6.4	6.4	9.7	19.0



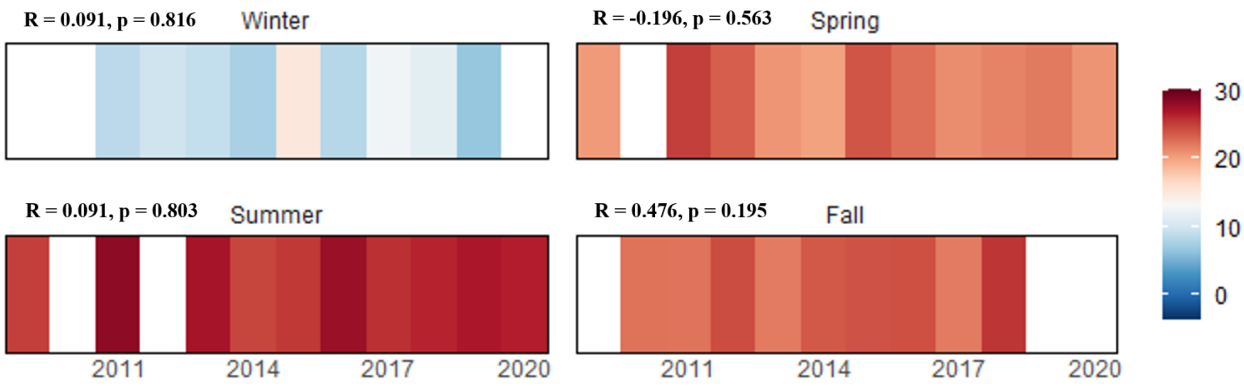
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Emory Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Emory Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Emory Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Emory Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.102, p = 0.659	4.14	4.14	2.43	3.29	3.86	4.43	3.86	4.43	3.29	3.00	4.14	3.29	3.57	2.43	3.86	3.00	3.86	4.14	3.57	4.71	4.14
# Taxa	R= -0.082, p = 0.723	29	28	15	18	17	34	21	22	22	17	26	20	21	16	20	18	17	28	18	24	28
# Ephemeroptera Taxa	R = 0.023, p = 0.921	2	1	0	1	2	1	1	2	0	0	2	1	1	0	2	1	1	1	1	2	1
# EPT Taxa	R = 0.376, p = 0.093	7	4	1	3	4	5	3	7	4	5	8	7	5	4	7	3	5	6	5	8	6
# Scraper Taxa	R = -0.239, p = 0.296	1	3	4	1	1	5	2	1	3	1	1	1	1	1	1	0	2	2	2	2	2
% Climbers	**R = -0.453, p = 0.039**	10.3	9.2	9.3	1.6	8.7	4.3	11.0	7.1	0.9	1.7	2.7	0.8	1.6	0	3.5	0.8	6.0	4.2	0.9	8.3	3.9
% Ephemeroptera	R = -0.028, p = 0.903	3.4	1.8	0	1.6	5.8	20.7	1.4	47.3	0	0	6.3	0.8	0.8	0	5.2	14.4	0.9	6.7	5.1	10.8	2.4
% Intolerant Urban Taxa	**R = 0.543, p = 0.011**	22.2	50.5	2.5	78.9	38.5	31.0	40.4	70.5	46.8	65.2	50.5	52.9	70.7	69.2	76.7	60.0	67.2	65.6	66.1	65.8	47.2

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.062, p = 0.794	2.00	2.00	na	2.00	1.67	2.00	1.67	2.67	2.00	2.33	1.67	2.00	2.33	2.33	2.33	2.00	2.00	1.67	2.33	1.67	1.67
Abundance per m2	R = -0.062, p = 0.795	0.28	0.8	na	0.12	0.24	4.65	0.3	2.9	0.41	0.16	0.19	0.2	0.47	1.81	0.91	1.27	2.69	0.56	0.27	0.18	0.5
# Benthic Sp. (Adjusted)	-	0	0	na	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Abundance of Dominant Species	R = -0.041, p = 0.863	80.4	97.1	na	82.1	80.5	93.0	70.3	66.0	63.6	58.1	76.5	40.7	69.0	89.8	84.7	94.7	97.8	89.7	46.2	83.3	81.3
% Generalists/ Omnivores/ Invertivores	R = 0.286, p = 0.221	87.0	97.1	na	89.3	80.5	97.1	29.7	86.0	81.8	41.9	100	81.5	96.6	97.3	93.0	96.9	98.2	100	86.5	91.7	100
% Round-bodied Suckers	-	0	0	na	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Tolerant	R = -0.106, p = 0.657	93.5	100	na	96.4	100	97.5	100	100	100	87.1	23.5	100	96.6	92.5	93.6	98.2	99.6	89.7	84.6	100	87.5

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Emory Creek by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	3	-		1	-	-	-	-	-	4	-	-	2	14	10	4	-	7	8	-	4
Black Crappie	M	-	-		-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Bluegill	T	-	-		-	-	1	-	11	-	1	-	5	-	-	-	-	-	-	8	-	-
Eastern Mosquitofish	M	-	-		-	-	6	-	-	-	-	13	-	-	7	-	-	1	1	-	-	2
Eastern Mudminnow	T	37	168	Not sampled in summer (dry)	23	33	227	7	66	7	8	3	11	40	265	133	214	266	70	24	10	39
Golden Shiner	T	-	-		1	-	3	2	5	2	-	1	-	1	-	-	1	-	-	-	-	-
Green Sunfish	T	-	-		-	-	-	2	2	-	-	-	6	10	-	3	-	-	-	5	1	3
Largemouth Bass	T	-	-		-	-	-	-	-	-	-	-	-	-	7	-	-	-	-	-	1	-
Pumpkinseed	T	-	-		-	-	-	-	2	-	-	-	-	3	-	-	-	-	-	-	-	-
Redfin Pickerel	T	6	5		3	8	7	26	14	2	18	-	5	2	1	11	7	5	-	7	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Emory Creek by sampling year.

Species	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Lacunicambarus diogenes	D	D	N	N	N	N	D	D	N	N	D	N	N	N

Species	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Procambarus clarkii	N	N	N	N	N	N	D	N	N	N	N	N	N	D
Procambarus sp.	N	N	N	N	N	N	N	N	N	N	D	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Emory Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna collected in or near the unnamed tributary to Emory Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Fowler's toad, Cope's Gray Treefrog, Gray Treefrog, New Jersey chorus frog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Wood frog
Squamata (Snakes and Lizards)	Common five-lined skink, Eastern garter snake
Testudines (Turtles)	Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to Emory Creek by sampling year, RA = % Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	6.9	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	1.0	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	0.9	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	0.7	-	-	-	-
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	-	-	8.7	-
Annelida	Tubificida	Tubificidae	na	T	2.6	-	-	-	-	-	-	0.9	-	-	0.9
Arthropoda	Amphipoda	na	na	M	5.1	-	-	-	-	2.6	1.4	0.9	3.7	-	29.7
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	10.3	-	-	-	-	9.9
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	5.1	-	-	0.8	1.9	3.4	2.7	0	0.9	-	1.8
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Acilius	M	-	-	-	-	-	0.9	-	0.9	3.7	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	2.1	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	0.9	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	1.7	-	-	-	-	-	1.4	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	0.8	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	0.9	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Scirtidae	na	M	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	10.3	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	na	na	M	10.3	-	-	-	1.9	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	na	M	1.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Culicoides	M	-	3.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	1.7	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	0.9	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	0.8	-	-	-	4.5	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	1.7	-	-	-	-	0.9	9.6	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	0.9	-	-	1.6	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	0.9	-	-	-	0.9	-	-	3.7	0.9	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	1.8	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Endochironomus	M	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	0.9	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	0.9	52.5	3.1	2.9	2.6	-	-	26.6	11.3	2.7
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	0.8	-	1.7	-	2.7	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.9	-	-	-	-	-	0.7	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Odontomesa	M	-	-	-	-	-	-	-	-	-	-	4.5
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	0.9	1.8	-	0.8	4.9	20.7	1.4	46.4	-	-	5.4
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.9	-	0.8	-	6.8	-	-	0.9	-	1.7	0.9
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	0.9	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	0.9	-	-	1.0	2.6	1.4	-	0.9	1.7	0.9
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	5.9	-	-	1.7	0.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	1.8	-	-	-	-	3.4	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	1.8	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	6.0	4.8	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	7.7	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	0.9	-	3.9	8.7	-	-	12.5	6.4	40.9	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	1.6	-	-	-	-	2.8	-	3.6
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	4.6	22.0	3.1	9.7	2.6	4.1	0.9	7.3	5.2	0.9
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	10.2	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	-	-	-	-	-	-	-	2.7
Arthropoda	Diptera	Simuliidae	na	M	-	5.5	-	-	1.9	0.9	-	-	-	0.9	1.8
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	0.9	-	1.8
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Pilaria	M	0.9	-	-	-	-	-	-	-	4.6	1.7	0.9
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Tipula	M	1.7	3.7	2.5	-	-	0.9	2.1	1.8	0.9	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.9	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	2.5	1.6	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.9	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	1.7	29.4	0.8	13.3	1.9	-	-	1.8	17.4	17.4	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	0.9	-	2.3	29.1	5.2	-	6.3	-	-	9.9
Arthropoda	Odonata	Corduliidae	Neurocordulia		-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	9.4	1.8	1.7	-	-	1.7	-	1.8	-	-	1.8
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	1.7	0.9
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	0.9	-	0.8	-	-	-	-	-	-	0.9

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Perlidae	Perlesta	I	1.7	1.8	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	1.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	1.7	2.1	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	0.7	-	0.9	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	5.1	13.8	-	46.1	5.8	0.9	-	2.7	10.1	3.5	0.9
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	1.7	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	0.9	-	2.3	14.6	0.9	29.5	3.6	2.8	-	3.6
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	2.8	-	-	-	-	0.7	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	3.4	1.8	-	-	-	-	4.1	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	13.7	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	4.9	6.9	-	1.8	-	0.9	0.9
Mollusca	Basommatophora	Planorbidae	Planorbella	T	-	0.9	-	-	1.0	1.7	-	1.8	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	0.9	-	-	-	-	0.9
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	0.9	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	3.4	0.9	5.1	1.6	-	-	-	-	0.9	-	3.6
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	-	0.8	-	-	-	-	1.8	-	0.9	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	0.9	-	-	-	-	-	0.9	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	2.6	6.4	-	2.3	-	3.4	26.0	0.9	0.9	0.9	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	0.8	-	0.8	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	6.7	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	5.1	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Amphipoda		na	M	0.8	-	-	-	-	-	2.5	-	3.3	8.7
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	1.6	-	1.7	-	-	0.8
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	-	-	-	-	-	1.6
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	2.4
Arthropoda	Coleoptera	Dytiscidae	Acilius	M	-	1.6	-	4.3	18.4	14.7	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	0.9	-	1.7	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	0.9	-	-	-	2.5	2.5	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	0.8	-	-	-	-	-	3.4	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Scirtidae	na	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	0.8	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	0.9	-	0.9	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Culicoides	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	0.9	-	-	0.8	0.8	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	1.6	-	-	-	-	0.8	-	-	1.6
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	0.8	-	-	-	4.0	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	4.2	-	2.6	-	-	2.6	-	2.5	3.3	2.4
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	2.4
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	2.4
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	6.7	6.5	14.5	3.4	-	1.7	-	6.8	2.5	-
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.8	0.9	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Odontomesa	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	4.3	-	-	5.0	-	2.5	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	0.8	0.8	-	-	14.4	0.9	1.7	5.1	1.7	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	-	-	-	-	3.1
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.8	0.8	-	-	-	5.2	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	0.8	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	0.9	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	0.8	0.9	0.8	-	1.7	0.8
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	0.9	-	-	-	0.8	-	-	1.6
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	0.8	-	-	-	-	-	-	-	0.8	0.8
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	9.2	7.3	1.7	4.3	4.8	7.8	-	4.2	0.8	0.8
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	1.6
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	1.7	0.8	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	4.2	1.6	-	3.4	3.2	-	4.2	9.3	1.7	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	1.6	-	-	-	2.6	1.7	-	8.3	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.8	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	26.1	1.6	-	-	0.8	0.9	-	1.7	-	7.1
Arthropoda	Diptera	Simuliidae	Simulium	M	-	0.8	-	0.9	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tabanidae	Tabanus	I	0.8	-	-	-	-	-	-	-	0.8	11.0
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	0.8	-	1.7	-	-	0.8	-	5.0	0.8
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	29.4	39.8	34.2	44.0	17.6	34.5	43.7	19.5	35.8	2.4
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Odonata	Corduliidae	Neurocordulia		-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	0.9	0.8	2.6	0.8	1.7	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	0.8	3.3	-	-	-	-	5.0	-	1.7	-

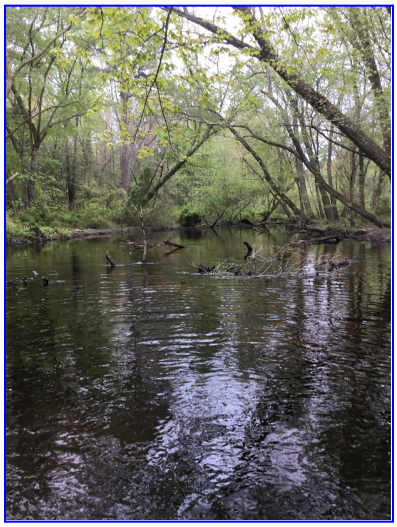
PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	5.9	-	5.0	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	0.8	0.8	0.9	-	-	-	-	-	0.8	0.8
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	4.0	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	9.2	19.5	31.6	21.6	20.8	18.1	3.4	33.9	3.3	3.9
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	0.8	-	-	2.4
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	0.8	-	-	0.8	-	11.0
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	0.8	-	-	2.4
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	-	-	-	-	1.7	0.8
Mollusca	Basommatophora	Physidae	Physa	T	-	4.9	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	0.9	1.6	-	3.4	2.5	0.8	-
Mollusca	Basommatophora	Planorbidae	Planorbella	T	-	-	-	0.9	3.2	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	0.8	0.9	0.9	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	0.8	-	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	6.8	-	-	2.6	1.7	0.8	4.2	14.2
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	0.8	-	0.9	-	-	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	0.8	-	-	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	0.9	1.6	-	-	-	-	9.4

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Leonard Pond Run (WIRH-220-S)

Site WIRH-220-S is located on Leonard Pond Run in the Coastal Plain – eastern shore region of Maryland. It is in the Wicomico River Head watershed in Wicomico County. This site was sampled from 2000 to 2020.



Leonard Pond Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	42.22	42.87	42.03	42.03	43.25	45.37	45.83
Urban	15.73	15.73	17.20	17.20	17.71	17.71	17.76
Agriculture	36.38	36.39	35.02	35.01	34.46	34.39	34.36
Other	5.67	5.01	5.75	5.76	4.58	2.54	2.05

Water Chemistry

Water chemistry measurements collected at Leonard Pond Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
pH	R = 0.127, p = 0.592	6.23	6.76	6.87	6.50	6.68	6.65	6.67	6.50	6.64	6.92	6.61	6.87	6.65	6.43
Specific Conductance (µS/cm)	R = 0.373, p = 0.105	79.2	122.0	152.0	100.0	125.5	131.7	135.2	130.7	128.6	155.6	133.2	146.1	129.7	96.5
Acid Neutralizing Capacity (µeq/L)	**R = 0.674, p = 0.001**	161.4	249.2	283.2	232.3	247.5	282.6	274.7	238.6	296.5	329.8	303.6	344.4	310.5	199.2
Dissolved Organic Carbon (mg/L)	R = -0.126, p = 0.596	16.000	3.700	2.000	6.100	3.700	5.449	2.701	5.407	6.191	3.433	5.306	3.732	5.604	9.927
Chloride (mg/L)	**R = 0.491, p = 0.028**	2.31	11.98	14.16	11.58	12.01	12.91	13.34	12.87	13.91	15.84	13.70	17.58	14.56	11.09
Sulfate (mg/L)	R = 0.326, p = 0.161	1.73	5.14	6.62	6.24	5.40	7.10	6.10	6.93	11.04	9.12	7.29	8.93	7.08	6.76
Total Nitrogen (mg/L)	R = 0.263, p = 0.262	2.536	4.607	6.158	2.841	4.492	4.517	5.037	5.419	2.841	5.756	4.695	5.366	4.672	3.408
Nitrate-Nitrogen (mg/L)	R = 0.225, p = 0.340	0.5480	3.8600	6.1850	2.4530	4.3280	4.9129	4.9485	4.6862	2.2749	5.2376	3.8881	4.2664	4.2785	2.9160
Nitrite-Nitrogen (mg/L)	R = 0.290, p = 0.215	0.0069	0.0141	0.0100	0.0090	0.0110	0.0081	0.0052	0.0097	0.0074	0.0090	0.0219	0.0249	0.0069	0.0049
Ammonia-Nitrogen (mg/L)	R = 0.377, p = 0.101	0.0483	0.0981	0.0069	0.0408	0.0358	0.0332	0.0174	0.0432	0.0297	0.0060	0.2949	0.2779	0.0187	0.0176
Total Phosphorus (mg/L)	R = 0.403, p =0.078	0.0290	0.0150	0.0210	0.0200	0.0190	0.0246	0.0157	0.0374	0.0469	0.0302	0.0543	0.0419	0.0224	0.0339
Ortho-phosphate (mg/L)	R = 0.350, p = 0.130	0.0129	0.0019*	0.0044	0.0037	0.0040	0.0106	0.0055	0.0138	0.0053	0.0074	0.0102	0.0046	0.0068	0.0111*
Bromide (mg/L)	R = 0.423, p = 0.345														0.0173
Magnesium (mg/L)	R = -0.619, p = 0.190										2.197				
Calcium (mg/L)	R = -0.170, p = 0.748										7.517				
Copper (µg/L)	R = -0.306, p = 0.556														
Zinc (µg/L)	R = -0.636, p = 0.175														

Water Chemistry continues

Parameter	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.57	6.84	6.63	6.67	6.58	6.68	
Specific Conductance (µS/cm)	164.0	144.8	141.8	139.1	121.6	137.3	
Acid Neutralizing Capacity (µeq/L)	296.7	377.9	348.6	370.9	286.2	354.0	
Dissolved Organic Carbon (mg/L)	3.276	5.972	3.786	3.899	8.437	4.480	
Chloride (mg/L)	20.23	15.83	14.49	13.88	13.07	13.40	
Sulfate (mg/L)	7.48	7.72	6.23	6.18	5.77	7.15	
Total Nitrogen (mg/L)	5.918	5.249	5.339	4.805	4.313	4.699	Not sampled due to COVID-19 Pandemic
Nitrate-Nitrogen (mg/L)	5.2579	3.9930	4.7750	4.4454	3.6033	4.5548	
Nitrite-Nitrogen (mg/L)	0.0178	0.0406	0.0076	0.0160	0.0140	0.0081	
Ammonia-Nitrogen (mg/L)	0.2401	0.5253	0.0407	0.0681	0.2814	0.0310	
Total Phosphorus (mg/L)	0.0187	0.0409	0.0197	0.0317	0.1469	0.0257	
Ortho-phosphate (mg/L)	0.0059	0.0040	0.0071	0.0121	0.1148	0.0061	
Bromide (mg/L)	0.0331	0.0273	0.0366	0.0347	0.0243	0.0333	
Magnesium (mg/L)	2.849	2.833	2.756	2.829	2.325	2.676	
Calcium (mg/L)	8.832	8.303	8.848	9.711	7.284	8.763	
Copper (µg/L)	0.669	0.750	0.314	0.409	0.805	0.374	
Zinc (µg/L)	7.873	8.746	7.333	5.342	6.246	6.913	

Physical Habitat

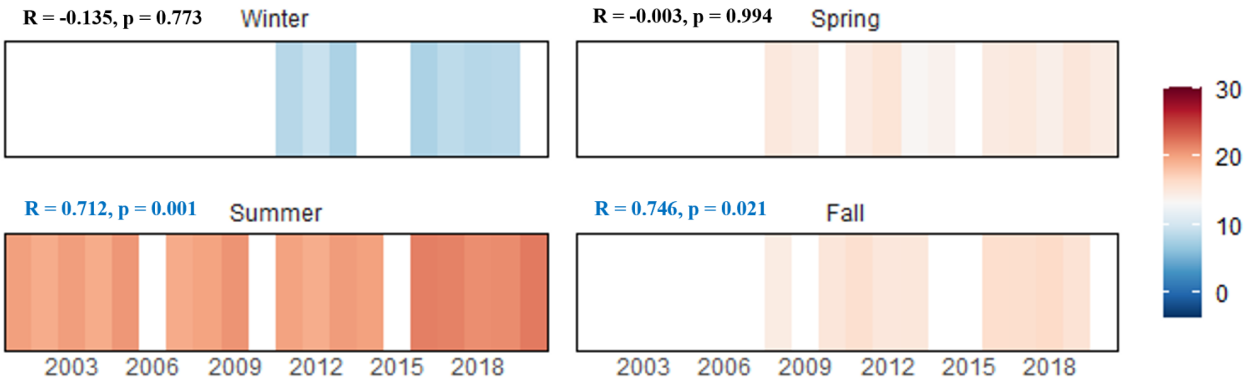
Physical habitat measurements collected at Leonard Pond Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficient*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.554, p = 0.009**	19	18	17	16	15	17	18	18	17	17	16	13	17	18	16	14	15	16	15	17	8
Epifaunal substrate (0-20)	R = -0.339, p = 0.133	16	16	13	16	13	12	16	14	14	17	15	15	16	16	16	12	14	12	14	16	7
Velocity/Depth Diversity (0-20)	**R = -0.726, p < 0.001**	18	19	15	17	13	14	11	8	9	9	10	6	8	10	10	8	10	10	10	10	8
Pool Quality (0-20)	R = -0.177, p = 0.443	17	17	17	16	16	16	17	19	18	17	18	16	15	18	19	15	16	17	17	18	13
Riffle Quality (0-20)	**R = -0.547, p = 0.010**	15	0	13	16	16	13	12	0	0	6	0	0	9	12	0	0	7	0	0	0	5
Shading (%)	**R = -0.532, p = 0.013**	87	85	60	80	78	80	85	85	85	80	80	65	75	85	55	50	60	60	70	0	80
Embeddedness (%)	R = 0, p = 1	100	100	100	100	100	100	100	100	100	100	95	100	100	100	100	100	100	100	100	100	100
Discharge (cfs)	R = -0.284, p = 0.211	39.23	20.77	13.82	31.74	18.07	39.53	12.66	12.45	9.14	11.59	7.05	5.73	6.9	20.35	13.08	23.26	14.63	31.52	19.06	14.15	14.74
Stream Area (m2)	R = 0.042, p = 0.856	909.4	832.5	735.0	883.1	742.5	896.3	660.0	686.3	671.3	701.3	603.8	474.4	513.8	808.1	821.3	886.9	802.5	922.5	843.8	843.8	772.5

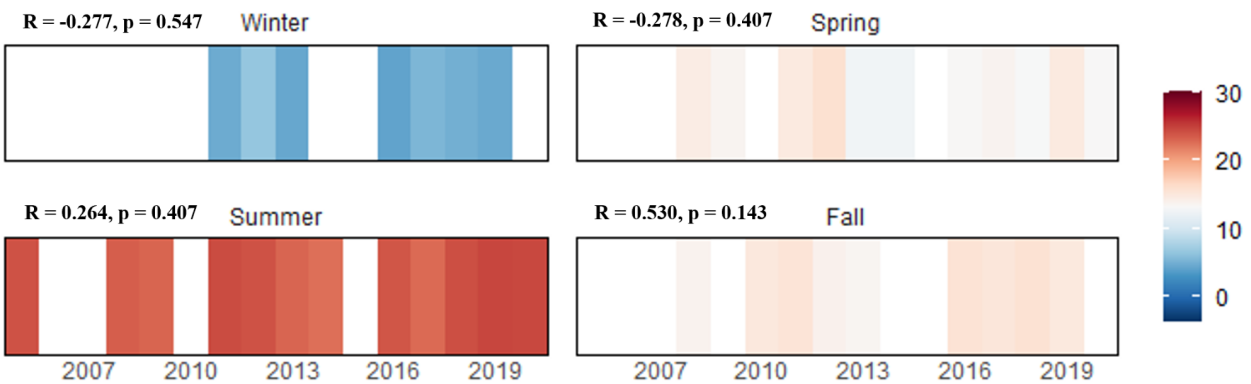
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Leonard Pond Run (only calculated for summers missing no less than 2 weeks of data).

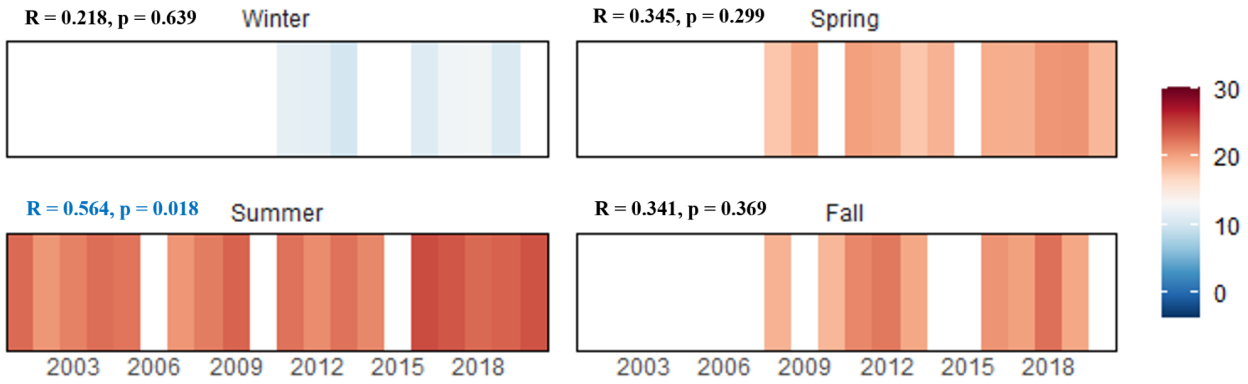
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.622, p = 0.008**	-	53.3	30.6	59.2	32.8	64.1	-	30.5	49.1	70.0	-	43.2	29.2	50.5	48.5	-	84.7	81.7	72.0	74.1	87.7
% above 24°C	**R = 0.643, p = 0.005**	-	0.1	0	0.1	2.5	0.2	-	0	0	2.1	-	2.0	0	0	0	-	12.5	6.0	3.3	4.3	13.7



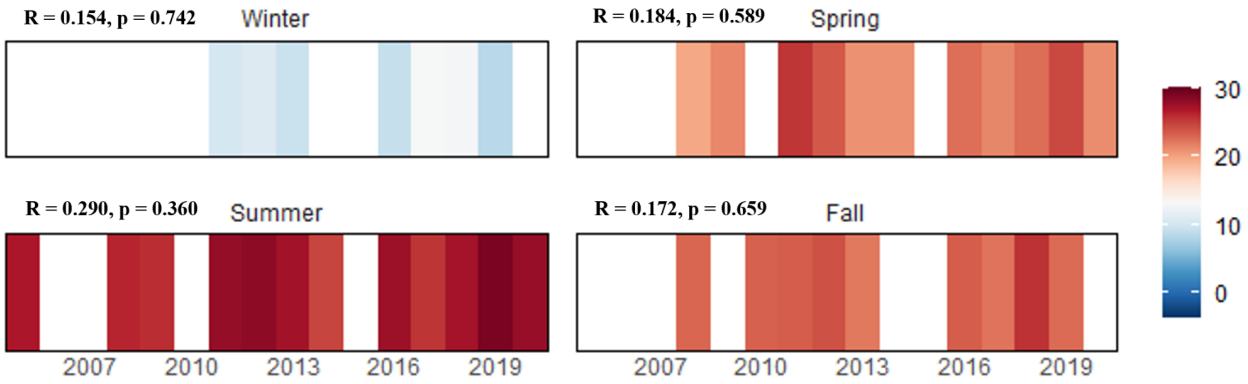
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Leonard Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Leonard Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Leonard Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Leonard Pond Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.278, p = 0.223	4.14	4.71	4.43	4.14	4.43	4.71	4.43	4.71	3.86	2.43	3.57	3.57	3.86	5.00	4.71	4.14	4.43	4.71	3.86	3.57	3.00
# Taxa	R = 0.009, p = 0.969	21	27	23	30	25	27	37	28	32	25	15	14	22	26	27	26	28	22	32	23	30
# Ephemeroptera Taxa	R = -0.277, p = 0.225	4	3	3	2	2	3	3	3	2	0	1	2	1	2	2	2	3	5	1	1	2
# EPT Taxa	R = -0.206, p = 0.370	6	6	6	6	8	12	10	9	6	2	4	2	4	10	7	7	6	9	6	4	4
# Scraper Taxa	R = -0.176, p = 0.445	2	3	2	3	3	4	6	4	3	0	1	2	2	4	4	2	3	4	2	3	0
% Climbers	R = -0.028, p = 0.904	18.3	16.2	26.3	11.2	22.8	9.7	18.2	16.7	3.0	46.7	23.5	15.6	16.5	24.4	20.2	39.6	10.6	20.7	26.3	6.9	6.0
% Ephemeroptera	R = -0.244, p = 0.286	23.5	35.9	21.1	3.5	9.9	15.0	9.1	30.0	7.9	0	15.7	1.6	8.3	16.5	12.8	6.9	20.6	39.7	2.6	1.5	9.8
% Intolerant Urban Taxa	R = 0.007, p = 0.976	6.1	10.3	7.4	6.9	17.8	13.3	19.1	11.7	5.0	3.7	20.6	0.8	21.1	33.9	17.4	8.9	4.3	18.2	5.3	10.8	1.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	**R = 0.483, p = 0.026**	4.00	3.67	3.67	3.33	3.33	3.33	3.67	4.00	3.00	3.67	3.67	4.33	4.33	3.67	3.67	4.33	4.00	3.67	4.00	4.33	4.00
Abundance per m2	R = -0.003, p = 0.988	0.18	0.25	0.49	0.16	0.35	0.09	0.35	0.31	0.39	0.36	0.57	0.46	0.59	0.33	0.34	0.16	0.17	0.16	0.27	0.39	0.26
# Benthic Sp. (Adjusted)	R = -0.331, p = 0.143	1.09	1.09	1.09	1.09	1.09	0.82	1.09	0.82	1.09	0.82	0.82	0.82	0.82	0.82	1.09	0.82	1.09	1.09	1.09	0.82	0.82
% Abundance of Dominant Species	**R = -0.658, p = 0.001**	41.7	44.5	60.8	32.6	45.8	26.6	37.8	37.0	48.3	31.0	61.7	35.5	21.6	27.7	30.1	21.0	21.7	26.4	19.4	30.4	16.5
% Generalists/ Omnivores/ Invertivores	R = -0.311, p = 0.170	80.4	83.7	89.5	88.9	83.1	79.8	72.6	76.8	77.7	64.3	87.6	78.6	69.8	68.9	79.8	83.3	71.7	85.4	81.9	74.5	75.5

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	R = -0.263, p = 0.249	7.1	2.9	0.3	0	0.8	0	0	0.5	0	0	0.3	0.9	0.7	0	0	2.2	0.7	0	0.9	2.5	0.5
% Tolerant	**R = -0.792, p < 0.001**	67.3	75.6	81.5	77.1	75.4	70.9	64.8	63.0	69.4	55.2	78.4	63.6	52.1	52.1	63.1	44.2	44.9	60.4	54.6	54.3	41.0

Fish

Cumulative list of fish species (with abundance) collected in Leonard Pond Run by year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	5	7	15	3	10	1	8	15	17	19	20	25	38	41	41	18	26	19	37	31	33
Black Crappie	M	1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bluegill	T	27	37	9	31	32	16	9	23	9	52	21	26	9	74	31	22	30	35	34	39	23
Bluespotted Sunfish	M	-	-	-	-	-	1	-	4	2	-	-	-	-	-	1	-	-	-	-	-	-
Brown Bullhead	T	-	-	2	-	1	1	-	-	-	3	-	1	1	2	-	-	-	-	-	-	2
Chain Pickerel	M	26	26	17	11	16	4	23	19	18	12	36	18	56	38	38	16	24	19	21	31	21
Creek Chubsucker	M	12	6	1	-	2	-	-	1	-	-	1	2	2	-	-	3	1	-	2	8	1
Eastern Mosquitofish	M	-	-	1	-	-	-	-	1	-	-	5	-	-	-	3	-	-	1	-	3	-
Eastern Mudminnow	T	6	6	19	4	9	-	15	5	25	14	6	15	28	4	25	4	4	1	8	5	5
Golden Shiner	T	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Green Sunfish	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	1	-
Largemouth Bass	T	2	6	1	2	8	3	-	2	5	-	2	-	-	3	2	4	-	-	1	2	-
Least Brook Lamprey	M	5	2	18	3	19	3	40	28	36	78	5	29	35	42	16	3	15	1	19	50	19
Margined Madtom	I	1	1	4	4	5	1	4	1	3	3	5	3	2	3	2	1	1	5	4	8	2

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Pirate Perch	T	7	16	42	10	17	3	24	17	12	19	14	17	48	20	32	5	12	7	28	15	5
Pumpkinseed	T	1	-	-	17	5	6	14	8	5	2	15	3	6	4	2	10	3	6	6	16	15
Redbreast Sunfish	M	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	1	3	1	3
Redear Sunfish	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	9
Redfin Pickerel	T	-	-	2	-	1	6	-	-	-	-	-	-	1	-	1	-	-	-	-	-	-
Tadpole Madtom	M	1	4	8	1	3	-	1	-	1	-	-	-	-	-	2	-	5	1	2	-	-
Tessellated Darter	T	70	93	220	47	119	21	87	78	128	49	214	78	66	32	85	16	13	38	44	99	32
White Perch	M	2	2	-	2	-	1	-	-	-	-	-	-	8	-	-	29	1	1	-	-	-
Yellow Bullhead	M	1	-	1	-	1	-	-	-	-	-	-	-	2	-	1	-	-	1	4	-	3
Yellow Perch	M	1	-	2	9	8	12	5	9	4	1	2	3	3	4	-	7	2	7	11	17	27

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Leonard Pond Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Faxonius limosus	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Lacunicambarus diogenes	N	D	N	N	N	N	D	N	N	N	N	N	N	N	N
Procambarus acutus	D	D	N	N	N	N	N	N	D	N	N	N	N	N	N
Procambarus sp.	N	N	D	D	N	D	D	D	D	D	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Leonard Pond Run by sampling year.

Species	*2000*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Corbicula fluminea	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*D*	*N*	*D*	*D*	*D*	*D*
Elliptio complanata	N	N	N	N	N	N	D	D	D	N	D	D	D	D	D	D	D	D	D	D
Elliptio fisheriana	N	N	N	N	N	N	N	D	N	N	D	D	D	N	N	N	N	N	N	N

Herpetofauna

Cumulative list of herpetofauna species collected in or near Leonard Pond Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Fowler's toad, Gray treefrog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander
Squamata (Snakes and Lizards)	Common five-linked skink, Northern ring-necked snake, Southern ring-necked snake
Testudines (Turtles)	Eastern box turtle, Eastern snapping turtle, Northern red-bellied cooter

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Leonard Pond Run by sampling year, RA = % Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	0.9	3.6	-	-	0.9	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Annelida	Haplotaxida	Naididae	na	T	2.6	-	-	-	-	0.9	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	6.1	-	-	-	-	-	-	-	-	-	10.8
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	0.9	1.8	0.8	-	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	0.9	-	-	0.9	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	1.1	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	-	-	-	1.0	-	-	1.7	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	0.9	-	-	1.7	-	1.8	-	3.3	4.0	-	1.0
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	1.7	0.9	-	1.7	1.0	4.4	1.8	0.8	-	0.9	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	1.0	1.9	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	1.1	-	-	-	-	-	5.0	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	1.7	1.0	-	-
Arthropoda	Coleoptera	Elmidae	Microcylloepus	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	2.6	1.1	0.9	3.0	10.6	2.7	2.5	1.0	0.9	10.8
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	2.6	-	-	-	-	2.0	-	-
Arthropoda	Decapoda	Cambaridae	Procambarus	I	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	na	na	M	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	0.9	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	3.2	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	3.6	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Apsectrotanypus	M	2.6	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	1.1	-	-	-	0.9	-	2.0	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	2.0	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	0.9	-	-	3.0	-	-	0.8	1.0	2.8	1.0
Arthropoda	Diptera	Chironomidae	Cladopelma	M	-	-	6.3	-	-	-	-	3.3	3.0	0.9	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	8.7	5.2	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	-	-	1.1	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	1.7	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptotendipes	M	-	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	1.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	1.7	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	15.7	25.0	12.6	2.6	1.0	1.8	1.8	9.2	7.0	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	0.9	2.6	3.2	1.7	10.9	7.1	1.8	4.2	1.0	7.5	21.6
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	1.1	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	0.9	-	-	4.5	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	0.9	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	2.6	4.3	4.2	3.4	9.9	2.7	0.9	1.7	1.0	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	0.9	-	-	-	1.8	-	6.7	-	-	2.9
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	1.1	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.9	0.9	-	-	-	-	2.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	0.9	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	1.0	1.8	0.9	-	2.0	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	1.0	-	15.7
Arthropoda	Diptera	Empididae	Chelifera	T	-	0.9	-	-	-	-	2.7	0.8	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Sciomyzidae	na	M	-	-	-	-	1.0	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	0.9	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	3.0	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	5.5	-	-	-	2.9
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	1.1	0.9	-	1.8	-	-	-	0.9	1.0
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	0.9	2.1	9.5	13.9	1.8	4.5	5.8	4.0	2.8	2.0
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	1.8	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	1.1	-	5.0	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Labiobaetis	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		0.9	0.9	-	-	-	0.9	-	1.7	-	4.7	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	27.6	-	-	-	-	17.0	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	13.0	12.1	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	0.9	-	-	-	-	3.0	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	1.7	-	0.9	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	3.4	-	-	1.0	0.9	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	2.0	0.9	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	10.0	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Odonata	Coenagrionidae	Argia	T	-	-	-	-	1.0	-	0.9	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	15.7	5.2	18.9	6.9	18.8	6.2	2.7	5.8	1.0	43.0	16.7
Arthropoda	Odonata	Coenagrionidae	Enallagma	T	-	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	3.6	-	1.0	-	-
Arthropoda	Odonata	Gomphidae	Hagenius	I	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	2.7	-	1.0	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	3.4	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	0.9	1.7	8.4	4.3	1.0	1.8	4.5	-	4.0	14.0	2.0
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	7.4	3.4	3.0	19.5	4.5	5.0	-	-	-
Arthropoda	Trichoptera	Brachycentridae	Brachycentrus	I	-	-	-	-	-	-	-	-	-	3.7	2.9
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	0.9	1.1	-	-	-	-	-	9.0	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	17.4	-	-	-	-	3.5	-	5.8	-	1.9	1.0
Arthropoda	Trichoptera	Leptoceridae	Ceraclea	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	-	6.9	-	-	1.0	-	3.6	1.7	-	-	1.0
Arthropoda	Trichoptera	Leptoceridae	Mystacides	M	4.3	10.3	7.4	-	8.9	12.4	-	10.8	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	0.8	-	-	2.0
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	1.1	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	0.9	-	0.8	-	-	2.0
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	3.4	7.4	1.7	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	2.6	-	6.0	-	-	2.7	0.8	1.0	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	0.9	-	1.7	7.9	4.4	12.7	3.3	6.0	1.9	2.0
Mollusca (Gastropoda)	na	na	na		-	-	-	0.9	-	-	-	-	-	-	-
Mollusca	Basommatophora	Lymnaeidae	Pseudosuccinea	M	-	-	-	-	-	-	-	-	1.0	-	-
Mollusca	Basommatophora	Physidae	Physa	T	0.9	-	-	-	-	-	0.9	0.8	-	-	-
Mollusca	Veneroida	Corbiculidae	Corbicula	M	-	-	-	-	1.0	-	4.5	-	1.0	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	0.9	1.1	-	-	-	-	-	4.0	-	-
Mollusca	Veneroida	Pisidiidae	na	M	0.9	3.4	6.3	3.4	2.0	5.3	3.6	7.5	4.0	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	2.8	-	-	4.0	-	-	6.1	-	2.3
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	0.7	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Tubificida	Tubificidae	na	T	-	-	0.9	0.9	-	-	-	-	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	-	-	3.3	-	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	3.0	-	-	-	-	-
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	0.9	-	-	8.3	-	-	0.8
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	0.8	-	2.6	0.9	-	-	1.7	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	0.9	1.7	-	1.0	0.7	1.7	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	1.5	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Microcylloepus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	6.4	7.8	11.9	1.0	0.7	1.7	0.9	3.8	0.8
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Procambarus	I	-	-	-	0.9	-	-	-	-	0.8	0.8
Arthropoda	Diptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	0.9	3.1	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-	0.8	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Apsectrotanypus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	2.1	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	1.6	-	-	-	-	0.7	-	1.8	-	1.5
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	0.9	2.6	-	2.0	0.7	-	5.3	0.8	1.5
Arthropoda	Diptera	Chironomidae	Cladopelma	M	-	1.8	-	0.9	-	11.3	5.0	1.8	-	36.1
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	-	-	-	1.8	-	0.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	0.8	3.0
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	1.5	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptotendipes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	0.9	-	-	-	0.7	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	-	1.5	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	0.9	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	0.9	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.8	-	2.6	1.8	3.0	0.7	1.7	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	11.9	13.9	5.5	3.0	21.3	3.3	3.5	20.8	9.8
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.8	-	-	-	1.0	0.7	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	19.1	24.8	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	5.5	13.9	1.8	3.0	-	0.8	0.9	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	7.4	-	-	6.0
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	4.4	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	2.6	-	1.0	-	-	0.9	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	1.4	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	0.9	1.8	-	-	-	0.9	0.8	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.8	8.3	13.9	11.0	4.0	-	2.5	2.6	1.5	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	3.7	-	-	-	0.7	1.7	0.9	-	-
Arthropoda	Diptera	Ephydridae	na		0.8	-	-	-	-	2.1	0.8	-	-	-
Arthropoda	Diptera	Sciomyzidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	2.8	1.0	-	-	0.9	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	0.7	-	-	16.2	0.8
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	0.9	0.8	1.5
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	0.9	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	0.9	2.6	-	-	2.1	0.8	1.8	0.8	3.0
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	1.6	-	0.9	4.6	3.0	-	2.5	2.6	23.1	1.5
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	0.9	-	0.9	-	0.7	-	-	1.5	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Baetidae	Labiobaetis	M	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	1.5	0.8
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	-	-	-	-	-	-	1.5	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	0.9	-	-	-	3.3	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	1.0	-	-	-	0.8	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	2.6	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	3.8
Arthropoda	Odonata	Coenagrionidae	Argia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	3.9	4.6	5.2	7.3	30.7	-	14.9	10.5	3.8	1.5
Arthropoda	Odonata	Coenagrionidae	Enallagma	T	-	-	-	-	-	-	-	-	5.4	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Odonata	Gomphidae	Hagenius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	4.7	6.4	1.7	18.3	13.9	2.1	4.1	20.2	-	3.0
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Brachycentridae	Brachycentrus	I	67.2	7.3	1.7	5.5	5.9	0.7	0.8	0.9	-	2.3
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	0.8	14.7	2.6	1.8	1.0	12.1	5.0	-	-	1.5
Arthropoda	Trichoptera	Leptoceridae	Ceraclea	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	13.0	6.4	3.0	2.8	-	10.5	-	1.5
Arthropoda	Trichoptera	Leptoceridae	Mystacides	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	1.8	1.0	-	-	-	2.3	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	0.9	4.0	-	0.8	-	0.8	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	1.0	-	-	0.9	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	11.7	7.3	0.9	3.7	2.0	5.0	-	2.6	-	1.5
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.8	-	-	1.8	-	-	-	1.8	-	3.8

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	3.9	8.3	-	-	3.0	-	2.5	-	1.5	0.8
Mollusca (Gastropoda)	na	na	na		-	0.9	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Lymnaeidae	Pseudosuccinea	M	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	1.0	-	-	-	-	-
Mollusca	Veneroida	Corbiculidae	Corbicula	M	-	1.8	-	-	-	0.7	-	0.9	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	-	4.4	1.5	3.8
Mollusca	Veneroida	Pisidiidae	na	M	-	0.9	0.9	-	-	6.4	-	1.8	-	2.3
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	0.9	-	0.8

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Millville Creek (NASS-108-S)

Site NASS-108-S is located on Millville Creek in the Coastal Plain – eastern shore region of Maryland. It is in the Nassawango Creek watershed in Worcester County. This site was sampled in 1997 and 2000 to 2020. The site was not sampled in summer 2010 to 2012.

Millville Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	82.35	86.46	85.49	86.01	86.30	86.28	86.97
Urban	2.61	2.61	2.61	2.61	2.61	2.61	2.61
Agriculture	8.32	8.30	8.29	8.29	8.29	8.29	8.29
Other	6.72	2.64	3.61	3.10	2.80	2.83	2.14

Water Chemistry

Water chemistry measurements collected at Millville Creek (1997, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = -0.081, p = 0.726	4.40	4.41	4.36	4.40	4.40	4.45	4.43	4.37	4.37	4.24	4.14	4.55	4.37
Specific Conductance (µS/cm)	R = -0.139, p = 0.546	51.5	63.1	80.5	122.3	60.0	65.4	46.5	72.4	49.6	153.9	146.4	51.4	99.6
Acid Neutralizing Capacity (µeq/L)	R = 0.087, p = 0.707	-64.6	-44.9	-54.8	-48.9	-42.9	-37.6	-48.0	-49.8	-46.8	-75.9	-104.1	-34.9	-57.1
Dissolved Organic Carbon (mg/L)	R = 0.073, p = 0.754	32.900	36.100	27.600	18.600	29.900	25.300	35.454	22.881	30.893	18.093	25.790	30.208	20.809
Chloride (mg/L)	R = -0.180, p = 0.448		7.79	10.33	21.56	8.63	9.21	5.25	9.36	5.93	14.15	21.60	7.15	12.74
Sulfate (mg/L)	R = -0.126, p = 0.587	3.99	3.40	5.48	11.12	5.10	2.68	2.35	7.75	2.31	29.36	14.55	2.46	19.32
Total Nitrogen (mg/L)	R = 0.079, p = 0.741		0.992	0.848	0.465	0.675	0.508	0.703	0.419	0.774	0.949	0.694	0.808	0.662
Nitrate-Nitrogen (mg/L)	**R = -0.586, p = 0.005**	0.3500	0.0820	0.1820	0.0320	0.0040	0.0270	0.0019*	0.0028	0.0231	0.2101	0.0374	0.0181	0.0029
Nitrite-Nitrogen (mg/L)	R = -0.040, p = 0.868		0.0098	0.0048	0.0054	0.0031	0.0058	0.0053	0.0027	0.0071	0.0029	0.0033	0.0066	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.406, p = 0.076		0.0719	0.0231	0.0131	0.0185	0.0323	0.0378	0.0186	0.0421	0.0189	0.0189	0.0376	0.0097
Total Phosphorus (mg/L)	R = -0.146, p = 0.539		0.0440	0.0270	0.0170	0.0320	0.0280	0.0317	0.0193	0.0369	0.0313	0.0238	0.0361	0.0217
Ortho-phosphate (mg/L)	R = -0.010, p = 0.967		0.0229	0.0040*	0.0007*	0.0114	0.0102	0.0135	0.0041	0.0222	0.0118	0.0083	0.0164	0.0067
Bromide (mg/L)	R = 0.660, p = 0.107													
Magnesium (mg/L)	**R = -0.863, p = 0.027**											1.543		
Calcium (mg/L)	**R = -0.857, p = 0.029**											3.629		
Copper (µg/L)	R = -0.706, p = 0.117													
Zinc (µg/L)	R = -0.585, p = 0.223													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	2018	2019	*2020*
pH	4.31	4.30	4.31	4.37	4.48	4.33	4.32	4.49	
Specific Conductance (µS/cm)	63.6	48.5	74.4	89.9	69.1	55.1	47.2	41.4	
Acid Neutralizing Capacity (µeq/L)	-76.0	-68.3	-63.3	-101.6	-45.3	-62.1	-59.4	44.1	
Dissolved Organic Carbon (mg/L)	39.048	23.310	27.235	28.479	31.941	33.294	31.671	29.797	
Chloride (mg/L)	9.06	4.88	12.98	10.34	13.43	8.94	6.53	5.39	Not sampled due to COVID-19 Pandemic
Sulfate (mg/L)	4.03	2.55	3.81	7.72	1.64	1.64	1.94	1.46	
Total Nitrogen (mg/L)	1.504	0.669	0.708	0.781	0.801	0.826	0.641	0.615	
Nitrate-Nitrogen (mg/L)	0.0159	0.0030	0.0019	0.0039	0.0030*	0.0062	0.0015*	0.0026*	
Nitrite-Nitrogen (mg/L)	0.0078	0.0045	0.0059	0.0040	0.0040*	0.0055	0.0052	0.0078	
Ammonia-Nitrogen (mg/L)	0.0385	0.0172	0.0142	0.0166	0.0172	0.0230	0.0160	0.0240	
Total Phosphorus (mg/L)	0.0624	0.0264	0.0159	0.0244	0.0272	0.0311	0.0146	0.0297	
Ortho-phosphate (mg/L)	0.0190	0.0121	0.0070	0.0100	0.0085	0.0120	0.0092	0.0121	
Bromide (mg/L)		0.0048	0.0095	0.0064	0.0166	0.0177	0.0083	0.0179*	
Magnesium (mg/L)			0.754	0.953	0.683	0.617	0.511	0.444	
Calcium (mg/L)			1.915	2.036	2.014	1.402	1.397	1.346	
Copper (µg/L)			2.598	0.808	0.605	0.686	0.552	0.627	
Zinc (µg/L)			9.624	17.594	13.914	11.610	6.581	7.695	

Physical Habitat

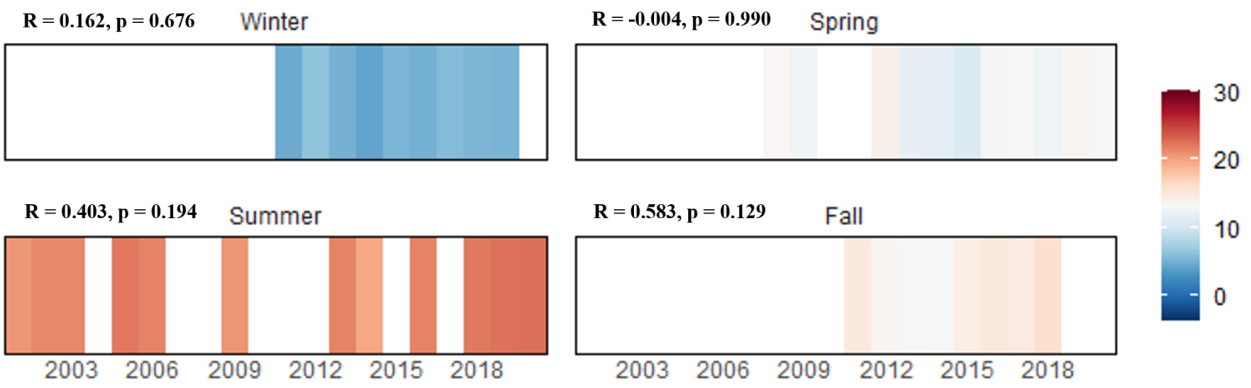
Physical habitat measurements collected at Millville Creek (1997, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.141, p = 0.565	17	17	6	12	11	12	7	15	1	11	14				16	10	12	7	15	14	11	6
Epifaunal substrate (0-20)	R = -0.023, p = 0.927	16	16	6	7	10	13	9	11	2	12	17				16	13	10	8	14	12	9	10
Velocity/Depth Diversity (0-20)	R = -0.085, p = 0.729	2	14	3	7	7	8	5	6	1	6	9	Not sampled in summer			7	8	7	8	8	3	4	6
Pool Quality (0-20)	R = -0.331, p = 0.166	18	14	7	11	15	13	7	15	2	13	15				12	11	11	6	9	12	11	8
Riffle Quality (0-20)	R = 0.130, p = 0.596	0	0	0	0	0	0	0	0	0	0	0				6	0	0	0	0	0	0	0
Shading (%)	R = -0.193, p = 0.429	80	99	93	92	90	90	95	98	95	98	90				95	90	97	85	95	85	95	75
Embeddedness (%)	-	100	100	100	100	100	100	100	100	100	100	100				100	100	100	100	100	100	100	100
Discharge (cfs)	R = -0.244, p = 0.299	0	0.92	0	0	0.57	0.71	0	0.17	0	0.05	0.07				0.24	0.06	0.24	0	0.43	0	0.2	0
Stream Area (m2)	R = -0.394, p = 0.105	234.4	894.4	28.0	179.4	525.0	431.3	75.0	243.8	na	365.6	253.1				251.3	228.8	296.3	99.6	156.0	276.0	156.4	36.3

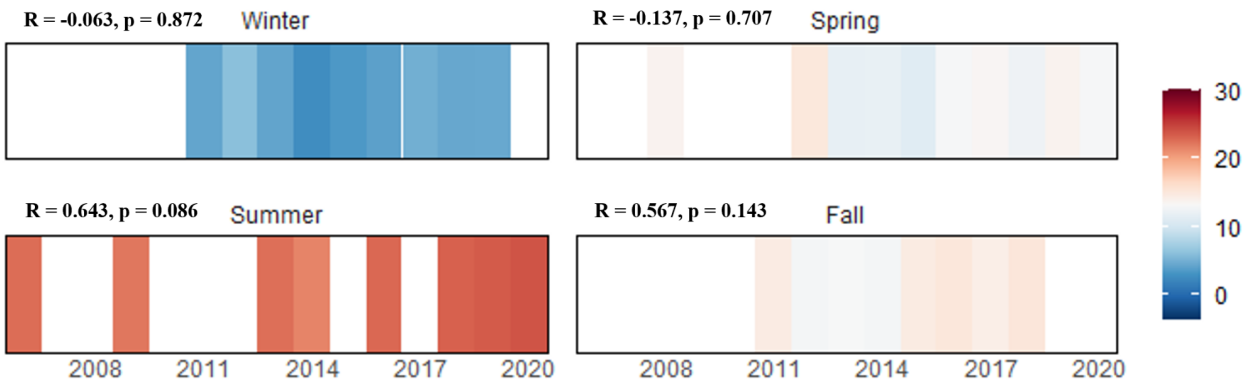
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Millville Creek (only calculated for summers missing no less than 2 weeks of data).

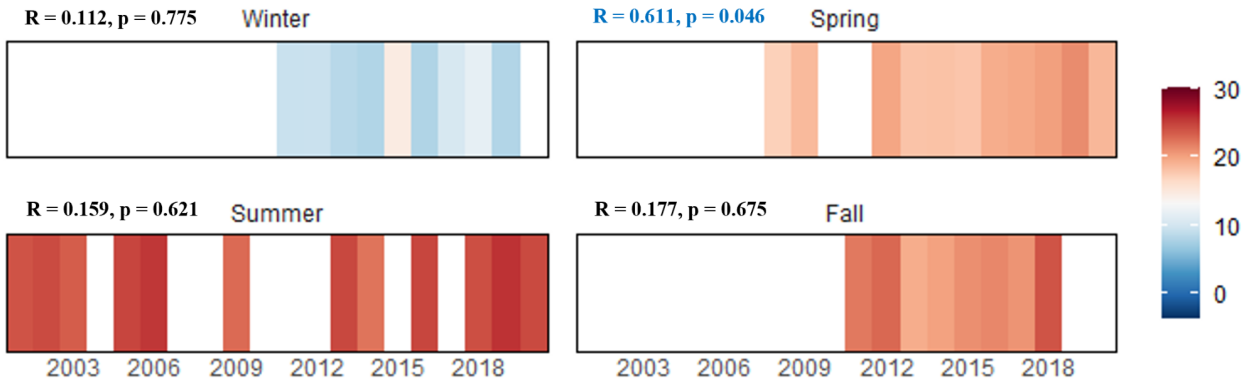
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.286, p = 0.368	-	62.3	65.7	76.7	-	82.5	75.5	-	-	62.7	-	-	-	73.3	40.7	-	74.9	-	82.0	84.7	86.8
% above 24°C	R = 0.386, p = 0.216	-	6.5	18.8	6.8	-	23.9	18.9	-	-	0.5	-	-	-	12.7	1.6	-	13.6	-	18.6	28.5	30.6



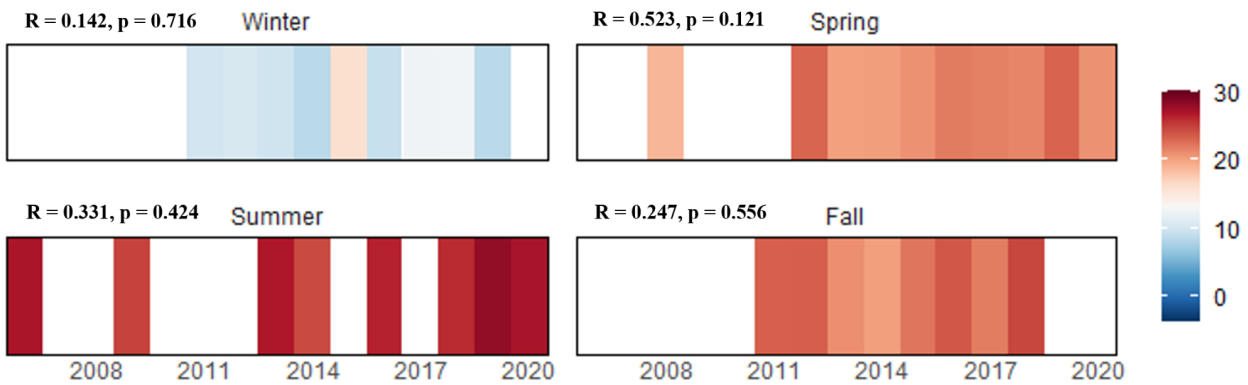
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Millville Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily air temperatures (℃) by season calculated using data collected annually at Millville Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Millville Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Millville Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.035, p = 0.878	2.43	2.14	2.43	1.00	1.57	1.86	2.43	1.57	1.86	2.14	1.57	1.29	2.14	2.71	2.43	2.14	2.43	1.86	1.86	1.86	1.57	1.86
# Taxa	R = 0.022, p = 0.923	14	10	15	6	11	12	15	10	14	11	13	12	14	15	19	11	17	11	10	10	12	10
# Ephemeroptera Taxa	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
# EPT Taxa	R = -0.357, p = 0.103	2	2	2	1	3	1	2	1	1	2	1	1	3	2	2	2	2	1	0	1	1	1
# Scraper Taxa	R = 0.053, p = 0.814	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
% Climbers	R = 0.334, p = 0.129	3.1	1.9	2.9	0.9	0	3.5	2.6	2.8	0.8	1.0	0.9	7.6	0	9.1	2.8	3.5	13.7	2.4	6.7	1.5	0	8.0
% Ephemeroptera	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Intolerant Urban Taxa	R = 0.320, p = 0.147	37.5	49.1	28.4	2.7	24.8	41.6	31.6	19.4	81.5	39.6	24.8	3.8	21.9	50.4	46.3	62.8	12.9	77.4	48.3	41.5	38.6	64.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.337, p = 0.172	2.33	2.00	2.00	2.00	1.67	2.00	2.00	2.00	na	1.67	1.67	na	na	na	2.33	2.67	2.00	2.00	2.00	2.33	2.67	2.00
Abundance per m2	R = -0.298, p = 0.230	2.04	0.22	36.57	1.13	0.42	0.52	31.17	0.28	na	0.13	0.14	na	na	na	0.97	0.6	0.05	4	0.53	0.71	1.92	1.54
# Benthic Sp. (Adjusted)	-	0	0	0	0	0	0	0	0	na	0	0	na	na	na	0	0	0	0	0	0	0	0
% Abundance of Dominant Species	R = -0.117, p = 0.644	77.2	69.0	98.1	89.6	75.7	86.6	93.4	80.9	na	87.2	69.4	na	na	na	83.6	68.6	60.0	91.7	74.4	77.0	83.7	91.1

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Generalists/ Omnivores/ Invertivores	R = -0.196, p = 0.435	92.1	77.2	99.2	92.1	81.2	96.4	98.2	85.3	na	95.7	77.8	na	na	na	91.0	82.5	40.0	98.7	81.7	86.7	88.7	92.9
% Round-bodied Suckers	-	0	0	0	0	0	0	0	0	na	0	0	na	na	na	0	0	0	0	0	0	0	0
% Tolerant	R = 0.224, p = 0.372	88.9	96.5	99.9	100	97.7	95.5	98.6	95.6	na	95.7	100	na	na	na	97.1	92.7	100	98.5	97.6	96.9	96.3	98.2

Fish

Cumulative list of fish species (with abundance) collected in Millville Creek by sampling year.

Species	*Tolerance*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	-	1	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-	-	-
Banded Sunfish	M	50	6	-	-	1	10	30	2	-	-	-				6	1	-	4	2	4	3	1
Bluespotted Sunfish	M	1	-	-	-	-	-	-	-	-	-	-				-	-	-	-	-	-	-	-
Eastern Mudminnow	T	370	136	1005	181	165	194	2184	55	-	41	25				204	94	4	365	61	151	251	51
Enneacanthus Sp.	M	-	-	-	-	-	-	-	-	-	1	-	Not sampled in summer due to lack of water			-	-	-	-	-	-	-	-
Mud Sunfish	M	2	-	1	-	4	-	3	1	-	1	-				1	9	-	-	-	2	8	-
Pirate Perch	T	18	9	10	5	7	12	79	-	-	3	3				11	9	2	22	4	13	4	-
Redfin Pickerel	T	38	45	8	16	41	8	42	10	-	1	8				22	24	9	5	15	26	34	4
Yellow Bullhead	M	-	-	-	-	-	-	-	-	-	-	-				-	-	-	2	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Millville Creek by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*
Devil crawfish (Lacunic*ambarus diogenes*)	N	N	N	D	N	N	N	D	N	N	N	N	N	D
Digger crayfish (*Fallicambarus fodiens*)	N	N	N	D	N	D	N	N	N	N	N	N	N	N
(*Procambarus sp.*)	D	N	N	D	N	N	N	D	D	D	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Millville Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Millville Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Fowler's toad, Gray treefrog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Wood frog
Squamata (Snakes and Lizards)	Common five-lined skink, Eastern fence lizard, Eastern wormsnake
Testudines (Turtles)	Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Millville Creek by sampling year, RA = % Relative Abundance.

					1997	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-	0.9	-
Annelida	Lumbriculida	Lumbriculidae	na	M	4.2	-	1.0	1.8	1.0	-	0.9	0.9	0.8	-	-	3.8
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	-	0.8	-	-	-
Annelida	Tubificida	Tubificidae	na	T	*1.0*	-	-	-	-	-	*0.9*	-	-	-	*0.9*	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	4.2	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	3.5	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	2.1	17.9	2.9	-	-	28.3	-	0.9	1.7	1.0	10.1	11.3
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	3.9	-	1.9	6.2	1.8	2.8	-	-	2.8	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	2.7	-	2.8	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Berosus	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Cymbiodyta	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	0.9	-	-	1.0	-	-
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	1.0	-	-	-	-	-	-	-	-	-	-	1.9
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	1.8	-	-	3.0	-	-
Arthropoda	Diptera	Chironomidae	Cantopelopia		-	-	-	-	-	-	-	-	-	-	-	1.9

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	2.1	-	1.0	-	17.1	-	-	-	-	-	1.8	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	2.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	3.9	-	4.8	-	0.9	-	-	-	1.8	1.9
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	4.2	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae B	M	-	14.2	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	1.8	-	4.6	-	10.9	-	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parachironomus	M	-	-	5.9	-	-	-	1.8	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	2.9	-	17.5	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	2.5	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	3.1	1.9	-	-	-	-	1.8	-	0.8	-	0.9	6.6
Arthropoda	Diptera	Chironomidae	Psectrocladius	M	1.0	9.4	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	1.0	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	1.0	2.7	-	7.1	3.5	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	0.9	5.9	9.8	2.9	-	-	9.3	-	42.6	2.8	-
Arthropoda	Diptera	Chironomidae	Zalutschia	M	-	-	43.1	82.1	22.9	15.9	12.3	62.0	2.5	-	12.8	65.1
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	2.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	2.0	-	7.6	-	36.8	-	0.8	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	17.7	-	20.6	-	-	0.9	-	5.6	1.7	3.0	5.5	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	0.9	-	-	-	-	-	-	-	2.0	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Isopoda	Asellidae	Caecidotea	I	19.8	47.2	2.0	-	1.0	30.1	12.3	8.3	79.0	17.8	16.5	2.8
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Odonata	Libellulidae	Libellula	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	2.0	-	18.1	4.4	-	2.8	-	16.8	-	0.9

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	39.6	3.8	-	-	18.1	-	1.8	-	-	-	41.3	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	2.1	-	-	-	1.0	-	0.9	-	0.8	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	2.9	0.9	-	-	-	-	-	1.0	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	0.9	-	-	1.0	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	*1.0*	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates continued

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	3.2	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	0.9	0.9	2.4	-	-	0.7	-	3.6
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	*1.0*	-	*0.9*	-	-	*0.8*	-	-	-	*4.3*
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	5.2	3.3	13.9	2.7	4.0	6.5	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	1.0	1.7	0.9	3.5	1.6	11.3	6.7	0.7	0.8	12.3

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporous	M	-	-	-	-	-	1.6	0.8	-	-	8.0
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	2.5	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Berosus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Cymbiodyta	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	0.8	-	0.9	0.8	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	2.5	1.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Cantopelopia		-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	9.4	0.8	1.9	0.9	3.2	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	0.7	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	1.7	-	-	1.6	5.6	1.7	1.5	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae B	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	4.0	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	8.3	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parachironomus	M	-	-	-	0.9	-	-	-	-	4.5	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	2.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	2.5	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	8.3	2.8	-	-	0.8	1.7	1.5	-	-
Arthropoda	Diptera	Chironomidae	Psectrocladius	M	-	-	-	-	-	5.6	28.3	3.0	-	2.9
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	15.7	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	0.8	-	0.8	2.2
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	4.2	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	0.8	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	2.1	-	0.9	-	-	-	-	-	1.5	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	6.3	17.4	1.9	-	43.5	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zalutschia	M	51.0	9.1	1.9	24.8	8.1	-	6.7	48.9	50.0	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	1.0	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	0.8	5.0	-	0.8	13.0
Arthropoda	Diptera	Simuliidae	Stegopterna	I	3.1	2.5	11.1	27.4	2.4	-	-	1.5	1.5	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	3.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	36.4	24.1	12.4	1.6	60.5	41.7	39.3	36.4	52.2
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Libellulidae	Libellula	T	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	15.6	7.4	1.9	11.5	6.5	4.8	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	1.7	1.9	8.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	-	0.8	0.7
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	1.9	3.5	-	-	-	1.5	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	2.7	12.9	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	*1.0*	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	*0.8*	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Nassawango Creek (NASS-302-S)

Site NASS-302-S is located on Nassawango Creek in the Coastal Plain – eastern shore region of Maryland. It is in the Nassawango Creek watershed in Worcester County. This site was sampled from 2001 to 2020. This site was not sampled in summer of 2004 or spring of 2010 due to high flows.

Nassawango Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	65.21	66.86	68.13	69.05	70.09	71.03	71.11
Urban	5.00	5.00	5.00	5.00	5.00	5.00	5.02
Agriculture	22.19	22.11	22.10	21.71	21.66	21.67	21.66
Other	7.60	6.03	4.77	4.24	3.25	2.29	2.21

Water Chemistry

Water chemistry measurements collected at Nassawango Creek (2001 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.069, p = 0.780	6.25	6.52	5.87	6.37	6.28	6.49	6.18	5.67	6.21	6.16	6.12
Specific Conductance (µS/cm)	R = -0.249, p = 0.304	78.2	97.3	50.0	74.0	60.9	75.9	60.0	147.0	82.9	54.7	94.0
Acid Neutralizing Capacity (µeq/L)	R = 0.143, p = 0.560	127.8	254.0	92.2	134.4	171.2	194.5	150.4	46.5	132.8	137.8	97.5
Dissolved Organic Carbon (mg/L)	R = 0.232, p = 0.340	12.200	10.700	19.300	12.600	22.542	9.359	19.490	11.030	15.126	19.921	12.428
Chloride (mg/L)	R = -0.066, p = 0.787	9.26	12.00	6.92	9.63	7.23	9.86	7.40	11.64	11.08	6.642	12.29
Sulfate (mg/L)	R = -0.204, p = 0.401	7.30	8.62	5.12	5.47	3.55	6.48	3.54	35.02	7.48	3.10	16.66
Total Nitrogen (mg/L)	R = 0.303, p = 0.207	0.598	0.389	0.726	0.561	0.659	0.246	0.870	0.937	0.640	0.825	0.716
Nitrate-Nitrogen (mg/L)	R = -0.404, p = 0.086	0.2520	0.0010*	0.1740	0.2140	0.1285	0.0883	0.0495	0.3511	0.0019*	0.1049	0.0846
Nitrite-Nitrogen (mg/L)	R = 0.162, p = 0.507	0.0004*	0.0022	0.0049	0.0044	0.0051	0.0033	0.0059	0.0019*	0.0032	0.0058	0.0032
Ammonia-Nitrogen (mg/L)	R = 0.033, p = 0.894	0.0087	0.0136	0.0224	0.0159	0.0253	0.0185	0.0225	0.0077	0.0125	0.0246	0.0071
Total Phosphorus (mg/L)	R = 0.134, p = 0.584	0.0310	0.0650	0.0450	0.0430	0.0809	0.0164	0.0913	0.0283	0.0411	0.0883	0.0388
Ortho-phosphate (mg/L)	R = 0.091, p = 0.710	0.0007*	0.0091	0.0123	0.0073	0.0150	0.0065	0.0163	0.0046	0.0081	0.0228	0.0070
Bromide (mg/L)	R = 0.472, p = 0.284											
Magnesium (mg/L)	R = -0.432, p = 0.393									1.437		
Calcium (mg/L)	R = -0.351, p = 0.495									3.252		
Copper (µg/L)	R = -0.613, p = 0.195											
Zinc (µg/L)	R = -0.347, p = 0.501											

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.24	5.86	6.30	6.30	6.25	6.37	6.34	6.33	
Specific Conductance (µS/cm)	67.4	44.9	66.2	75.7	70.5	62.1	55.6	62.3	
Acid Neutralizing Capacity (µeq/L)	138.5	64.1	128.4	226.2	190.8	192.3	128.0	223.7	
Dissolved Organic Carbon (mg/L)	16.842	15.574	10.828	18.962	17.620	18.636	16.291	15.952	
Chloride (mg/L)	10.08	5.82	9.41	9.97	11.05	9.27	7.74	8.26	Not sampled due to COVID-19 Pandemic
Sulfate (mg/L)	5.72	4.44	5.78	5.43	3.13	2.19	4.09	2.43	
Total Nitrogen (mg/L)	0.713	0.670	0.495	0.856	0.724	0.756	0.630	0.707	
Nitrate-Nitrogen (mg/L)	0.0012	0.0978	0.0225	0.0088	0.0030*	0.0037	0.0748	0.1597	
Nitrite-Nitrogen (mg/L)	0.0042	0.0039	0.0025	0.0043	0.0029*	0.0034	0.0031	0.0053	
Ammonia-Nitrogen (mg/L)	0.0138	0.0153	0.0105	0.0209	0.0145	0.0152	0.0116	0.0269	
Total Phosphorus (mg/L)	0.0455	0.0375	0.0252	0.0567	0.0585	0.0790	0.0282	0.0866	
Ortho-phosphate (mg/L)	0.0077	0.0088	0.0059	0.0078	0.0085	0.0114	0.0064	0.0143	
Bromide (mg/L)		0.0060	0.0142	0.0166	0.0217	0.0235	0.0096	0.0199	
Magnesium (mg/L)			1.227	1.842	1.381	1.377	1.182	1.229	
Calcium (mg/L)			2.889	4.116	3.458	2.960	3.099	2.982	
Copper (µg/L)			1.005	1.134	1.040	1.039	0.984	0.950	
Zinc (µg/L)			5.553	14.698	6.851	6.265	4.453	7.067	

Physical Habitat

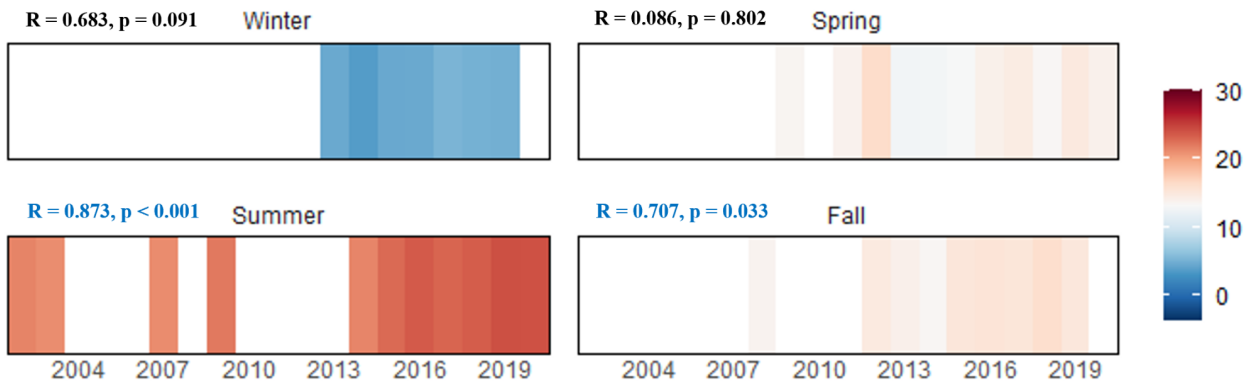
Physical habitat measurements collected at Nassawango Creek (2001 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = 0.054, p = 0.826	19	16	16		17	18	17	14	14	14	12	18	18	15	16	15	18	19	17	17
Epifaunal substrate (0-20)	R = 0.227, p = 0.351	18	14	13		12	12	16	15	14	16	12	15	17	14	16	17	11	19	15	16
Velocity/Depth Diversity (0-20)	R = -0.091, p = 0.710	8	10	8	Not sampled in summer (high flows)	9	10	6	8	7	9	6	6	9	9	7	9	6	7	9	10
Pool Quality (0-20)	R = -0.370, p = 0.119	19	17	17		18	19	17	17	18	18	16	19	18	19	16	18	15	16	17	17
Riffle Quality (0-20)	-	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Shading (%)	R = -0.349, p = 0.143	80	89	85		80	75	80	65	70	75	80	70	75	50	80	50	85	90	75	60
Embeddedness (%)	-	100	100	100		100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
Discharge (cfs)	R = -0.140, p = 0.556	8.91	0.87	12.88		23.77	2.74	0.31	0	1.01	0.11	0	0	1.35	0.45	2.4	1.47	15.71	6.65	1.08	5.04
Stream Area (m2)	R = 0.270, p = 0.263	631.9	461.3	680.6		881.3	605.6	442.5	545.6	483.8	450.0	504.4	528.8	688.1	556.9	650.6	611.3	828.8	729.8	692.3	654.4

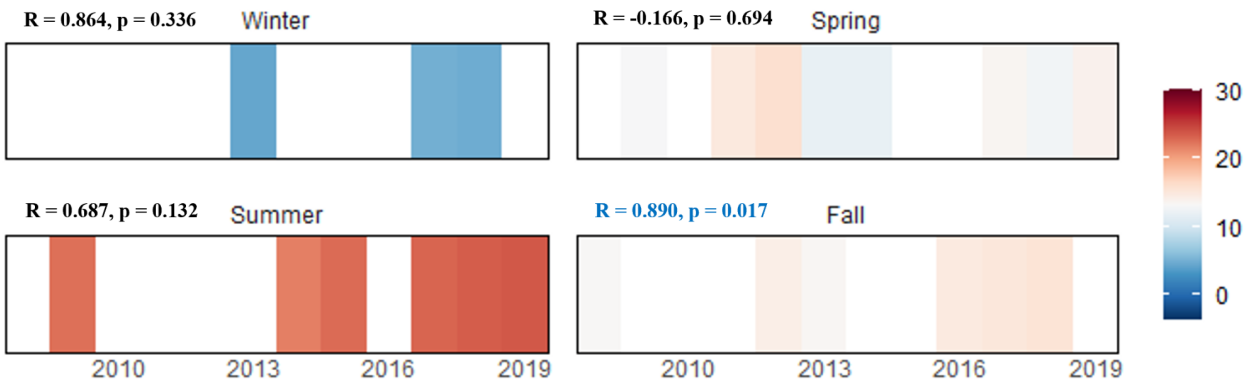
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Nassawango Creek (only calculated for summers missing no less than 2 weeks of data).

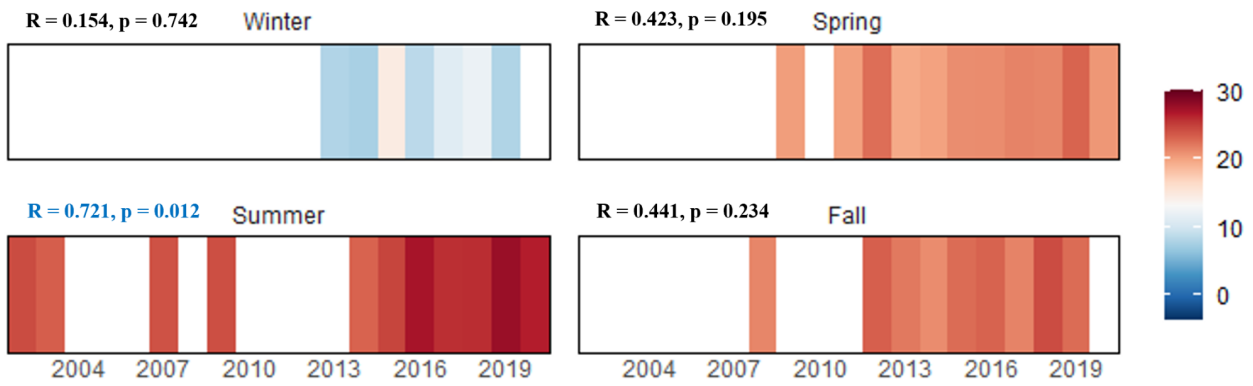
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.866, p = 0.001**	-	-	73.1	77.8	-	-	-	70.5	-	88.2	-	-	-	-	81.5	92.3	94.4	89.6	92.0	97.4	94.4
% above 24°C	**R = 0.840, p = 0.001**	-	-	16.9	1.8	-	-	-	10.3	-	14.0	-	-	-	-	6.5	30.1	46.0	43.8	51.1	57.9	57.3



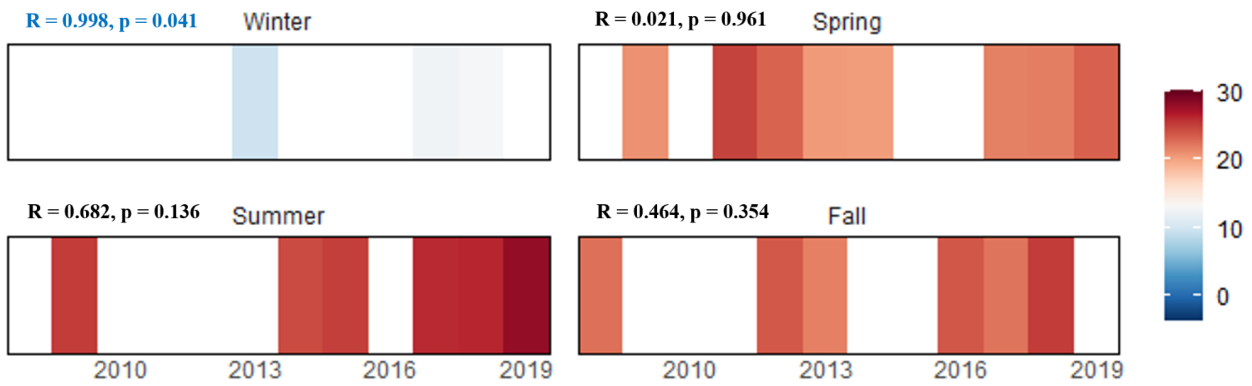
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Nassawango Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Nassawango Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Nassawango Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Nassawango Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.138, p = 0.573	3.57	5.00	4.43	3.57	4.14	5.00	4.43	1.86	4.43	na	3.57	3.86	4.14	4.71	5.00	4.43	4.43	4.43	4.14	4.14
# Taxa	**R = 0.596, p = 0.007**	12	23	20	20	16	28	23	15	25	na	23	24	30	22	31	27	29	27	22	25
# Ephemeroptera Taxa	R = 0.031, p = 0.900	2	2	4	1	2	2	3	0	3	na	1	1	1	3	2	2	3	3	3	1
# EPT Taxa	R = -0.141, p = 0.565	4	6	7	4	3	6	6	0	6	na	3	2	2	7	5	4	4	4	5	4
# Scraper Taxa	R = 0.305, p = 0.204	1	2	2	0	2	3	4	0	2	na	3	0	3	2	4	2	3	2	3	2
% Climbers	R = 0.390, p = 0.099	6.6	16.2	16.4	10.7	25.8	22.2	23.6	0	12.6	na	20.2	10.1	11.4	7.1	17.6	33.3	28.0	17.7	59.0	13.8
% Ephemeroptera	R = -0.417, p = 0.076	50.9	36.2	19.7	38.1	5.6	24.1	10.4	0	6.8	na	1.0	12.8	4.8	47.3	33.3	15.6	5.6	17.7	3.3	0.9
% Intolerant Urban Taxa	R = -0.122, p = 0.618	56.6	30.5	19.7	45.2	41.6	29.6	10.4	39.2	15.5	na	3.9	28.4	49.5	70.5	46.3	18.8	29.0	24.5	9.0	38.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.152, p = 0.534	4.67	4.67	4.67	na	4.33	4.33	4.67	4.67	4.67	4.33	4.33	3.33	5.00	5.00	4.67	4.67	4.00	5.00	4.33	4.00
Abundance per m2	R = 0.014, p = 0.953	0.5	0.87	0.51	na	0.25	0.52	1.19	0.5	0.76	1.08	0.32	0.21	0.96	0.86	0.76	0.57	0.3	0.76	0.92	0.38
# Benthic Sp. (Adjusted)	R = 0.289, p = 0.231	0.51	1.02	0.51	na	0.25	1.02	1.02	1.02	1.02	0.51	0.51	0.76	0.51	0.76	1.02	1.02	0.76	1.02	1.02	0.76
% Abundance of Dominant Species	R = 0.003, p = 0.989	36.7	21.8	27.9	na	30.9	21.3	25.0	18.8	24.6	42.7	24.4	32.1	21.3	23.6	29.2	22.3	22.3	21.6	42.1	28.1
% Generalists/ Omnivores/ Invertivores	R = 0.101, p = 0.681	89.3	95.3	85.5	na	85.2	95.5	95.6	90.4	84.7	94.3	89.4	97.3	89.1	84.3	96.2	85.7	95.2	89.5	91.8	93.5
% Round-bodied Suckers	R = 0.188, p = 0.440	5.0	4.5	10.2	na	8.5	7.6	4.4	8.5	10.7	20.5	10.6	0	10.8	11.3	6.7	5.7	19.1	5.6	7.9	9.8

Metric	*Pearson's Correlation Coefficients*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Tolerant	R = 0.113, p = 0.644	63.6	63.5	54.7	na	63.2	48.1	47.9	54.8	69.1	65.5	45.6	62.5	67.5	60.5	60.1	58.0	56.2	58.9	69.5	57.3

Fish

Cumulative list of fish species (with abundance) collected in Nassawango Creek by sampling year. Fish were not sampled during 2004 due to high flow conditions.

Species	*Tolerance*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	31	58	52		18	37	102	41	27	25	39	17	86	44	88	59	38	71	41	24
Banded Sunfish	M	11	7	35		34	35	21	2	1	15	3	1	11	9	-	11	4	40	9	1
Black Crappie	M	-	-	1	Not sampled in summer (high flows)	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-
Bluegill	T	1	8	3		-	-	-	5	1	3	20	3	16	4	2	5	8	12	16	12
Bluespotted Sunfish	M	17	12	4		3	25	17	6	9	3	5	9	3	17	11	4	4	19	43	24
Brown Bullhead	T	-	2	1		4	12	11	8	7	16	3	4	15	9	6	1	4	3	2	2
Chain Pickerel	M	17	6	10		1	9	5	5	4	5	11	1	16	4	3	3	2	1	1	1
Creek Chubsucker	M	16	18	35		19	24	23	23	39	100	17	-	71	54	33	20	48	31	50	24
Eastern Mosquitofish	M	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4
Eastern Mudminnow	T	25	60	9		18	8	10	9	29	7	17	36	92	20	33	5	-	8	5	6
Golden Shiner	T	117	88	96		69	67	132	51	60	208	9	5	98	59	144	78	56	113	268	69
Green Sunfish	T	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	4
Largemouth Bass	T	-	-	1		-	-	-	-	1	-	-	-	-	-	3	-	2	-	-	-
Least Brook Lamprey	M	-	1	5		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Longnose Gar	M	-	-	-		-	-	-	1	-	-	-	-	-	-	-	-	-	3	-	-

Species	*Tolerance*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Margined Madtom	I	-	1	1		1	1	20	5	6	-	-	-	-	-	2	1	2	5	8	2
Mud Sunfish	M	-	-	-		-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Pirate Perch	T	35	68	35		9	46	59	49	90	33	11	18	140	113	83	52	37	119	84	23
Pumpkinseed	T	7	14	9		9	12	18	3	12	29	7	1	27	4	11	12	24	10	14	10
Redbreast Sunfish	M	1	1	6		1	-	-	-	3	-	-	-	2	-	2	1	2	1	-	-
Redfin Pickerel	T	17	12	34		32	5	18	20	51	23	6	2	56	71	13	47	8	54	51	15
Swamp Darter	I	-	-	-		-	1	19	11	11	5	1	2	2	4	6	15	-	4	3	6
Tadpole Madtom	M	7	9	-		-	17	24	8	2	8	10	3	19	51	47	28	8	37	21	11
Tessellated Darter	T	1	4	-		-	1	5	4	2	-	-	1	-	9	2	3	2	6	1	-
White Crappie	M	-	-	-		-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Bullhead	M	1	1	-		1	5	7	4	3	6	1	6	-	6	3	2	1	9	4	6
Yellow Perch	M	15	33	7		4	9	36	17	8	-	-	-	4	-	2	3	-	6	14	2

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Nassawango Creek by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Faxonius limosus	D	D	N	D	D	N	N	N	N	N	N	N	N	N	D
Procambarus acutus	D	D	N	N	N	N	N	N	D	N	N	N	N	N	N

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Procambarus sp.	N	N	D	D	D	D	D	D	D	D	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Nassawango Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Nassawango Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	Atlantic Coast leopard frog, American bullfrog, Eastern American toad, Fowler's toad, Cope's Gray treefrog, Gray treefrog, New Jersey chorus frog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog
Squamata (Snakes and Lizards)	Common five-lined skink, Northern black racer, Northern Brownsnake, Northern watersnake
Testudines (Turtles)	Eastern box turtle, Eastern snapping turtle, Stinkpot

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Nassawango Creek by sampling year, RA = % Relative Abundance.

					2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Annelida	Haplotaxida	Enchytraeidae	na	T	3.8	-	-	-	-	-	-	9.8	-	
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	
Annelida	Lumbriculida	Lumbriculidae	na	M	12.3	-	-	-	1.1	-	2.8	-	-	
Annelida	Tubificida	Tubificidae	na	T	7.5	-	0.8	-	-	-	-	-	-	
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	6.6	1.0	-	3.6	-	2.8	-	3.9	3.9	
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	2.4	-	-	-	-	-	
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	-	-	-	-	1.9	5.7	-	-	
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	1.9	
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	1.0	-	6.0	1.1	10.2	0.9	-	-	Not sampled in spring (high flows)
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	0.9	-	-	-	
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	3.8	-	-	-	2.8	-	-	-	
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	

					2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Coleoptera	Scirtidae	na	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	0.9	-	-	-	
Arthropoda	Decapoda	Palaemonidae	Palaemonetes	T	-	-	-	1.2	-	6.5	-	-	1.0	
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	0.9	-	-	-	
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	0.8	-	-	-	-	33.3	-	
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	5.7	1.6	-	10.1	0.9	32.1	-	-	
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	1.1	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	2.4	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	2.0	-	
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	5.8	
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Larsia	T	-	5.7	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Limnophyes	T	0.9	-	-	-	-	-	-	-	2.9	
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	13.5	0.9	-	-	-	
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	8.6	-	-	-	-	-	-	-	

					2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	1.6	-	2.2	-	-	2.9	-	
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	7.4	4.8	-	8.3	1.9	-	4.9	
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	4.6	-	-	1.0	
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	2.5	-	-	0.9	-	2.0	-	
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	1.2	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	1.0	0.8	1.2	-	-	-	-	5.8	
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	0.8	-	-	-	0.9	-	1.0	
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Procladius	I	0.9	-	-	-	-	-	-	-	2.9	
Arthropoda	Diptera	Chironomidae	Psectrocladius	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Pseudosmittia	M	-	-	-	-	-	-	2.8	-	-	
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	4.1	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	1.9	-	-	7.9	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	1.9	
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	12.4	1.6	-	-	-	-	-	22.3	
Arthropoda	Diptera	Chironomidae	Tanypus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	1.1	0.9	-	-	-	

					2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	4.8	13.9	-	10.1	-	3.8	-	6.8	
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	0.9	-	-	
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	4.9	13.1	11.2	-	3.8	-	5.8	
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	1.0	-	1.2	-	1.9	3.8	-	-	
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Unniella	M	-	6.7	-	-	-	13.9	-	-	5.8	
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Chironomidae	Zalutschia	M	-	-	-	1.2	-	1.9	-	-	-	
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	1.9	-	-	3.6	-	0.9	-	-	-	
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	1.1	-	-	-	-	
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	-	-	1.0	-	
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	-	-	-	-	5.9	-	
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	28.7	-	-	-	-	-	-	
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	2.0	1.9	
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	

					2001	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Diptera	Tipulidae	Limonia	M	-	-	-	-	1.1	-	-	-	-	
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	1.2	-	0.9	-	-	-	
Arthropoda	Ephemeroptera	Baetidae	Pseudocloeon	M	-	-	-	-	-	-	-	-	-	
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	0.9	-	-	1.0	
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	3.8	6.7	0.8	-	2.2	-	2.8	-	-	
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	1.0	
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	4.1	-	3.4	-	6.6	-	-	
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	47.2	-	1.6	38.1	-	22.2	-	-	-	
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	29.5	13.1	-	-	0.9	0.9	-	4.9	
Arthropoda	Hemiptera	Nepidae	na		-	-	-	-	-	-	0.9	-	-	
Arthropoda	Hemiptera	Notonectidae	Notonecta	T	-	-	-	-	-	0.9	-	-	-	
Arthropoda	Isopoda	Asellidae	Caecidotea	I	8.5	-	4.9	4.8	28.1	1.9	7.5	31.4	2.9	
Arthropoda	Isopoda	Asellidae	Lirceus	M	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Odonata	Aeshnidae	Nasiaeschna	T	-	-	-	1.2	-	-	-	-	-	
Arthropoda	Odonata	Coenagrionidae	Argia	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Odonata	Coenagrionidae	na	T	-	1.9	-	-	-	-	-	-	-	

PHYLUM	ORDER	FAMILY	GENUS	TOL	*2001* RA	*2002* RA	*2003* RA	*2004* RA	*2005* RA	*2006* RA	*2007* RA	*2008* RA	*2009* RA	*2010* RA
Arthropoda	Odonata	Coenagrionidae	Ischnura	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	-	-	-	-	-	1.0	
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	-	-	-	-	-	1.9	-	-	
Arthropoda	Odonata	Libellulidae	Erythemis	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Odonata	Libellulidae	Libellula	T	-	-	-	-	-	-	-	-	-	
Arthropoda	Odonata	Libellulidae	na	T	-	-	-	-	-	-	-	1.0	-	
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	4.8	-	-	-	-	6.8	
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	-	-	-	-	-	-	-	-	-	
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	0.8	-	-	-	-	-	-	
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	1.0	-	-	-	-	-	-	-	
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	1.0	-	-	-	4.6	1.9	-	-	
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	2.5	-	-	-	-	-	1.9	
Arthropoda	Trichoptera	Limnephilidae	na	M	-	1.0	-	-	-	1.9	-	-	1.9	
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	-	-	-	1.2	-	-	-	-	-	
Arthropoda	Trichoptera	Limnephilidae	Platycentropus	M	-	-	-	-	-	-	0.9	-	-	
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	5.7	-	1.6	2.4	-	-	0.9	-	1.0	
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	0.9	-	-	-	1.1	-	-	-	-	
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	0.9	-	-	-	

PHYLUM	ORDER	FAMILY	GENUS	TOL	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	1.0	-	-	-	0.9	-	-	-	
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	-	-	-	-	-	-	7.5	-	1.0	
Mollusca	Architaenioglossa	Viviparidae	Viviparus	I	-	-	-	-	-	-	-	-	-	
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	0.9	-	-	-	
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	-	-	-	1.0	
Mollusca	Mesogastropoda	Hydrobiidae	na	T	-	-	-	-	-	-	6.6	-	-	
Mollusca	Neotaenioglossa	Hydrobiidae	Amnicola	T	-	-	-	-	-	-	-	-	-	
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	4.8	3.4	-	1.9	-	-	
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	0.9	-	-	-	
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	0.8	-	-	-	-	-	-	
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	3.8	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	0.9

PHYLUM	ORDER	FAMILY	GENUS	TOL	*2011* RA	*2012* RA	*2013* RA	*2014* RA	*2015* RA	*2016* RA	*2017* RA	*2018* RA	*2019* RA	*2020* RA
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	1.0	-	-	-	0.9	7.8	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	1.6	12.8
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	2.8	9.5	0.9	3.7	1.0	-	7.8	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	0.9	-	1.9	-	-	0.9
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	2.9	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	3.7	1.0	0.9	3.7	-	0.9	1.0	5.7	1.8
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	14.4	3.7	4.8	-	1.9	18.8	-	-	0.8	6.4
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	1.0	-	1.0	-	2.8	1.0	-	-	1.6	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	1.8	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Scirtidae	na	M	-	-	1.9	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Palaemonidae	Palaemonetes	T	-	-	-	-	2.8	1.0	2.8	2.9	1.6	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	2.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	1.9	0.9	-	1.8	-	-	5.6	3.9	2.5	0.9
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Chironomini	M	1.9	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	3.1	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	1.0	-	-	5.2	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	3.1	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	1.9	6.4	2.9	-	-	-	1.9	-	1.6	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	1.0	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	1.9	3.9	2.5	-
Arthropoda	Diptera	Chironomidae	Larsia	T	2.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	0.9	1.0	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	1.0	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	1.0	0.9	1.0	0.8	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	1.0	-	0.9	-	-	-	-	4.6
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	2.9	-	-	-	3.7	-	-	-	-	3.7
Arthropoda	Diptera	Chironomidae	Orthocladius	T	51.0	12.8	1.0	-	6.5	2.1	0.9	1.0	-	0.9
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	1.0	-	-	-	0.9	5.2	8.4	-	-	20.2
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	1.0	1.8	1.9	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	1.0	-	1.9	-	-	-	-	6.9	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	0.9	-	-	-	-	-	1.0	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	2.1	1.9	2.9	0.8	4.6
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	5.5	-	-	0.9	-	3.7	3.9	-	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	0.9	6.3	0.9	-	2.5	3.7
Arthropoda	Diptera	Chironomidae	Psectrocladius	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	0.9	1.0	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	0.9	-	2.1	4.7	2.0	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	1.0	-	1.0	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	2.7	-	1.0	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	1.0	0.9	1.9	-	1.9	2.1	2.8	-	1.6	0.9
Arthropoda	Diptera	Chironomidae	Tanypus	M	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	3.7	-	3.3	1.8
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	1.0	-	-	0.9	-	10.4	19.6	12.7	51.6	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	1.8	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	1.0	1.8	1.9	1.0	9.3	4.9	5.7	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	1.9	6.3	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	11.9	5.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Unniella	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Zalutschia	M	-	0.9	-	-	2.8	-	-	1.0	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	*2011* RA	*2012* RA	*2013* RA	*2014* RA	*2015* RA	*2016* RA	*2017* RA	*2018* RA	*2019* RA	*2020* RA
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	0.9	-	3.1	-	1.0	-	-
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	1.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	1.8	3.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	10.1	3.8	-	-	2.1	0.9	5.9	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	9.2	7.6	20.5	0.9	-	-	2.9	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	1.0	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.0	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Tipulidae	Limonia	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	1.0	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Pseudocloeon	M	-	-	-	-	-	14.6	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	0.9	-	-	1.0	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	2.7	-	-	0.9	1.0	1.6	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	1.0	1.9	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	*2011* RA	*2012* RA	*2013* RA	*2014* RA	*2015* RA	*2016* RA	*2017* RA	*2018* RA	*2019* RA	*2020* RA
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	4.8	43.8	31.5	-	2.8	5.9	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	1.0	12.8	-	0.9	0.9	-	-	9.8	0.8	0.9
Arthropoda	Hemiptera	Nepidae	na		-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Notonectidae	Notonecta	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	4.6	26.7	2.7	6.5	5.2	10.3	3.9	4.1	11.0
Arthropoda	Isopoda	Asellidae	Lirceus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Nasiaeschna	T	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	Argia	T	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	0.9	-	0.8	-
Arthropoda	Odonata	Coenagrionidae	Ischnura	T	-	1.8	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Libellulidae	Erythemis	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Libellulidae	Libellula	T	-	-	-	-	0.9	-	-	-	-	5.5
Arthropoda	Odonata	Libellulidae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlidae	na	I	-	-	2.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	0.9	-	1.8	-	-	-	-	-	2.8
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	-	-	-	-	0.9	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	*2011* RA	*2012* RA	*2013* RA	*2014* RA	*2015* RA	*2016* RA	*2017* RA	*2018* RA	*2019* RA	*2020* RA
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	3.6	5.6	-	0.9	1.0	2.5	0.9
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Platycentropus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	1.8	-	-	-	-	1.6	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	1.0	-	-	-	-	-	-	-	-	-
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	-	-	-	-	-	2.1	0.9	-	-	2.8
Mollusca	Architaenioglossa	Viviparidae	Viviparus	I	-	-	-	-	-	-	1.9	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	1.9	0.9	1.9	-	-	-	-	-
Mollusca	Mesogastropoda	Hydrobiidae	na	T	1.0	-	-	-	2.8	-	-	-	-	-
Mollusca	Neotaenioglossa	Hydrobiidae	Amnicola	T	-	-	-	-	-	-	-	-	-	1.8
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	0.9	0.9	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	1.9	1.0	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	1.8
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	2.9	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	ORDER	FAMILY	GENUS	TOL	RA	RA	RA	RA	RA	RA	RA	RA	RA	RA
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	0.9	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Skeleton Creek (UPCK-113-S)

Site UPCK-113-S is located on an unnamed tributary to Skeleton Creek in the Coastal Plain – eastern shore region of Maryland. It is in the Upper Choptank River watershed in Caroline County. This site was sampled in 1996 and from 2000 to 2020. The site was not sampled in summer 2005 due to lack of access to the site.

Skeleton Creek in the spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	60.61	60.90	60.71	60.61	60.66	60.66	60.71
Urban	4.81	4.81	4.81	4.81	4.81	4.81	4.81
Agriculture	34.20	34.20	34.20	34.20	34.20	34.20	34.20
Other	0.38	0.09	0.28	0.38	0.33	0.33	0.28

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Skeleton Creek (1996, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.292, p = 0.188	5.95	5.53	6.12	6.84	6.10	6.31	6.37	6.27	6.39	6.20	6.36	6.15	6.02
Specific Conductance (µS/cm)	R = -0.216, p = 0.335	99.0	61.2	92.3	191.3	80.0	104.3	102.3	93.9	84.2	121.1	125.9	70.7	75.6
Acid Neutralizing Capacity (µeq/L)	R = 0.053, p = 0.813	100.3	94.1	163.7	768.9	164.4	198.6	311.0	236.5	231.2	206.7	238.9	167	122.6
Dissolved Organic Carbon (mg/L)	R = 0.261, p = 0.240	15.900	28.600	17.400	3.500	21.200	14.900	22.474	27.979	19.629	15.894	16.757	32.219	26.147
Chloride (mg/L)	R = -0.177, p = 0.442		5.55	9.42	15.82	9.37	11.43	9.69	9.00	8.41	10.12	12.65	7.48	6.72
Sulfate (mg/L)	R = -0.239, p = 0.284	15.90	6.41	10.98	24.11	10.97	12.08	11.34	11.60	9.42	23.71	19.69	6.25	13.21
Total Nitrogen (mg/L)	R = 0.190, p = 0.409		1.335	0.798	0.609	0.734	0.849	0.711	1.257	1.015	0.761	0.979	1.609	1.275
Nitrate-Nitrogen (mg/L)	**R = -0.645, p = 0.001**	0.6000	0.1170	0.3030	0.3610	0.1090	0.2540	0.2285	0.0826	0.1041	0.1021	0.0824	0.1092	0.1604
Nitrite-Nitrogen (mg/L)	R = 0.337, p = 0.135		0*	0.0066	0.0084	0.0043	0.0060	0.0059	0.0085	0.0077	0.0042	0.0045	0.0100	0.0079
Ammonia-Nitrogen (mg/L)	R = -0.044, p = 0.850		0.0973	0.0574	0.0613	0.0422	0.2514	0.0786	0.1505	0.0828	0.0548	0.0168	0.2107	0.0361
Total Phosphorus (mg/L)	R = 0.028, p = 0.903		0.1210	0.0530	0.0500	0.0700	0.0460	0.0971	0.1565	0.1199	0.0581	0.0919	0.1572	0.0876
Ortho-phosphate (mg/L)	R = -0.221, p = 0.335		0.0662	0.0183	0.0106	0.0254	0.0137	0.0199	0.0263	0.0146	0.0158	0.0100	0.0393	0.0227
Bromide (mg/L)	R = 0.653, p = 0.112													
Magnesium (mg/L)	R = -0.368, p = 0.472													
Calcium (mg/L)	R = 0.474, p = 0.342													
Copper (µg/L)	R = -0.646, p = 0.166													
Zinc (µg/L)	R = -0.722, p = 0.105													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.39	6.14	6.20	6.40	6.28	6.19	6.18	6.59	
Specific Conductance (µS/cm)	92.1	67.6	84.9	99.7	92.1	80.8	81.2	101.0	
Acid Neutralizing Capacity (µeq/L)	287.7	140.9	134.6	312.3	195.7	252.4	176.7	439.1	
Dissolved Organic Carbon (mg/L)	22.162	17.253	15.382	20.598	22.137	32.371	24.438	17.059	
Chloride (mg/L)	10.19	7.90	9.40	10.02	10.35	8.12	9.27	8.13	Not sampled due to COVID-19 Pandemic
Sulfate (mg/L)	9.52	8.96	12.22	11.46	12.75	7.10	9.50	11.43	
Total Nitrogen (mg/L)	1.326	0.943	0.799	1.138	0.809	1.463	0.934	0.830	
Nitrate-Nitrogen (mg/L)	0.1260	0.1410	0.1040	0.1147	0.0635	0.1416	0.1053	0.0998	
Nitrite-Nitrogen (mg/L)	0.0100	0.0069	0.0057	0.0059	0.0047	0.0117	0.0061	0.0071	
Ammonia-Nitrogen (mg/L)	0.1434	0.0819	0.0413	0.1162	0.0211	0.1623	0.0353	0.1116	
Total Phosphorus (mg/L)	0.1187	0.0512	0.0396	0.0988	0.0545	0.1465	0.0620	0.0879	
Ortho-phosphate (mg/L)	0.0176	0.0128	0.0115	0.0215	0.0118	0.0425	0.0161	0.0163	
Bromide (mg/L)		0.0143	0.0176	0.0224	0.0160	0.0245	0.0167	0.0306	
Magnesium (mg/L)			2.236	2.511	2.516	2.131	2.158	2.291	
Calcium (mg/L)			5.440	8.256	6.889	7.205	5.851	9.502	
Copper (µg/L)			3.058	1.560	1.701	2.221	1.931	1.137	
Zinc (µg/L)			16.256	23.667	16.545	14.986	14.500	10.293	

Physical Habitat

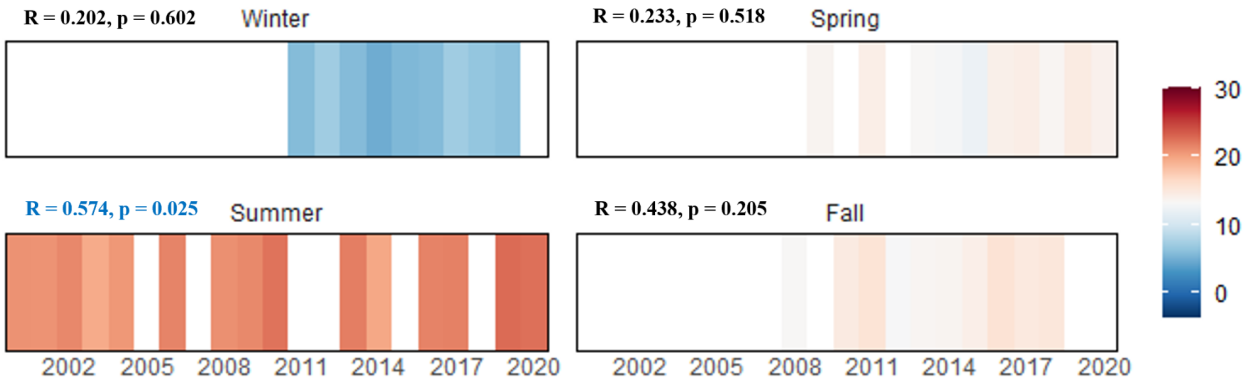
Physical habitat measurements collected at the unnamed tributary to Skeleton Creek (1996, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.036, p = 0.877	12	17	11	13	11	12		16	14	8	11	17	10	17	16	16	13	11	12	14	10	12
Epifaunal substrate (0-20)	R = 0.028, p = 0.903	10	17	9	13	11	11	Not sampled in summer (lack of access to the site)	11	10	10	13	14	10	15	15	14	13	13	11	6	12	13
Velocity/Depth Diversity (0-20)	R = -0.415, p = 0.061	4	14	10	8	13	10		10	7	7	8	13	7	6	9	9	9	5	5	7	6	5
Pool Quality (0-20)	R = -0.128, p = 0.580	8	14	12	12	14	13		14	12	12	13	17	11	10	18	16	9	9	10	11	11	10
Riffle Quality (0-20)	R = -0.081, p = 0.728	2	7	8	7	8	9		3	6	6	7	10	3	6	8	3	8	3	6	5	5	7
Shading (%)	**R = -0.485, p = 0.026**	80	96	97	96	95	95		98	85	95	85	90	85	90	90	75	75	98	87	85	75	80
Embeddedness (%)	R = 0.031, p = 0.894	85	40	40	15	50	65		40	30	70	45	75	30	80	75	70	100	80	45	55	20	25
Discharge (cfs)	R = -0.367, p = 0.102	0.13	1	0.04	0.02	0.04	0.04		0.06	0	0.04	0.05	0.03	0.02	0.02	0.17	0.07	0	0	0.01	0.05	0.03	0.01
Stream Area (m2)	**R = -0.446, p = 0.043**	185.6	189.4	161.3	191.3	200.6	181.9		144.4	187.5	204.4	202.5	148.1	120.0	125.6	166.9	131.3	138.8	142.5	155.6	180.0	174.8	157.5

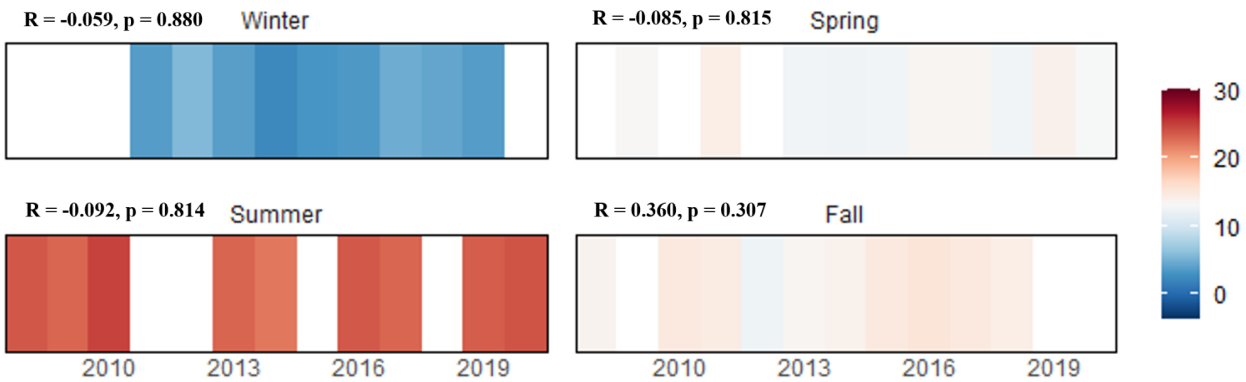
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Skeleton Creek (only calculated for summers missing no less than 2 weeks of data).

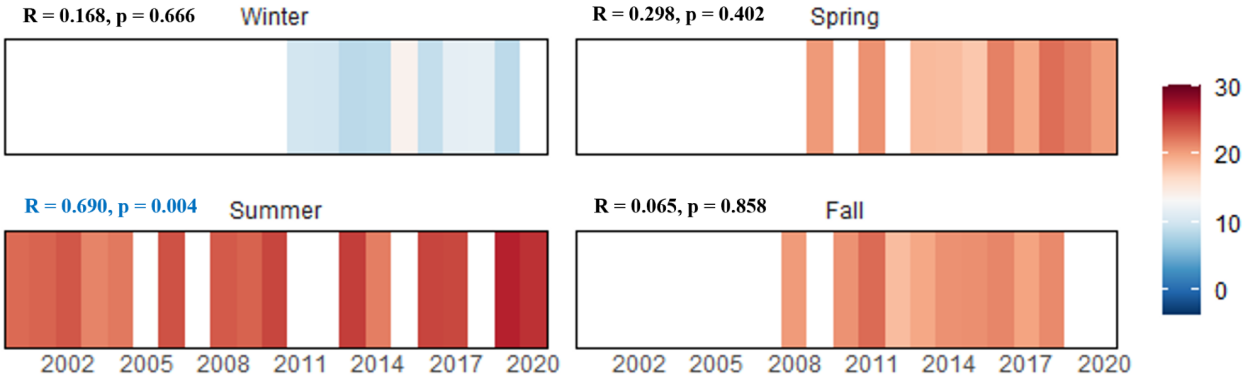
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.274, p = 0.322	67.6	69.7	72.6	49.7	67.3	-	76.7	-	72.8	78.5	89.0	-	-	76.5	34.0	-	75.0	81.7	-	82.7	82.0
% above 24°C	**R = 0.697, p = 0.004**	4.2	0.3	6.2	0.4	0.6	-	13.4	-	3.6	4.6	21.3	-	-	18.1	0.6	-	11.2	9.7	-	33.7	30.5



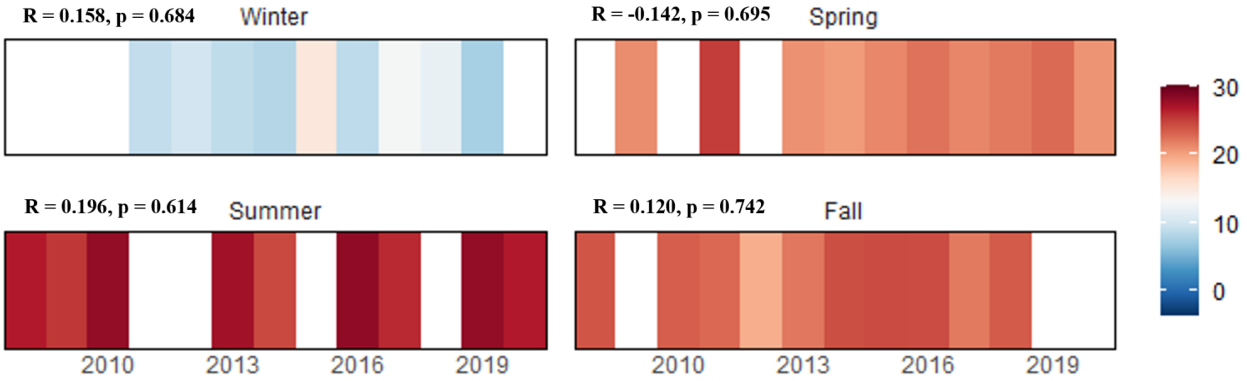
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Skeleton Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Skeleton Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Skeleton Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Skeleton Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	**R = -0.518, p = 0.013**	3.86	3.00	4.43	3.86	4.14	4.14	3.86	3.00	3.86	2.43	3.29	3.29	2.14	3.00	3.29	2.43	3.00	2.14	4.14	3.57	2.43	2.71
# Taxa	R = -0.070, p = 0.759	20	22	26	15	26	23	28	23	25	12	21	23	11	22	23	13	22	10	23	30	20	25
# Ephemeroptera Taxa	**R = -0.561, p = 0.007**	2	0	2	1	1	1	1	0	1	0	1	0	0	0	0	0	0	0	1	1	0	0
# EPT Taxa	**R = -0.439, p = 0.041**	3	3	5	2	2	6	3	0	3	0	2	4	1	2	2	0	1	1	2	4	1	0
# Scraper Taxa	R = 0.375, p = 0.086	2	4	3	2	3	3	4	4	3	2	2	5	2	2	4	3	5	3	4	4	3	5
% Climbers	R = -0.095, p = 0.676	1.8	5.9	8.2	3.3	8.3	2.7	10.1	20.2	21.9	1.7	0.9	4.0	0.7	0.9	2.4	3.2	13.3	0.8	10.5	4.7	6.1	3.4
% Ephemeroptera	**R = -0.466, p = 0.029**	1.8	0	4.1	11.6	4.6	0.9	1.8	0	1.0	0	0.9	0	0	0	0	0	0	0	0.8	0.9	0	0
% Intolerant Urban Taxa	R = 0.102, p = 0.652	39.1	26.9	21.3	48.8	31.2	70.3	11.9	17.2	22.9	55.9	48.3	31.0	73.3	70.4	64.8	84.0	15.0	75.0	49.2	21.5	27.2	11.7

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.133, p = 0.564	2.67	2.00	2.67	3.33	2.33	4.00	3.67	3.00	3.33	3.00	3.00	4.00	2.67	2.67	2.67	2.33	3.00	3.67	3.67	3.67	2.00	2.67
Abundance per m2	R = 0.340, p = 0.131	0.59	0.72	0.51	0.5	0.65	0.79	0.73	0.45	1.01	0.39	0.72	1.16	1.58	0.86	1.26	0.58	0.67	0.98	0.57	1.05	0.71	0.59
# Benthic Sp. (Adjusted)	**R = 0.515, p = 0.017**	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.84	0.84	0.84	0	0
% Abundance of Dominant Species	R = -0.259, p = 0.258	46.8	69.3	47.0	57.3	73.1	36.8	38.1	31.0	28.5	33.3	34.9	24.5	49.5	60.8	57.8	54.3	33.7	38.8	32.0	37.2	53.6	46.8
% Generalists/ Omnivores/ Invertivores	R = 0.348, p = 0.122	93.6	100	97.6	74.0	91.5	63.9	88.6	98.8	95.7	97.4	100	83.5	99.0	97.9	97.6	98.8	93.7	94.7	96.1	98.9	100	93.6

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	R = -0.256, p = 0.263	1.8	0	1.2	2.1	0	6.3	1.9	10.7	1.9	5.1	5.7	2.2	0	0	0	0	1.1	0	1.9	0	0	1.8
% Tolerant	R = -0.131, p = 0.570	89.0	90.5	85.5	89.6	96.9	89.6	94.3	85.7	94.2	91.0	90.6	95.7	93.9	90.2	91.0	95.1	90.5	86.8	87.4	83.6	89.3	89.0

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Skeleton Creek by sampling year.

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	10	13	11	8	4	6			3	8	3	4	3	12	10	11	3	2	12	6	8	7
Bluegill	T	-	4	-	-	5	2		1	3	12	9	2	2	6	4	3	4	14	24	21	14	11
Brown Bullhead	T	-	-	-	-	3	7		1	3	12	-	4	9	10	4	-	-	-	-	1	-	-
Creek Chubsucker	M	2	-	1	2	-	9	Not sampled in summer (lack of landowner permission)	2	9	4	4	6	3	-	-	-	-	1	-	2	-	-
Eastern Mosquitofish	M	-	-	-	-	-	-		-	-	-	-	-	-	-	1	-	-	-	-	-	10	-
Eastern Mudminnow	T	51	25	30	55	95	53		35	26	33	17	37	17	24	15	31	21	32	59	28	68	23
Golden Shiner	T	-	-	-	-	3	2		3	1	21	2	4	15	5	2	5	-	-	-	-	2	-
Green Sunfish	T	-	-	-	-	-	-		-	3	14	6	13	34	98	87	96	44	26	35	33	58	60
Lepomis Hybrid	M	-	-	-	-	-	-		-	-	-	-	-	-	-	3	4	1	6	8	4	2	-
Pirate Perch	T	34	95	39	6	8	10		40	19	59	26	29	32	27	8	14	7	14	13	3	2	6
Pumpkinseed	T	5	-	-	-	1	3		7	16	35	9	7	1	14	9	2	1	-	-	-	-	-
Redfin Pickerel	T	7	-	2	25	11	52		12	1	9	2	-	23	2	-	-	-	-	-	-	-	-
Tessellated Darter	T	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	1	4	9	-

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Yellow Bullhead	M	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	1	10	5

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Skeleton Creek by sampling year.

Species	*1996*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Procambarus acutus	*D*	D	D	N	N	N	N	N	N	N	N	N	N	N	N	N
Procambarus sp.	N	N	N	D	D	N	D	D	N	D	N	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Skeleton Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the unnamed tributary to Skeleton Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Eastern spadefoot, Fowler's toad, Gray treefrog, New Jersey chorus frog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog
Squamata (Snakes)	Common five-lined skink, Eastern Ratsnake, Eastern wormsnake, Northern black racer, Northern rough greensnake, Northern watersnake, Southern ring-necked snake
Testudines (Turtles)	Eastern box turtle, Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to Skeleton Creek by sampling year, RA = % Relative Abundance.

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	0.9	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	0.9	-	-	-	3.7	-	0.9	-	-	-	-	-
Annelida	Rhynchobdellida	Glossiphoniidae	na	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Annelida	Tubificida	Tubificidae	na	T	0.9	2.5	-	-	3.7	-	2.8	3.0	-	-	-	2.0
Arthropoda	Amphipoda		na	M	-	-	-	-	-	-	1.8	-	1.9	-	-	5.0
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	6.1	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	-	1.8	-	-	3.8	-	-	2.0
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	2.5	1.6	-	16.5	4.5	-	24.2	12.4	2.5	-	9.0
Arthropoda	Coleoptera	Curculionidae	na		-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	0.8	3.7	-	-	7.1	6.7	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	3.4	0.9	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	4.2	4.1	0.8	2.8	-	0.9	6.1	2.9	0.8	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	0.9	3.4	-	-	0.9	-	9.2	7.1	1.0	-	1.7	11.0
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	2.0	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	0.8	-	-	-	-	-	1.0	-	-	-	-

					1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Procambarus	I	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	1.0	-	-	0.9	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	2.9	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	2.0	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	1.8	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	5.1	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	0.9	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	0.9	0.8	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	22.7	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	2.5	-	-	0.9	-	0.9	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	0.9	-	-	0.8	2.8	-	0.9	-	1.9	0.8	1.7	1.0
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	8.6	25.4	-	1.0
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	-	-	-	-	-	1.0	-	-	-

					1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	2.8	1.8	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Larsia	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.9	0.8	-	-	2.8	-	-	1.0	1.0	0.8	0.9	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	0.8	-	1.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	4.5	-	1.6	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.9	-	-	6.6	1.8	5.4	0.9	-	-	-	2.6	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	0.9	-	-	3.0	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-	2.6	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	0.8	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.9	-	-	-	-	0.9	3.7	1.0	2.9	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	17.3	14.3	50.8	37.2	2.8	4.5	47.7	-	10.5	-	28.4	9.0
Arthropoda	Diptera	Chironomidae	Stictochironomus	T	-	1.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	3.3	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia	M	-	-	0.8	-	-	-	-	-	-	-	-	-

					1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	0.8	-	1.8	1.8	0.9	2.0	7.6	-	3.4	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	0.8	-	-	3.7	-	0.9	-	1.9	-	1.7	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	1.8	-	0.8	-	4.6	-	0.9	1.0	-	-	-	-
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	-	0.8	-	-	1.8	-	-	-	-	-	15.0
Arthropoda	Diptera	Simuliidae	Prosimulium	I	21.8	9.2	5.7	19.0	7.3	57.7	3.7	-	-	31.4	7.8	3.0
Arthropoda	Diptera	Simuliidae	na	M	-	4.2	-	-	-	-	0.9	-	-	-	-	5.0
Arthropoda	Diptera	Simuliidae	Simulium	M	-	19.3	0.8	-	-	-	1.8	-	-	-	-	1.0
Arthropoda	Diptera	Simuliidae	Stegopterna	I	14.5	16.0	4.9	14.0	2.8	0.9	1.8	-	1.0	22.0	37.9	4.0
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	1.0	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	1.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	0.9	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	0.9	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	0.8	11.6	0.9	-	1.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.9	-	1.6	-	3.7	0.9	-	-	1.0	-	0.9	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	1.6	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Belostomatidae	Belostoma	T	-	-	-	0.8	-	-	-	-	1.0	-	-	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Nepidae	Ranatra	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	4.1	4.1	16.5	5.4	2.8	13.1	14.3	1.7	1.7	4.0
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	0.9	-	-	-	-	-

					1996	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	0.8	-	-	-	-	1.0	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	0.8	-	0.9	-	2.8	-	4.8	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	0.8	-	-	-	-	-	2.9	-	-	-
Arthropoda	Odonata	Coenagrionidae	Ischnura	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	0.8	-	0.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	1.6	-	-	1.8	-	-	-	-	-	4.0
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	5.5	5.9	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	0.9	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	2.5	0.8	-	-	0.9	0.9	-	1.9	-	-	1.0
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	0.9	-	-	1.0	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	1.6	-	-	1.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	-	-	-	0.9	-	-	-	-	10.0
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	-	0.8	-	-	-	0.9	-	-	-	-	-	-
Mollusca	Architaenioglossa	Viviparidae	na		-	-	-	-	-	-	-	-	-	-	0.9	-
Mollusca	Architaenioglossa	Viviparidae	Viviparus	I	0.9	-	-	-	-	-	-	-	-	-	-	3.0
Mollusca	Basommatophora	Lymnaeidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	1996 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Mollusca	Basommatophora	Physidae	Physa	T	-	-	1.6	-	-	-	-	1.0	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	0.8	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	na	T	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Mesogastropoda	Hydrobiidae	na	T	-	0.8	-	-	-	-	-	-	-	0.8	-	1.0
Mollusca	Neotaenioglossa	Bithyniidae	Bithynia	T	-	-	-	-	-	-	1.8	2.0	-	-	0.9	-
Mollusca	Neotaenioglossa	Hydrobiidae	Amnicola	T	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	-	4.0	3.8	-	-	2.0
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	2.8	0.9	1.8	4.0	-	0.8	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	0.9	3.4	-	0.8	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	-	3.3	-	-	-	-	-	-	8.5	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	0.8	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	4.6	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	0.9	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	0.8	-	-	-	1.4	3.9
Annelida	Lumbriculida	Lumbriculidae	na	M	-	0.9	-	-	-	-	-	-	-	2.9
Annelida	Rhynchobdellida	Glossiphoniidae	na	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Tubificida	Tubificidae	na	T	1.4	-	-	-	-	-	1.6	1.9	2.7	1.5
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	1.6	0.8	-	4.8	0.9	20.4	11.2
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	4.3	1.6	3.2	0.8	-	8.9	6.5	3.4	41.0
Arthropoda	Coleoptera	Curculionidae	na		-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	1.6	0.9	-	1.0
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	0.8	-	0.8	-	1.6	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	3.5	1.6	-	0.8	2.3	5.6	8.4	4.8	1.5
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Procambarus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	2.4	0.9	2.7	1.0
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	0.9	-	0.5

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	0.8	-	-	-	-	-	-	1.5
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	1.7	-	1.6	-	0.7	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	4.2	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	0.5
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	-	-	-	-	-	-	-	-	-	0.5
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	0.8	0.8	0.8	-	-	2.8	-	1.0
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	1.6	-	-	4.7	-	16.8	25.9	9.8
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	2.7	0.9	2.4	-	0.8	0.8	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Larsia	T	-	-	-	-	-	-	-	-	-	0.5
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.7	0.9	0.8	2.4	-	-	-	0.9	-	2.0
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	1.4	-	0.8	-	1.7	1.6	-	1.9	0.7	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	4.1	2.6	3.2	4.0	1.7	5.5	0.8	6.5	5.4	1.5
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	0.9	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.9	0.8	-	1.7	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	0.5
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	3.5	8.0	-	41.7	1.6	4.8	6.5	10.9	-
Arthropoda	Diptera	Chironomidae	Stictochironomus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	0.8	-	-	0.5
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	1.4	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	0.9	-	0.8	1.7	-	-	1.9	-	8.3
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	0.8	-	10.0	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	1.6	-	-	1.5
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	0.9	-	-	0.8	-	-	0.9	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	21.2	39.1	36.8	69.6	10.8	49.2	1.6	0.9	2.0	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Simuliidae	na	M	13.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	1.4	0.9	0.8	-	1.7	-	8.9	3.7	2.0	2.9
Arthropoda	Diptera	Simuliidae	Stegopterna	I	50.7	29.6	26.4	12.8	3.3	25.0	5.6	6.5	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	-	-	0.8	0.9	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Belostomatidae	Belostoma	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Corixidae	na	M	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Nepidae	Ranatra	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	1.7	-	-	-	-	34.7	11.2	4.1	-
Arthropoda	Lepidoptera	na	na	M	-	1.7	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	Ischnura	T	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	0.8	-	-	0.8	1.6	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	0.9	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	0.9	-	-	-	-	-	1.9	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.7	-	-	-	-	-	-	-	-	-
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	-	-	-	1.6	2.5	0.8	4.8	-	-	0.5
Mollusca	Architaenioglossa	Viviparidae	na		-	0.9	1.6	-	-	-	-	-	-	-
Mollusca	Architaenioglossa	Viviparidae	Viviparus	I	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Lymnaeidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	0.8	-	-	-	0.8	1.9	0.7	0.5
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	0.8	8.3	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	na	T	-	-	-	-	-	-	-	-	-	0.5
Mollusca	Mesogastropoda	Hydrobiidae	na	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Neotaenioglossa	Bithyniidae	Bithynia	T	-	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Neotaenioglossa	Hydrobiidae	Amnicola	T	-	-	-	-	-	-	-	-	3.4	1.0
Mollusca	Veneroida	Pisidiidae	Musculium	M	1.4	2.6	-	-	-	7.8	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	2.8	5.4	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	5.6	-	-	-	1.6	1.9	-	2.4
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	-	-	0.8	-	-	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	0.8	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	0.8	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Swan Creek (LOCR-102-S)

Site LOCR-102-S is located on Swan Creek in the Coastal Plain – eastern shore region of Maryland. It is in the Lower Chester River watershed in Kent County. This site was sampled in 1995 and from 2000 to 2020.

Swan Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	75.08	74.66	74.87	73.84	71.47	74.87	74.72
Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	17.80	17.80	17.80	17.75	17.80	17.75	17.80
Other	7.12	7.53	7.33	8.41	10.73	7.38	7.48

Water Chemistry

Water chemistry measurements collected at Swan Creek (1995, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.318, p = 0.160	5.86	6.02	5.92	5.82	5.79	5.91	5.91	5.82	5.87	5.89	6.04	5.84	5.92
Specific Conductance (µS/cm)	R = -0.261, p = 0.253	86.7	60.8	71.5	140.5	70.0	86.5	68.1	75.3	72.8	142.1	137.3	54.6	75.3
Acid Neutralizing Capacity (µeq/L)	R = 0.005, p = 0.983	100.4	139.5	84.4	136.0	79.3	85.3	106.6	111.6	78.5	62.8	87.6	97.0	97.6
Dissolved Organic Carbon (mg/L)	R = 0.203, p =0.377	20.000	33.200	20.200	15.900	24.900	15.800	30.233	35.402	20.388	10.866	13.931	31.551	26.085
Chloride (mg/L)	R = -0.041, p = 0.864		6.52	8.35	16.25	8.23	13.16	8.01	7.92	10.66	12.82	20.15	6.07	11.27
Sulfate (mg/L)	R = -0.409, p = 0.065	17.46	4.94	7.82	24.62	7.84	9.28	6.26	8.24	6.94	30.30	18.81	3.52	8.23
Total Nitrogen (mg/L)	R = -0.052, p = 0.828		2.850	0.677	1.085	0.708	0.527	0.877	1.640	0.868	0.899	1.186	1.303	1.195
Nitrate-Nitrogen (mg/L)	R = -0.114, p = 0.621	0.1200	0.0850	0.1690	0.0720	0.0290	0.0640	0.0650	0.0465	0.0389	0.0529	0.0449	0.0735	0.0511
Nitrite-Nitrogen (mg/L)	R = 0.384, p = 0.095		0*	0.0072	0.0062	0.0063	0.0046	0.0082	0.0099	0.0056	0.0033	0.0060	0.0094	0.0089
Ammonia-Nitrogen (mg/L)	R = -0.366, p = 0.112		0.3187	0.0318	0.1402	0.0185	0.0457	0.0664	0.2020	0.0317	0.0880	0.1380	0.0558	0.0649
Total Phosphorus (mg/L)	R = -0.110, p = 0.643		0.1380	0.0760	0.2110	0.0880	0.0740	0.1395	0.1968	0.0854	0.0974	0.1186	0.1312	0.0981
Ortho-phosphate (mg/L)	R = 0.258, p = 0.272		0.0252	0.0071	0.0043	0.0093	0.0085	0.0117	0.0277	0.0055	0.0039	0.0040	0.0173	0.0132
Bromide (mg/L)	R = 0.620, p = 0.137													
Magnesium (mg/L)	R = -0.164, p = 0.757											3.775		
Calcium (mg/L)	R = -0.315, p = 0.543											4.756		
Copper (µg/L)	R = 0.303, p = 0.559													
Zinc (µg/L)	R = -0.244, p = 0.642													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.07	5.83	6.06	5.91	6.31	6.03	5.96	5.78	
Specific Conductance (µS/cm)	56.8	54.3	79.7	60.2	71.4	74.4	89.8	42.5	
Acid Neutralizing Capacity (µeq/L)	123.5	70.2	86.7	79.0	192.1	134.8	98.4	62.9	
Dissolved Organic Carbon (mg/L)	22.536	21.028	21.978	19.171	26.458	37.714	31.946	22.365	Not sampled due to COVID-19 Pandemic
Chloride (mg/L)	5.77	6.58	12.83	9.39	9.88	10.30	14.16	5.71	
Sulfate (mg/L)	5.35	6.52	6.94	4.41	4.09	4.79	7.40	2.59	
Total Nitrogen (mg/L)	1.325	1.855	1.110	0.916	1.256	1.498	1.234	0.746	
Nitrate-Nitrogen (mg/L)	0.1411	0.0688	0.0545	0.0284	0.0404	0.0990	0.1266	0.0922	
Nitrite-Nitrogen (mg/L)	0.0090	0.0065	0.0065	0.0038	0.0071	0.0104	0.0074	0.0078	
Ammonia-Nitrogen (mg/L)	0.0688	0.0445	0.0295	0.0204	0.0988	0.1034	0.0695	0.0331	
Total Phosphorus (mg/L)	0.1289	0.1099	0.1019	0.0821	0.1583	0.1416	0.1157	0.0929	
Ortho-phosphate (mg/L)	0.0175	0.0100	0.0083	0.0099	0.0223	0.0271	0.0175	0.0144	
Bromide (mg/L)		0.0060	0.0168	0.0052	0.0159	0.0268	0.0184	0.0179*	
Magnesium (mg/L)			2.211	1.656	2.146	2.538	2.527	1.310	
Calcium (mg/L)			2.789	2.428	3.083	3.180	3.078	1.722	
Copper (µg/L)			2.654	2.448	2.664	3.183	3.392	2.436	
Zinc (µg/L)			15.514	14.924	12.914	21.305	14.384	10.978	

Physical Habitat

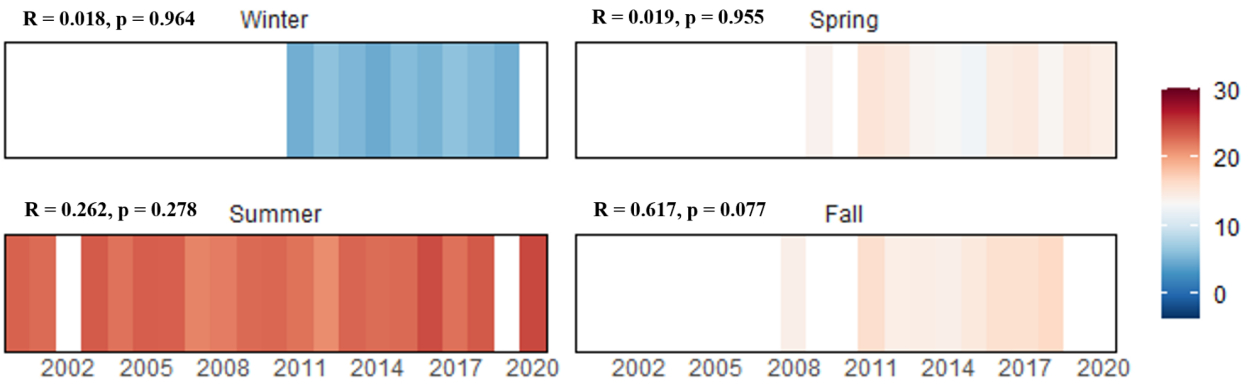
Physical habitat measurements collected at Swan Creek (1995, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.335, p = 0.128	15	16	8	11	13	13	9	17	8	14	14	16	12	17	16	13	14	11	8	9	5	9
Epifaunal substrate (0-20)	R = 0.027, p = 0.907	5	17	8	11	14	11	9	16	8	13	15	16	8	12	13	16	11	12	10	11	7	10
Velocity/Depth Diversity (0-20)	R = -0.060, p = 0.791	3	8	4	5	12	9	4	10	2	3	6	3	3	5	4	9	8	4	5	8	5	4
Pool Quality (0-20)	**R = -0.455, p = 0.034**	14	11	7	5	13	12	8	10	7	8	9	10	8	10	9	10	7	9	6	8	7	8
Riffle Quality (0-20)	R = 0.101, p = 0.656	0	10	8	0	11	11	8	13	1	6	12	0	7	6	11	6	8	8	7	11	3	6
Shading (%)	R = 0.366, p = 0.094	80	40	20	65	65	40	45	40	80	70	60	40	60	80	65	45	70	75	75	75	70	65
Embeddedness (%)	R = 0.058, p = 0.797	100	30	99	100	30	100	100	30	95	100	100	100	70	85	100	90	100	85	75	95	75	60
Discharge (cfs)	R = 0.281, p = 0.205	0	0.29	0.05	0	0.22	0.21	0.02	0.2	0	0.03	0.33	0	0.05	0.02	0.36	0.41	0.17	0.18	0	1.51	0.03	0.06
Stream Area (m2)	R = -0.139, p = 0.539	360.0	187.5	127.5	67.5	95.6	120.0	90.0	123.8	101.3	91.9	140.6	114.4	135.0	163.3	204.4	157.5	125.6	148.1	94.7	182.3	178.5	161.3

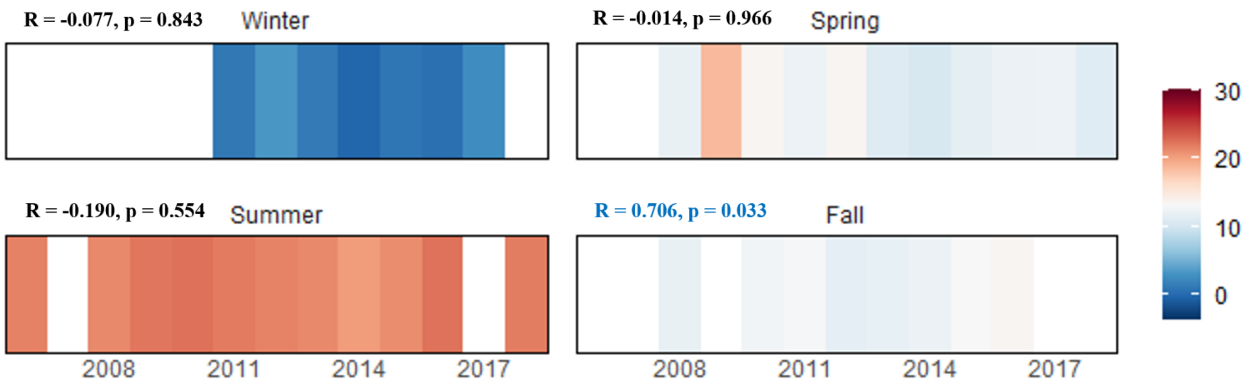
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Swan Creek (only calculated for summers missing no less than 2 weeks of data).

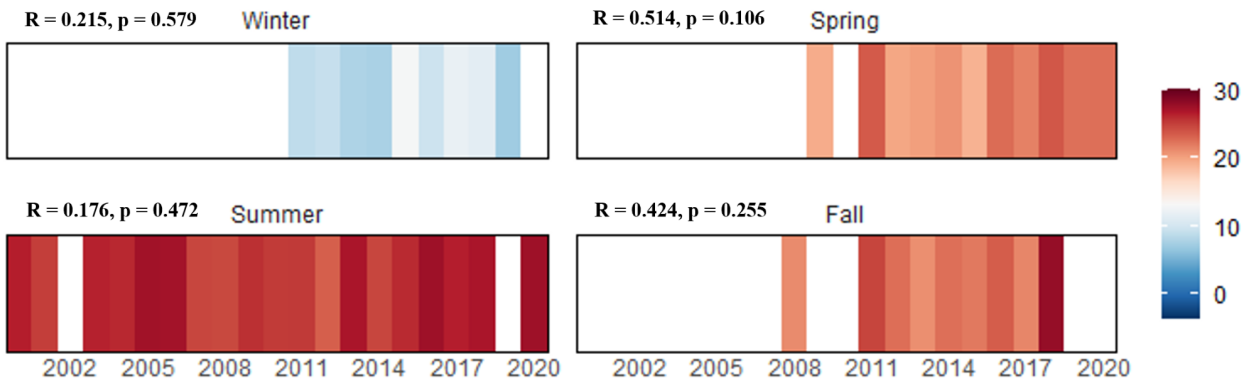
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.282, p = 0.242	84.5	95.3	-	85.2	85.4	89.5	83.2	73.5	85.3	89.7	90.3	89.0	72.9	93.8	96.1	88.8	86.8	89.4	92.9	-	94.0
% above 24°C	R = 0.220, p = 0.366	41.2	24.7	-	47.6	23.0	41.0	43.7	14.0	12.8	26.6	35.0	20.8	2.1	29.1	25.6	32.9	62.8	19.4	47.5	-	66.4



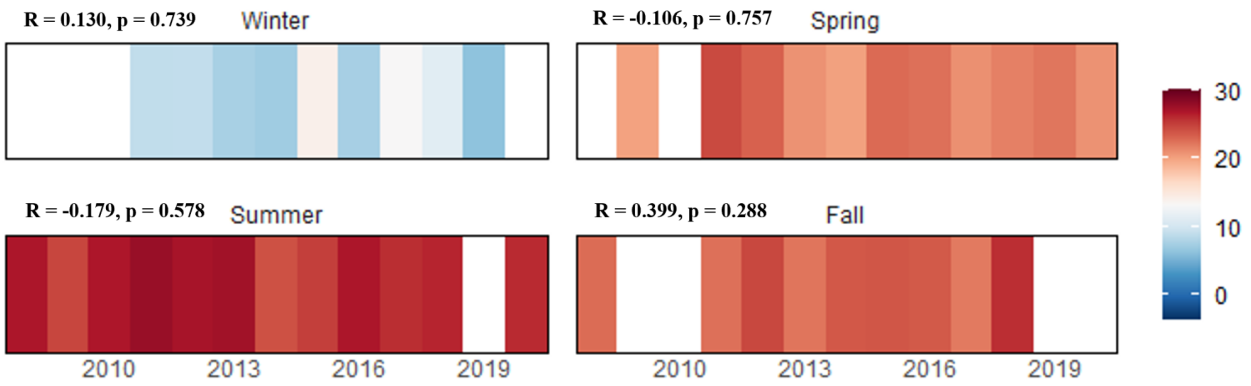
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Swan Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Swan Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Swan Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Swan Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.191, p = 0.394	2.71	1.86	2.43	3.29	2.43	1.86	2.14	2.43	2.14	2.14	3.29	1.86	1.86	1.57	3.00	2.43	1.57	2.14	2.71	1.00	2.43	2.71
# Taxa	R = -0.300, p = 0.175	25	17	21	23	21	15	13	16	20	17	32	15	11	20	19	15	5	14	24	10	21	18
# Ephemeroptera Taxa	R = 0.118, p = 0.599	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1
# EPT Taxa	R = -0.060, p = 0.789	1	0	1	2	1	2	1	0	0	1	4	0	0	1	2	1	0	0	1	0	2	1
# Scraper Taxa	R = -0.369, p = 0.091	3	0	1	1	0	0	0	0	0	0	2	0	1	0	1	1	0	1	0	0	0	0
% Climbers	R = -0.063, p = 0.781	12.2	0	2.5	9.1	12.7	0	0.9	9.6	2.7	2.9	8.7	1.7	0	0.9	1.9	5.9	0	0	4.1	0.8	24.6	2.1
% Ephemeroptera	R = 0.144, p = 0.523	0	0	0	1.0	0	0	2.8	0	0	0	0	0	0	0	0	0	0	0	0.8	0	0	2.8
% Intolerant Urban Taxa	R = 0.146, p = 0.515	8.2	38.7	55.9	9.1	33.3	21.9	10.1	72.2	39.6	46.1	23.5	11.2	83.5	14.9	64.5	64.4	53.6	42.7	26.5	9.9	15.3	47.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.328, p = 0.136	3.00	2.00	2.00	1.67	2.00	2.00	2.67	2.67	2.67	2.33	2.00	2.67	2.33	2.33	2.67	2.00	2.33	3.00	2.67	2.67	3.00	2.33
Abundance per m2	R = -0.395, p = 0.069	0.9	6.29	15.27	9.16	18.88	7.7	18.17	4.19	2.41	4.2	3.41	2.03	2.84	0.99	1.98	3.92	3.92	2.19	13.54	1.15	1.43	0.67
# Benthic Sp. (Adjusted)	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Abundance of Dominant Species	R = -0.297, p = 0.180	36.7	44.8	82.3	83.3	98.0	85.1	45.4	59.9	48.4	66.1	78.1	64.2	56.8	53.1	64.1	83.0	43.8	32.6	73.3	42.6	39.2	40.7
% Generalists/ Omnivores/ Invertivores	R = -0.093, p = 0.681	92.9	100	99.9	100	99.6	99.6	100	99.0	97.5	96.9	99.0	99.6	99.2	100	99.0	99.7	100	99.1	99.8	95.2	98.4	92.6

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Tolerant	R = -0.277, p = 0.212	89.2	97.8	99.5	98.2	99.7	99.0	59.7	78.0	91.8	97.2	99.0	89.2	98.7	85.8	91.8	98.9	75.1	78.5	26.5	94.7	91.8	91.7

Fish

Cumulative list of fish species (with abundance) collected in Swan Creek by sampling year.

Species	*Tolerance*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	1	9	6	10	4	6	11	12	4	4	-	6	3	1	3	3	1	4	1	2	1	1
Black Crappie	M	34	-	-	-	-	1	-	6	-	-	-	-	-	-	3	-	3	3	1	4	-	-
Bluegill	T	7	27	-	-	-	9	2	2	17	1	6	11	1	6	7	21	8	13	2	34	100	44
Brown Bullhead	T	119	-	22	8	2	26	12	7	-	8	1	2	7	-	4	1	-	2	6	3	9	4
Eastern Mosquitofish	M	-	-	-	-	1	-	643	92	15	7	4	19	-	21	19	-	119	63	940	-	10	2
Eastern Mudminnow	T	40	513	1603	515	1768	786	743	310	118	255	375	149	218	86	259	512	216	106	326	52	33	21
Golden Shiner	T	97	86	97	42	2	39	57	26	34	28	20	20	15	27	18	19	4	52	1	10	1	-
Largemouth Bass	T	19	-	-	-	-	-	-	-	-	-	1	-	-	-	2	1	-	-	2	-	3	2
Pumpkinseed	T	3	528	213	42	21	51	162	54	49	71	68	24	135	20	79	55	142	79	3	89	87	22
Redfin Pickerel	T	4	-	2	-	7	4	-	5	6	12	4	1	3	-	2	1	-	3	-	10	1	6
Warmouth	M	-	16	4	1	-	1	5	4	1	-	1	-	2	1	8	4	-	-	-	5	10	6
Yellow Bullhead	M	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Yellow Perch	M	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Swan Creek by sampling year.

Species	*2006*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2017*	*2020*
Lacunicambarus diogenes	N	D	D	N	D	N	D	D	N	N	N
Procambarus clarkii	D	D	D	D	D	D	D	D	D	D	D
Procambarus sp.	N	D	D	N	N	N	N	N	D	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Swan Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Swan Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Fowler's toad, Cope's Gray treefrog, Eastern American toad, Fowler's Toad, Gray treefrog, New Jersey chorus frog, Eastern cricket frog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog
Squamata (Snakes and Lizards)	Common five-lined skink, Eastern rat snake, Northern black racer, Northern watersnake, Ringneck snake
Testudines (Turtles)	Eastern box turtle, Eastern painted turtle, Eastern snapping turtle, Red bellied turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the Swan Creek by sampling year, RA = % Relative Abundance.

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Arhynchobdellida	Erpobdellidae	na	T	0.0	0.0	-	-	-	-	-	0.9	-	-	-	-
Annelida	Haplotaxida	Enchytraeidae	na	T	0.0	0.0	0.8	1.0	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	0.0	0.0	-	2.0	0.8	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	1.0	10.6	5.9	4.0	1.6	-	-	-	0.9	1.0	-	1.7
Annelida	Rhynchobdellida	Glossiphoniidae	Placobdella	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	0.0	5.8	1.7	4.0	0.8	-	-	1.7	-	-	0.9	0.9
Arthropoda	Amphipoda	na	na	M	0.0	1.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	0.0	0.0	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	4.1	0.0	-	-	1.6	-	-	1.7	3.6	-	3.5	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	0.0	0.0	-	-	-	0.7	-	10.4	2.7	1.0	2.6	-
Arthropoda	Coleoptera	Dytiscidae	Deronectes	M	2.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	0.0	0.0	-	-	0.8	-	-	2.6	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	0.0	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	0.0	0.0	-	3.0	-	-	-	-	-	1.0	0.9	-
Arthropoda	Coleoptera	Scirtidae	na	M	2.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	0.0	0.0	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	na	na	M	0.0	0.0	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	0.0	1.9	-	-	-	-	-	0.9	-	-	1.7	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	1.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	0.0	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Ceratopogonidae	Mallochohelea	M	0.0	0.0	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	0.0	0.0	-	-	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Alotanypus	M	0.0	0.0	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	0.0	0.0	0.8	-	-	-	-	-	-	-	0.9	0.9
Arthropoda	Diptera	Chironomidae	Chironomus	M	1.0	0.0	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	0.0	0.0	0.8	-	-	0.7	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	9.2	1.9	-	10.1	-	0.7	-	-	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	0.0	2.9	9.3	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	0.0	0.0	-	-	-	-	-	-	1.8	-	0.9	0.9
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	8.2	0.0	0.8	9.1	3.2	0.7	0.9	0.9	-	-	2.6	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	0.0	1.0	-	2.0	-	-	1.8	-	18.9	2.0	-	0.9
Arthropoda	Diptera	Chironomidae	Endochironomus	M	0.0	3.8	0.8	-	-	0.7	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.0	0.0	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Glyptotendipes	M	2.0	0.0	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	6.1	0.0	-	-	-	-	-	-	-	-	2.6	-
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	0.0	0.0	-	-	-	-	-	-	0.9	-	2.6	-
Arthropoda	Diptera	Chironomidae	Krenopelopia	M	0.0	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	0.0	0.0	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	0.0	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Mesosmittia	M	0.0	0.0	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Nanocladius	T	0.0	0.0	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	11.2	0.0	1.7	-	3.2	-	-	-	0.9	4.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	8.2	0.0	-	13.1	19.8	13.1	2.8	-	-	22.5	20.0	5.2
Arthropoda	Diptera	Chironomidae	Parachironomus	M	0.0	0.0	-	-	3.2	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	0.0	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.0	1.0	0.8	4.0	-	1.5	-	-	-	-	4.3	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.0	0.0	-	14.1	2.4	-	-	-	1.8	-	5.2	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	0.0	0.0	-	2.0	-	-	-	-	0.9	-	1.7	0.9
Arthropoda	Diptera	Chironomidae	Paratendipes	M	2.0	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	1.0	0.0	0.8	-	11.9	-	0.9	6.1	1.8	2.0	3.5	1.7
Arthropoda	Diptera	Chironomidae	Procladius	I	0.0	0.0	-	5.1	15.9	-	0.9	3.5	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Psilometriocnemus	M	1.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.0	1.9	1.7	-	1.6	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.0	1.0	1.7	-	-	1.5	0.9	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypus	M	0.0	0.0	-	1.0	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	0.0	0.0	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.0	0.0	5.1	-	-	10.9	0.9	-	6.3	-	5.2	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	1.0	0.0	-	-	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	0.0	0.0	-	-	1.6	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.0	0.0	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.0	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Dolichopodidae	na	T	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ephydridae	na		0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Cnephia	M	0.0	0.0	-	-	1.6	-	-	-	15.3	11.8	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	0.0	0.0	1.7	-	-	-	-	-	0.9	1.0	-	-
Arthropoda	Diptera	Simuliidae	na	M	0.0	0.0	-	-	0.8	-	1.8	1.7	-	5.9	-	1.7
Arthropoda	Diptera	Simuliidae	Simulium	M	0.0	2.9	4.2	-	7.9	46.0	77.1	-	-	-	-	64.7
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.0	0.0	47.5	-	12.7	16.8	2.8	-	14.4	34.3	4.3	4.3
Arthropoda	Diptera	Tabanidae	Chrysops	I	0.0	1.9	-	-	-	-	0.9	-	-	-	0.9	-
Arthropoda	Diptera	Tabanidae	na	I	0.0	0.0	-	1.0	-	-	-	-	0.9	1.0	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	1.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.0	0.0	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	0.0	0.0	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	0.0	0.0	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pilaria	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	0.0	0.0	-	-	-	1.5	-	-	0.9	-	-	0.9
Arthropoda	Diptera	Tipulidae	Tipula	M	0.0	0.0	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	0.0	0.0	-	-	0.8	-	0.9	0.9	-	1.0	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	0.0	0.0	-	1.0	-	-	2.8	-	-	-	-	-
Arthropoda	Hemiptera	Corixidae	na	M	1.0	0.0	-	-	-	-	-	-	-	-	0.9	-

PHYLUM	ORDER	FAMILY	GENUS	TOL	1995 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Isopoda	Asellidae	Caecidotea	I	6.1	37.5	4.2	2.0	3.2	2.9	2.8	57.4	19.8	1.0	13.0	6.0
Arthropoda	Lepidoptera	na	na	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Lepidoptera	Tortricidae	na	M	3.1	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	0.0	0.0	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	0.0	0.0	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	0.0	0.0	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Libellulidae	na	T	0.0	0.0	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Plecoptera	Nemouridae	na	I	0.0	0.0	1.7	-	0.8	-	-	-	-	5.9	2.6	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	0.0	0.0	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	3.1	0.0	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.0	0.0	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	0.0	0.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	0.0	0.0	-	-	-	0.7	-	-	-	-	4.3	-
Arthropoda	Trichoptera	Limnephilidae	na	M	0.0	0.0	-	3.0	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	0.0	0.0	-	-	-	-	-	-	-	-	1.7	-
Mollusca	Basommatophora	Lymnaeidae	Pseudosuccinea	M	1.0	0.0	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	1.0	0.0	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	4.1	0.0	0.8	3.0	-	-	-	-	-	-	2.6	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	0.0	0.0	-	12.1	-	-	0.9	7.8	1.8	1.0	0.9	2.6
Mollusca	Veneroida	Pisidiidae	na	M	0.0	0.0	-	-	0.8	-	-	-	-	-	-	4.3
Mollusca	Veneroida	Pisidiidae	Pisidium	M	18.4	22.1	-	-	0.8	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	0.0	0.0	3.4	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Arhynchobdellida	Erpobdellidae	na	T	-	-	-	0.8	-	-	-	-	-	-
Annelida	Haplotaxida	Enchytraeidae	na	T	-	1.8	-	-	-	1.8	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	0.8	2.1
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	2.8	-	-	-	0.8	-	0.8	-
Annelida	Rhynchobdellida	Glossiphoniidae	Placobdella	M	-	0.9	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	1.7	6.1	1.9	-	0.9	1.8	0.8	4.5	1.7	3.5
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	0.9	-	-	-	-	-	-	-	21.3
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	1.7	0.9	-	-	-	-	2.5	-	0.8	21.3
Arthropoda	Coleoptera	Dytiscidae	Deronectes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	0.9	-	-	-	-	2.5	-	0.8	0.7
Arthropoda	Coleoptera	Haliplidae	Peltodytes	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Scirtidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Mallochohelea	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Alotanypus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	2.8
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Clinotanypus	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	0.8	0.8	0.7
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	0.9	-	-	0.9	0.8	-	-	0.7
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	0.9	-	-	-	-	4.1	-	-	8.5
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	-	-	-	0.8	0.8	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Glyptotendipes	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	0.9	-	0.9	2.5	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Kiefferulus	M	-	-	-	1.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Krenopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	-	1.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Mesosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	2.5	1.5	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	0.9	2.5	0.8	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	4.3	0.9	7.5	2.5	-	2.7	2.5	1.5	3.4	-
Arthropoda	Diptera	Chironomidae	Parachironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	5.1	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	0.9	3.4	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.9	1.9	5.9	-	-	0.8	0.8	20.3	1.4
Arthropoda	Diptera	Chironomidae	Procladius	I	-	0.9	-	1.7	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Psilometriocnemus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.9	-	3.7	1.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	0.9	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.9	0.9	-	0.8	-	1.8	1.7	0.8	4.2	0.7
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	1.8	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	0.9	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Cnephia	M	-	-	-	10.2	44.5	40.0	38.0	77.3	13.6	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	5.6	2.5	1.8	-	-	-	0.8	-
Arthropoda	Diptera	Simuliidae	na	M	-	0.9	1.9	-	-	-	-	-	-	2.1
Arthropoda	Diptera	Simuliidae	Simulium	M	5.2	64.0	3.7	-	-	-	11.6	-	0.8	2.1
Arthropoda	Diptera	Simuliidae	Stegopterna	I	80.0	9.6	57.0	58.5	51.8	42.7	7.4	9.8	1.7	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	0.9	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	0.9	0.9	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	na	M	-	0.9	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	-	-	0.8	-	-	2.8
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	1.7	0.9	0.9	0.8	-	-	13.2	-	11.9	23.4
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Lepidoptera	Tortricidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Libellulidae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	1.8	-	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	-	-	26.3	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	3.4	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Lymnaeidae	Pseudosuccinea	M	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	1.7	-	2.8	-	0.9	1.8	-	-	1.7	0.7

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Veneroida	Pisidiidae	na	M	-	1.8	-	-	-	-	-	1.5	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	3.5
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Appendix B
Sentinel Sites in the Coastal Plain – Western Shore Region

Hoghole Run (PTOB-002-S)
Mattawoman Creek (MATT-033-S)
Unnamed Tributary to Mattawoman Creek (MATT-102-S)
Mill Run (Nanjemoy Creek, NANJ-331-S)
Unnamed Tributary to Reeder Run (PRMT-177-S)
Unnamed Tributary to St. Clements Creek (STCL-051-S)
Swanson Creek (PAXL-294-S)
Unnamed Tributary to Zekiah Swamp Run (ZEKI-012-S)

Hoghole Run (PTOB-002-S)

Site PTOB-002-S is located on Hoghole Run in the Coastal Plain – western shore region of Maryland. It is in the Port Tobacco River watershed in Charles County. This site was sampled from 2000 to 2018. Hoghole Run was not sampled during the summer of 2018 due to lack of access to the site.

Hoghole Run in spring 2018.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	88.51	89.15	89.13	89.68	88.98	88.98	88.79
Urban	4.47	4.47	4.49	4.49	4.91	4.91	4.91
Agriculture	4.17	4.17	4.17	4.17	4.17	4.17	4.17
Other	2.85	2.21	2.21	1.66	1.94	1.94	2.13

Water Chemistry

Water chemistry measurements collected at Hoghole Run (2000 to 2018). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.093, p = 0.705	6.46	6.59	6.62	6.04	6.06	6.46	6.59	6.55	6.24	6.36	6.47	6.42
Specific Conductance (µS/cm)	R = 0.308, p = 0.200	52.7	66.2	60.1	60.0	57.2	61.6	62.5	57.2	65.1	81.4	56.9	73.4
Acid Neutralizing Capacity (µeq/L)	R = 0.250, p = 0.302	69.6	71.0	112.6	29.3	41.1	71.1	84.4	90.5	50.3	69.4	76.3	54.0
Dissolved Organic Carbon (mg/L)	R = 0.114, p = 0.643	3.400	1.500	3.700	2.400	5.700	3.190	3.437	3.996	4.304	2.563	3.344	3.216
Chloride (mg/L)	R = 0.382, p = 0.107	4.85	7.65	7.11	6.40	6.18	6.17	7.94	6.00	7.99	12.22	6.65	12.50
Sulfate (mg/L)	R = -0.237, p = 0.328	9.93	9.79	7.70	14.04	9.53	10.09	9.64	9.20	10.58	9.64	9.66	10.39
Total Nitrogen (mg/L)	R = 0.046, p = 0.852	0.308	0.125*	0.159	0.127	0.282	0.141	0.117	0.193	0.270	0.138	0.229	0.210
Nitrate-Nitrogen (mg/L)	R = 0.071, p = 0.772	0*	0.0010*	0.0360	0.0190	0.0900	0.0352	0.0028	0.0123	0.0308	0.0019*	0.0088	0.0534
Nitrite-Nitrogen (mg/L)	**R = 0.636, p = 0.003**	0*	0.0009*	0.0009	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	**R = -0.469, p = 0.043**	0.0093*	0.0097	0.0141	0.0034	0.0201	0.0038	0.0067	0.0095	0.0077	0.0039	0.0020*	0.0052
Total Phosphorus (mg/L)	R = -0.140, p = 0.567	0.0300	0.0170	0.0500	0.0160	0.0520	0.0368	0.0527	0.0529	0.0266	0.0241	0.0565	0.0163
Ortho-phosphate (mg/L)	**R = 0.568, p = 0.011**	0*	0.0020*	0.0099	0.0047	0.0073	0.0060	0.0089	0.0052	0.0065	0.0055	0.0101	0.0062
Bromide (mg/L)	R = 0.709, p = 0.114												
Magnesium (mg/L)	R = 0.322, p = 0.597										1.558		
Calcium (mg/L)	R = 0.650, p = 0.235										4.056		
Copper (µg/L)	R = -0.876, p = 0.051												
Zinc (µg/L)	R = -0.758, p = 0.138												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.47	6.38	6.24	6.29	6.66	6.54	6.47		
Specific Conductance (µS/cm)	51.9	59.3	65.2	112.3	61.4	65.1	61.5		
Acid Neutralizing Capacity (µeq/L)	105.7	68.2	58.0	51.4	94.1	115.2	86.4		
Dissolved Organic Carbon (mg/L)	2.444	4.358	6.961	4.302	3.506	2.186	2.685		
Chloride (mg/L)	5.03	8.26	10.01	23.46	7.59	8.64	6.76		
Sulfate (mg/L)	9.92	9.97	8.36	9.39	8.72	8.22	10.60		
Total Nitrogen (mg/L)	0.126	0.231	0.316	0.249	0.160	0.139	0.187		
Nitrate-Nitrogen (mg/L)	0.0060	0.0439	0.0474	0.0436	0.0034	0.0095	0.0326	Not sampled (lack of access to the site)	
Nitrite-Nitrogen (mg/L)	0.0010*	0.0011*	0.0019	0.0011*	0.0040*	0.0022*	0.0022*		
Ammonia-Nitrogen (mg/L)	0.0029	0.0053	0.0088	0.0058	0.0055	0.0049	0.0041		
Total Phosphorus (mg/L)	0.0312	0.0218	0.0479	0.0289	0.0439	0.0313	0.0111		
Ortho-phosphate (mg/L)	0.0074	0.0072	0.0115	0.0060	0.0119	0.0082	0.0079		
Bromide (mg/L)		0.0087	0.0065	0.0049	0.0162	0.0246	0.0153		
Magnesium (mg/L)			1.212	1.548	1.312	1.458	1.389		
Calcium (mg/L)			2.657	3.692	3.192	3.921	3.558		
Copper (µg/L)			1.579	0.833	0.354	0.222	0.320		
Zinc (µg/L)			11.303	13.345	6.436	4.898	6.987		

Physical Habitat

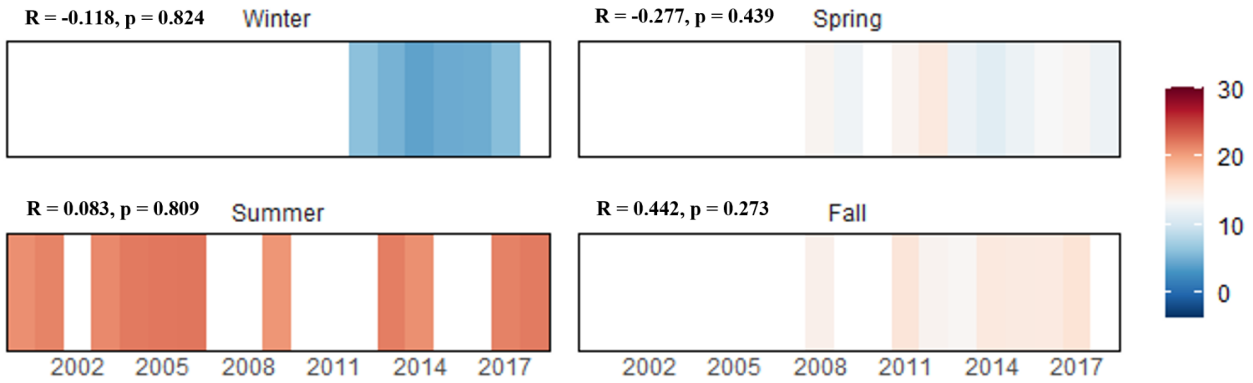
Physical habitat measurements collected at Hoghole Run (2000 to 2017). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = 0.037, p = 0.883	17	18	10	13	16	16	16	15	18	18	17	18	16	17	13	13	17	15	Not sampled (lack of access to the site)		
Epifaunal substrate (0-20)	R = 0.207, p = 0.410	15	18	9	17	15	14	14	16	16	16	16	16	17	16	14	14	17	16			
Velocity/Depth Diversity (0-20)	R = 0.208, p = 0.407	14	14	2	12	13	14	13	14	15	13	15	10	13	13	14	13	14	12			
Pool Quality (0-20)	R = 0.306, p = 0.217	16	15	9	14	14	15	14	14	16	14	13	18	16	17	15	14	16	14			
Riffle Quality (0-20)	R = 0.004, p = 0.986	12	14	0	15	14	16	14	15	16	13	13	7	11	14	12	10	13	12			
Shading (%)	**R = -0.620, p = 0.006**	80	90	96	93	85	90	90	96	75	85	90	80	80	90	45	70	60	75			
Embeddedness (%)	R = -0.147, p = 0.561	40	15	21	35	40	60	45	40	25	20	70	15	20	35	35	40	20	20			
Discharge (cfs)	R = -0.221, p = 0.378	0.38	0.36	0	3.89	0.28	1.18	0.91	0.69	2.71	2.41	0.25	0.1	0.53	0.37	0.39	0.18	0.28	0.63			
Stream Area (m2)	R = 0.375, p = 0.125	260.6	181.9	60.0	262.5	208.1	157.5	204.4	159.4	228.8	191.3	161.3	91.9	243.8	240.0	283.1	249.4	245.6	277.5			

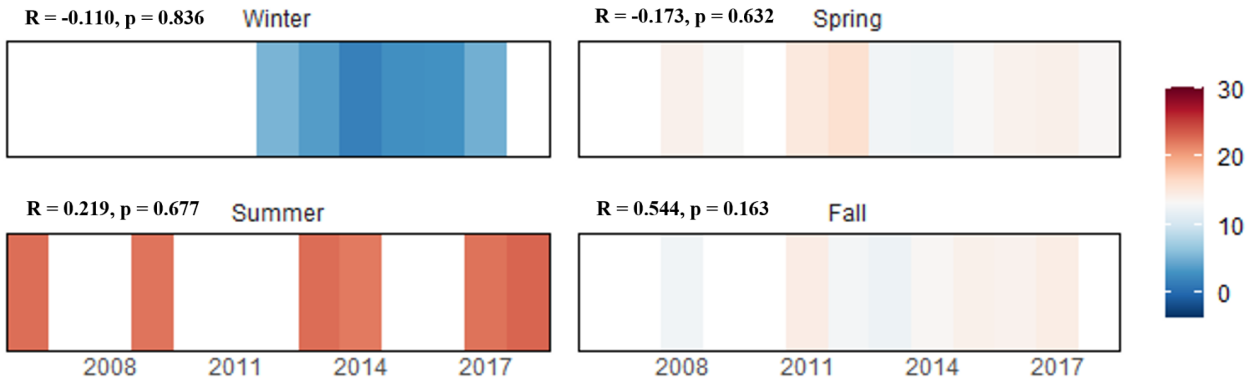
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Hoghole Run (only calculated for summers missing no less than 2 weeks of data).

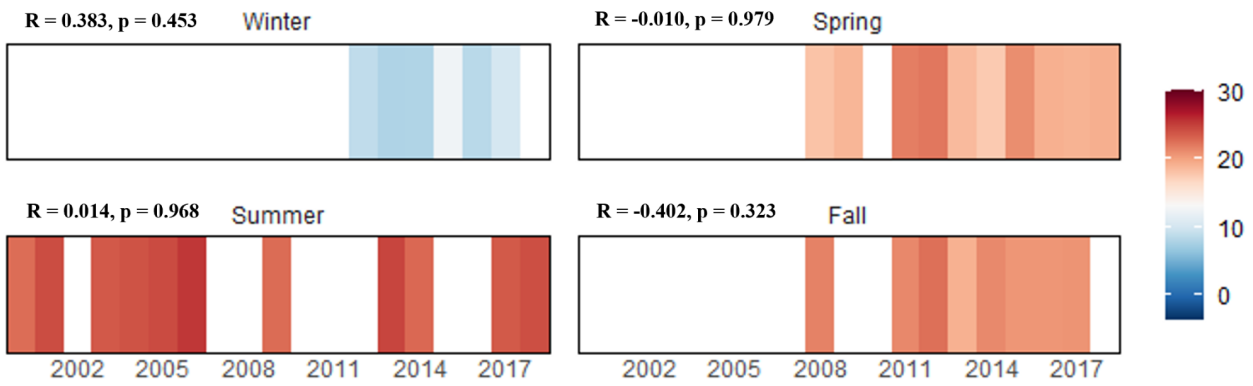
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.190, p = 0.576	71.6	77.7	-	72.2	84.3	85.1	82.0	-	-	65.2	-	-	-	81.6	72.2	-	-	80.5	84.0	-	-
% above 24°C	R = -0.138, p = 0.686	5.3	10.5	-	14.1	17.9	18.9	28.4	-	-	0.2	-	-	-	16.4	1.2	-	-	7.4	16.6	-	-



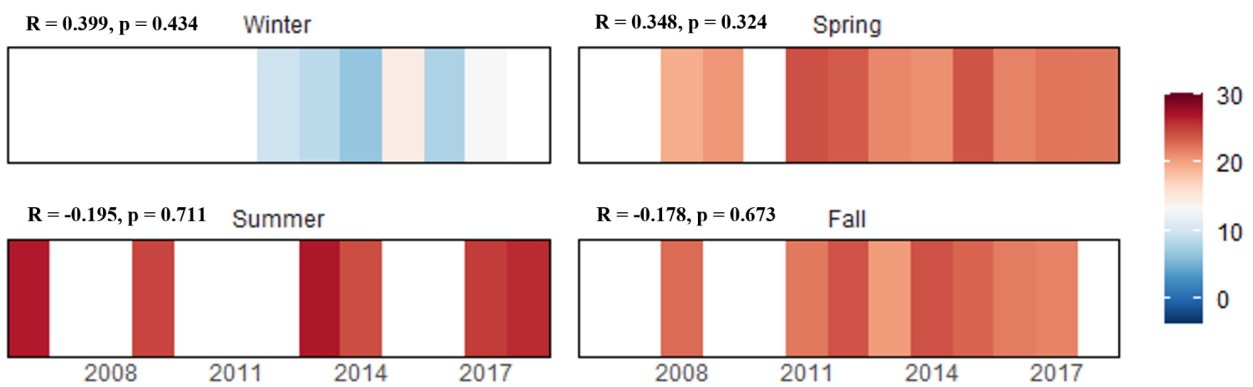
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Hoghole Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Hoghole Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Hoghole Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Hoghole Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
BIBI	R = -0.061, p = 0.805	4.71	4.14	4.71	3.29	4.71	4.71	4.43	4.71	4.14	4.43	4.71	4.43	4.43	3.29	4.14	4.43	3.86	4.43	5.00
# Taxa	R = -0.159, p = 0.515	23	21	27	26	25	25	27	30	30	30	24	24	25	16	20	23	20	29	26
# Ephemeroptera Taxa	R = 0.296, p = 0.218	3	2	5	0	2	3	2	3	1	2	3	2	3	1	2	3	4	5	4
# EPT Taxa	R = 0.370, p = 0.119	9	8	13	10	8	11	10	6	8	10	8	14	10	7	9	11	13	13	13
# Scraper Taxa	R = 0.164, p = 0.503	2	2	5	3	2	5	5	6	4	5	4	3	3	1	3	4	5	6	3
% Climbers	R = 0.084, p = 0.731	2.0	3.8	1.9	0	16.5	6.1	5.0	9.6	3.4	3.2	7.6	2.5	6.3	0	6.1	3.9	0.8	0.7	16.8
% Ephemeroptera	R = -0.241, p = 0.321	26.3	5.7	39.6	0	1.7	30.3	4.2	4.8	3.4	1.6	12.3	2.5	10.8	0.8	7.0	6.2	9.4	15.3	15.0
% Intolerant Urban Taxa	R = 0.287, p = 0.234	48.5	87.7	58.5	60.6	33.9	62.6	60.0	35.6	60.7	33.9	50.9	74.4	52.3	83.7	83.5	64.6	82.0	73.7	52.2

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
FIBI	R = 0.204, p = 0.418	4.33	4.00	4.00	1.00	3.67	4.33	3.67	4.33	3.00	4.00	4.00	4.33	3.67	4.00	3.67	4.33	4.33	3.67	4.33
Abundance per m2	R = -0.442, p = 0.066	1.27	2.43	6.62	0.28	2.67	1.94	1.05	2.08	0.55	0.78	1.97	2.75	0.25	1.13	0.71	1.29	0.81	0.5	1.27
# Benthic Sp. (Adjusted)	R = 0.121, p = 0.631	1.61	1.61	1.61	0	0.54	0.54	0.54	0.54	0.54	1.08	1.61	1.08	0.54	0.54	1.08	1.08	1.08	2.15	1.61
% Abundance of Dominant Species	R = -0.141, p = 0.577	24.7	47.5	35.8	73.0	46.8	29.2	56.7	34.1	42.1	48.3	44.0	35.6	32.8	44.9	41.6	42.2	29.0	43.2	24.7
% Generalists/ Omnivores/ Invertivores	R = -0.206, p = 0.413	97.3	97.7	97.2	100	99.8	99.0	98.6	99.7	97.6	98.7	97.8	97.6	100	99.3	99.5	93.2	97.5	97.8	97.3
% Round-bodied Suckers	**R = 0.807, p < 0.001**	0.9	0.7	1.0	0	0.5	2.3	0.5	1.5	0	2.7	1.6	2.4	6.6	8.1	4.5	5.9	14.0	13.7	0.9

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*
% Tolerant	R = -0.018, p = 0.944	67.5	47.1	72.0	97.3	92.3	68.5	80.0	64.7	71.4	79.2	52.2	77.5	63.9	80.5	74.3	67.1	68.5	75.5	67.5

Fish

Cumulative list of fish species (with abundance) collected in Hoghole Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	2	4	-	2	-	-	1	1	1	2	-	-	1	1	1	8	1	2			
Blacknose Dace	T	58	101	13	17	175	89	32	67	53	72	47	55	8	47	84	136	58	16			
Bluegill	T	2	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-			
Creek Chub	T	71	60	121	1	78	56	18	34	7	6	41	44	9	49	22	15	12	9			
Creek Chubsucker	M	3	3	4	-	3	7	1	5	-	4	5	6	4	22	9	19	28	19			
Eastern Mudminnow	T	61	11	142	54	260	63	122	113	28	40	76	90	20	122	32	31	35	60			
Fallfish	I	7	3	3	-	-	1	2	-	1	-	-	-	-	-	-	-	-	-	Not sampled in summer (lack of access to the site)		
Green Sunfish	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	13	22	12			
Largemouth Bass	T	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-			
Least Brook Lamprey	M	9	10	11	-	1	3	3	-	1	2	4	6	-	2	1	22	5	2			
Pumpkinseed	T	-	-	2	-	-	-	-	-	-	-	-	6	1	-	-	10	-	1			
Rosyside Dace	M	82	210	92	-	39	85	36	110	33	22	140	45	17	28	41	57	29	9			
Sea Lamprey	I	-	-	-	-	-	-	-	1	-	-	3	-	-	-	-	-	-	1			
Tadpole Madtom	M	5	4	1	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1			

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Tessellated Darter	T	5	19	1	-	-	-	-	-	-	-	2	1	1	-	9	11	10	7			
White Sucker	T	27	17	7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Hoghole Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	N	N	N		
Faxonius limosus	D	D	D	D	D	D	D	D	D	D	N	N	N	Not sampled	
Lacunicambarus diogenes	N	N	N	N	D	N	N	D	D	N	N	N	N		

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Hoghole Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Hoghole Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Fowler's toad, Eastern cricket frog, Northern green frog, Northern spring peeper, Pickerel frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-spotted newt, Northern dusky salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Eastern wormsnake, Northern watersnake, Little brown skink

Order (Common)	*Species*
Testudines (Turtles)	Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Hoghole Run by sampling year, RA = % Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.9	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	1.0	1.7	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	0.9	-	0.9	0.8	-	2.5	-	1.7	0.8	-
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	0.8	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	6.1	-	-	-	-	-	-	1.9	-	0.8	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	1.7	-	1.7	5.8	3.4	10.5	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	2.4	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	2.0	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	1.7	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	2.5	1.0	-	0.8	0.9
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	7.1	6.6	1.9	3.7	-	12.1	4.2	1.9	-	-	1.9
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	1.0	-	-	0.9	-	1.0	-	2.9	-	-	1.9
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	1.9	0.9	-	-	-	-	1.9	0.9	-	-
Arthropoda	Collembola	na	na	M	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	1.0	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	0.9	-	-	-	-	1.7	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	0.9	-	-	0.8	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	1.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	1.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	4.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	2.0	1.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	1.7	0.8	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	3.0	0.9	-	1.8	-	1.0	7.5	1.0	2.6	0.8	3.8
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	1.7	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	2.8	-	-	3.3	5.8	5.1	6.5	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	1.9	-	-	-	-	0.8	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	1.9	-	-	3.0	0.8	1.0	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	4.7	0.9	2.5	-	5.0	3.8	10.3	33.9	3.8
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	1.7	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	5.7	-	13.2	3.0	0.8	17.3	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	2.5	-	-	7.7	-	-	6.6

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.9	-	-	8.3	1.0	-	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	0.9	-	-	3.3	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Stempellina	M	2.0	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	0.9	-	-	-	1.0	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	0.9	-	-	-	-	0.9	5.6	-
Arthropoda	Diptera	Chironomidae	Synorthocladius	M	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.9	-	13.2	1.0	0.8	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	11.6	2.0	0.8	2.9	0.9	0.8	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	1.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	0.9	-	-	-	-	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	3.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	56.6	2.8	30.3	-	-	1.7	1.0	17.1	-	-
Arthropoda	Diptera	Simuliidae	na	M	2.0	-	-	-	-	-	4.2	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	16.2	1.9	3.8	-	3.3	4.0	1.7	6.7	0.9	-	23.6
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	1.9	-	7.3	-	-	-	-	0.9	0.8	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	0.9	-	-	1.0	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	2.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.0	-	-	-	2.5	-	0.8	-	-	0.8	1.9
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	0.9	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	1.0	-	-	0.9	-	-	-	-	1.7	-	2.8
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	3.4	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	12.1	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	1.0	2.8	22.6	-	-	21.2	2.5	-	-	-	4.7
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	13.1	2.8	6.6	-	0.8	1.0	-	1.9	-	-	2.8
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-	2.8
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	1.9	-	0.8	-	-	1.9	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	7.5	-	-	8.1	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	0.9	-	-	-	-	-	-	-	1.9
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	1.7	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	0.8	-	-	1.9	1.7	1.6	0.9
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	2.0	-	1.0	-	0.8	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	5.5	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	0.9	-	-	-	-	2.6	2.4	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Chloroperlidae	na	I	4.0	1.9	13.2	0.9	10.7	2.0	2.5	-	-	0.8	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	5.1	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	9.1	-	0.9	-	9.9	4.0	-	1.0	3.4	-	3.8
Arthropoda	Plecoptera	Leuctridae	na	I	-	0.9	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	6.1	4.7	3.8	4.6	-	12.1	35.0	14.4	17.1	7.3	19.8
Arthropoda	Plecoptera	Nemouridae	na	I	-	6.6	-	5.5	-	-	-	-	2.6	4.0	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	4.7	14.7	-	-	5.0	-	3.4	4.0	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	5.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	0.9	0.9	-	-	-	-	3.4	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	2.0	-	1.9	0.9	-	1.0	4.2	3.8	-	-	8.5
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.9	-	1.8	-	-	1.7	-	0.9	0.8	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	5.5	-	-	0.8	-	0.9	1.6	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	3.0	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	0.9	-	-	-	2.0	-	-	-	-	0.9
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	0.8	1.0	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	0.9	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	0.9	-	1.7	2.0	3.3	-	2.6	2.4	0.9

PHYLUM	ORDER	FAMILY	GENUS	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	1.0	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	0.9	-	0.8	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	1.0	-	-	-	0.8	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrate Continued

PHYLUM	ORDER	FAMILY	GENUS	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-		
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-		
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	0.8	0.9	-	-	-	-		
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	-		
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	0.8	-	-		
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-		
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	0.9	-	0.9	-	-	-	-		
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	-	0.8	0.8	0.7	7.1		
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	Not sampled (lack of access to the site)	
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	1.8	-	-	-	-	-	-		
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-		
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-		
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-		
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	0.8	-	0.7	-		
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.5	-	-	-	-	-	0.7	0.9		
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	2.3	0.7	1.8		

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	0.7	-		
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	0.8	0.8	0.7	-		
Arthropoda	Collembola	na	na	M	-	-	-	-	-	-	-	-		
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	0.9	1.5	0.8	-	-		
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	0.8	-	-	-		
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	0.7	-		
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	0.7	-		
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.7	1.8	0.8	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	1.8	-	0.9	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Micropsectra	I	0.8	0.9	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	1.5	-		
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.8	9.0	0.8	1.7	0.8	-	2.9	8.0		

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	0.8	-	-	-		
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	0.9	-	0.9	-	-	-	5.3		
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	1.8	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.8	5.4	-	0.9	-	-	-	15.0		
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	0.7	-		
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	6.3	-	-	-	-	-	1.8		
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.7	-	-	-	-	-	-	1.8		
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	0.8	-	-	-		
Arthropoda	Diptera	Chironomidae	Synorthocladius	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	0.7	-		
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	0.9		
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	0.8	-	0.8	-	-	-		
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	0.9	-	-	-	-	-	-		
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	0.7	-		
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	0.8	-	-	-		
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	0.8	-	-	-	-	-		

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	0.9	-	-	-	-		
Arthropoda	Diptera	Empididae	na	T	-	-	1.6	-	-	-	-	-		
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Simuliidae	Prosimulium	I	16.5	-	55.3	29.6	30.8	4.7	5.1	8.0		
Arthropoda	Diptera	Simuliidae	na	M	0.8	0.9	-	-	-	0.8	-	-		
Arthropoda	Diptera	Simuliidae	Simulium	M	-	9.0	6.5	1.7	-	10.2	6.6	8.8		
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.8	-	-	-	-	-	0.7	10.6		
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	0.8	-	-	-		
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-		
Arthropoda	Diptera	Tipulidae	Tipula	M	-	1.8	1.6	-	-	-	0.7	-		
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	0.9	2.3	0.8	0.7	-		
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-		
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	6.3	-	-	-	-	4.4	12.4		
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	-	-	0.7	-		
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	1.7	-	-	-	-	-	-	-		
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	0.9	0.8	6.1	0.8	7.0	4.4	-		
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	1.5	-	-	0.9		
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	3.6	-	-	1.5	0.8	-	0.9		

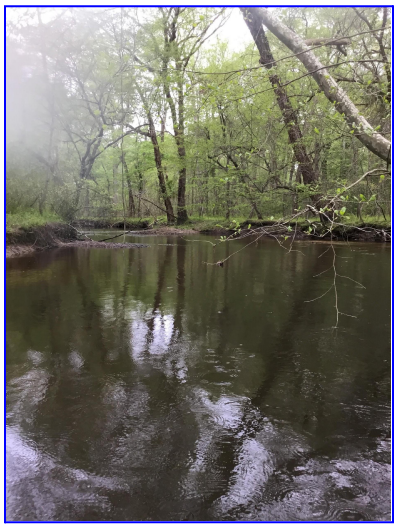
					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	5.1	-		
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-		
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.8	-	-	-	-	0.8	-	0.9		
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	-	-		
Arthropoda	Isopoda	Asellidae	Caecidotea	I	0.8	6.3	-	0.9	-	-	0.7	3.5		
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-		
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-		
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-		
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	0.9	-	-	-	-	-	-		
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	0.8	-	-	-	-	-	-	-		
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	6.2	-	-	-		
Arthropoda	Plecoptera	Chloroperlidae	na	I	5.8	-	1.6	-	-	0.8	0.7	-		
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	0.9	-	-	-	-	-	1.8		
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.8	-	2.6	0.8	2.3	-	-		
Arthropoda	Plecoptera	Leuctridae	na	I	0.8	-	-	-	0.8	-	-	1.8		
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	14.9	27.9	17.1	36.5	13.8	46.9	38.0	1.8		
Arthropoda	Plecoptera	Nemouridae	na	I	4.1	-	-	0.9	2.3	-	-	-		
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-		
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	15.7	-	-	-	10.8	0.8	8.0	0.9		
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	0.9		
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-		
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	1.7	-	-	-	-	-	2.2	-		
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	6.6	4.5	1.6	-	0.8	11.7	5.1	0.9		
Arthropoda	Plecoptera	Perlodidae	na	I	1.7	-	0.8	-	0.8	-	2.2	-		
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-		

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*GENUS*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	1.7	-	2.4	2.6	7.7	0.8	0.7	-		
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	1.8	-	-	-	-	-	1.8		
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.7	0.9	-	-	-	-	0.7	0.9		
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	-	-	-		
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-		
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	0.9		
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-		
Arthropoda	Trichoptera	Limnephilidae	na	M	0.8	-	-	4.3	0.8	-	-	-		
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	0.8	-	-	-		
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	0.8	-	-	2.6	-	0.8	-	-		
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-		
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	4.9	-	-	0.8	-	-		
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	12.4	0.9	1.6	3.5	8.5	4.7	0.7	-		
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	-		
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	-	-	-	-		
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-		

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Mattawoman Creek (MATT-033-S)

Site MATT-033-S is located on Mattawoman Creek in the Coastal Plain – western shore region of Maryland. It is in the Mattawoman Creek watershed in Charles County. This site was sampled in 1995 and from 2000 to 2020.



Mattawoman Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	65.44	64.25	61.61	60.52	58.99	58.70	58.41
Urban	23.55	23.55	25.94	25.94	27.88	27.88	28.55
Agriculture	8.11	8.04	7.81	7.86	7.69	7.72	7.62
Other	2.90	4.16	4.64	5.69	5.44	5.69	5.42

Water Chemistry

Water chemistry measurements collected at Mattawoman Creek (1995, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	**R = 0.692, p = 0.001**	6.60	6.73	6.72	6.58	6.46	6.95	6.96	7.07	6.87	6.75	6.83	7.01	6.77
Specific Conductance (µS/cm)	R = 0.170, p = 0.463	125.2	95.5	191.4	185.9	160.0	115.7	130.7	160.4	148.0	132.4	290.4	152.8	144.4
Acid Neutralizing Capacity (µeq/L)	**R = 0.760, p < 0.001**	107.9	170.2	110.3	136.2	77.5	250.5	173.1	194.6	163.3	146.3	191.4	261.8	158.4
Dissolved Organic Carbon (mg/L)	R = 0.261, p = 0.253	4.000	7.000	3.500	6.000	3.700	7.800	6.106	4.480	4.775	4.957	4.791	5.927	6.060
Chloride (mg/L)	R = 0.036, p = 0.879		15.30	39.99	35.52	34.81	20.70	23.52	30.10	28.21	22.04	66.55	26.54	25.57
Sulfate (mg/L)	R = -0.317, p = 0.162	12.84	9.47	11.13	14.34	16.21	8.09	10.289	13.60	11.05	14.47	13.35	9.49	11.97
Total Nitrogen (mg/L)	R = -0.027, p = 0.910		0.947	0.191	0.348	0.448	0.606	0.428	0.240	0.457	0.429	0.374	0.562	0.507
Nitrate-Nitrogen (mg/L)	**R = -0.443, p = 0.044**	0.2400	0.1370	0.1150	0.1220	0.2470	0.1930	0.2253	0.0519	0.2143	0.1228	0.0539	0.1829	0.2212
Nitrite-Nitrogen (mg/L)	R = 0.414, p = 0.070		0*	0.0014*	0.0020	0.0004*	0.0057	0.0023	0.0023	0.0029	0.0019*	0.0019*	0.0038	0.0030
Ammonia-Nitrogen (mg/L)	R = 0.234, p = 0.321		0.0692	0.0105	0.0097	0.0050	0.0738	0.0180	0.0065	0.0148	0.0076	0.0094	0.0243	0.0099
Total Phosphorus (mg/L)	R = 0.071, p = 0.766		0.0380	0.0210	0.0770	0.0170	0.0580	0.0390	0.0250	0.0291	0.0261	0.0305	0.0544	0.0267
Ortho-phosphate (mg/L)	**R = 0.636, p = 0.003**		0*	0.0007*	0.0056	0.0007*	0.0060	0.0039	0.0032	0.0021	0.0030	0.0044	0.0060	0.0044
Bromide (mg/L)	R = 0.487, p = 0.267													
Magnesium (mg/L)	R = -0.243, p = 0.642											3.066		
Calcium (mg/L)	R = 0.022, p = 0.967											9.246		
Copper (µg/L)	R = -0.608, p = 0.200													
Zinc (µg/L)	R = -0.663, p = 0.151													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.97	6.86	7.13	6.95	7.16	7.21	6.94	6.96	
Specific Conductance (µS/cm)	108.5	119.5	167.3	190.8	187.4	177.1	161.3	131.6	
Acid Neutralizing Capacity (µeq/L)	212.8	181.5	254.5	274.1	318.9	301.6	209.2	411.4	
Dissolved Organic Carbon (mg/L)	5.667	3.196	6.399	6.560	5.620	5.007	5.181	8.075	
Chloride (mg/L)	18.05	22.12	32.76	38.66	37.67	33.24	30.51	20.83	
Sulfate (mg/L)	9.90	12.81	10.19	10.85	10.29	11.01	11.95	7.65	
Total Nitrogen (mg/L)	0.511	0.390	0.484	0.512	0.319	0.308	0.357	0.798	Not sampled due to COVID-19 Pandemic
Nitrate-Nitrogen (mg/L)	0.1745	0.1315	0.1096	0.1211	0.0193	0.0214	0.1226	0.1511	
Nitrite-Nitrogen (mg/L)	0.0025	0.0037	0.0020	0.0036	0.0008*	0.0022*	0.0022*	0.0098	
Ammonia-Nitrogen (mg/L)	0.0195	0.0066	0.0359	0.0273	0.0089	0.0073	0.0090	0.2223	
Total Phosphorus (mg/L)	0.0353	0.0230	0.0429	0.0422	0.0332	0.0301	0.0169	0.0886	
Ortho-phosphate (mg/L)	0.0042	0.0030	0.0066	0.0048	0.0042	0.0051	0.0062	0.0143	
Bromide (mg/L)		0.0275	0.0377	0.0318	0.0431	0.0411	0.0292	0.0447	
Magnesium (mg/L)			2.496	2.561	2.654	2.756	2.237	2.51	
Calcium (mg/L)			6.767	7.887	7.986	8.821	7.033	7.175	
Copper (µg/L)			1.476	0.643	0.554	0.528	0.636	0.667	
Zinc (µg/L)			4.586	5.152	3.056	2.707	4.171	2.578	

Physical Habitat

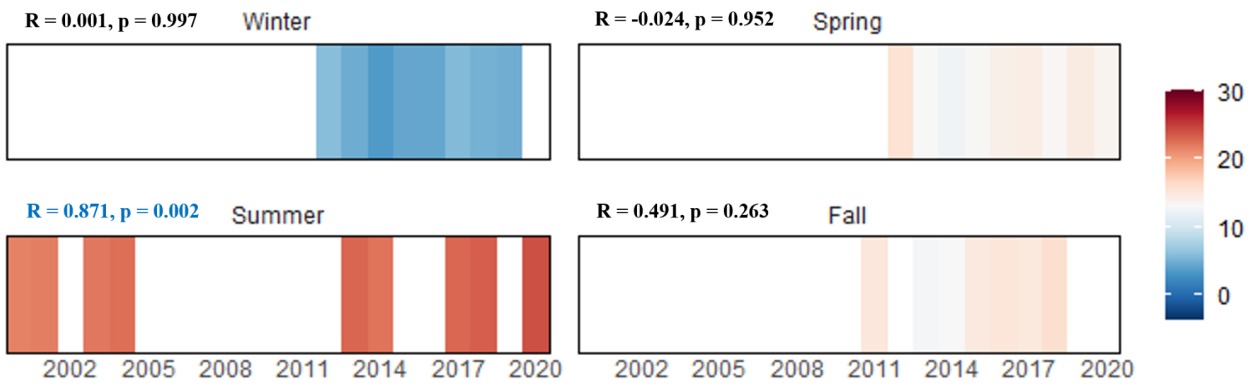
Physical habitat measurements collected at Mattawoman Creek (1995, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.003, p = 0.989	15	19	13	13	18	16	13	16	16	15	16	14	16	12	17	15	11	16	18	16	15	16
Epifaunal substrate (0-20)	R = 0.258, p = 0.246	14	18	3	11	17	16	6	13	14	13	14	14	15	13	15	11	12	15	17	17	14	15
Velocity/Depth Diversity (0-20)	R = 0.009, p = 0.967	17	17	8	6	15	15	10	10	10	13	11	13	5	6	7	9	7	15	16	15	13	18
Pool Quality (0-20)	R = 0.400, p = 0.065	15	12	14	12	19	16	16	17	17	18	14	17	17	16	18	18	15	17	18	16	16	16
Riffle Quality (0-20)	R = 0.122, p = 0.590	16	13	0	0	14	15	0	0	0	12	6	12	0	0	0	0	0	14	15	16	14	16
Shading (%)	**R = -0.539, p = 0.010**	80	85	90	91	90	85	90	85	88	80	80	85	85	80	65	65	25	60	75	55	85	75
Embeddedness (%)	R = 0.412, p = 0.057	40	35	40	35	5	15	30	40	40	35	15	40	35	40	70	75	40	35	55	45	70	25
Discharge (cfs)	R = 0.088, p = 0.696	8.28	5.51	0	0	18.89	9.19	0	0	0	3.27	0.47	12.67	0	0	0	0.02	0.01	3.15	11.07	13.27	1.54	16.50
Stream Area (m2)	R = 0.203, p = 0.366	710.6	646.9	442.0	233.8	693.8	555.0	243.0	291.5	266.5	639.4	705.0	757.5	502.5	305.6	388.1	483.8	450.0	626.3	736.9	772.5	585.0	678.8

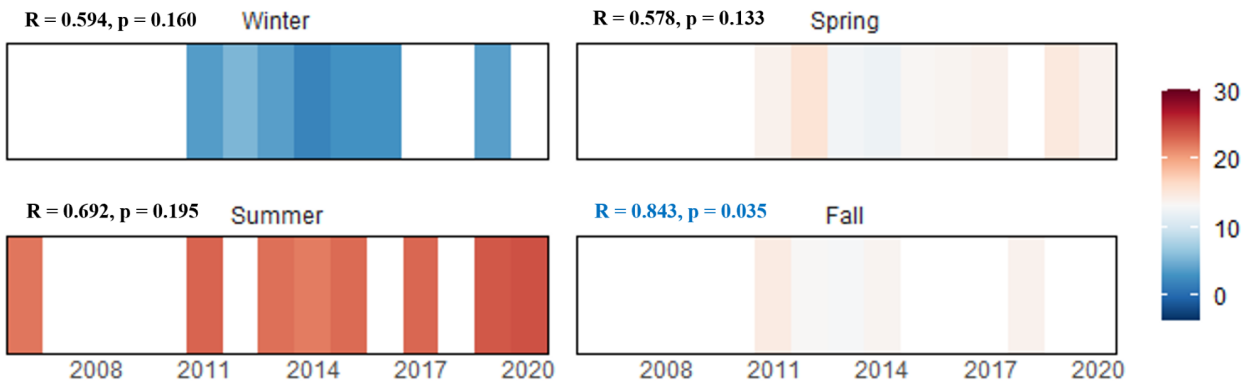
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Mattawoman Creek (only calculated for summers missing no less than 2 weeks of data).

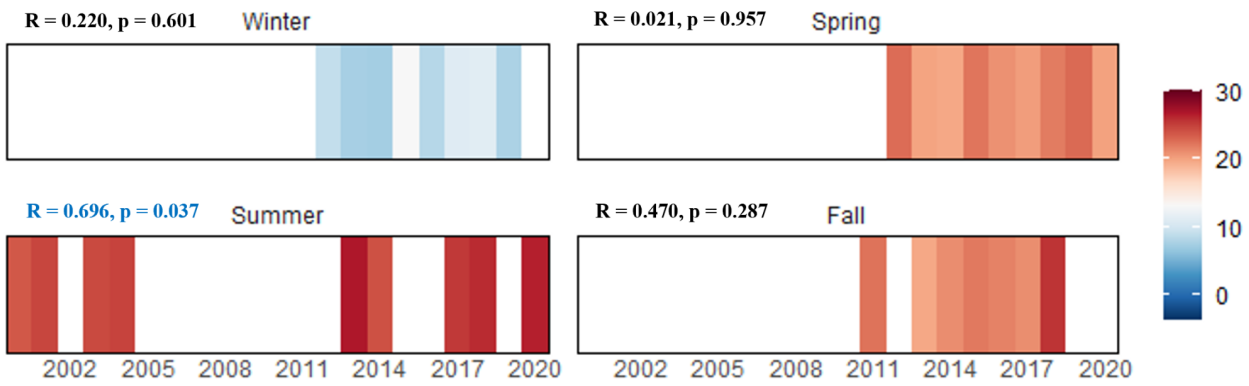
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.821, p = 0.007**	85.7	83.1	-	81.6	90.6	-	-	-	-	-	-	-	-	91.6	92.4	-	-	89.0	93.3	-	95.1
% above 24°C	**R = 0.823, p = 0.006**	10.0	11.1	-	24.9	22.2	-	-	-	-	-	-	-	-	32.0	15.9	-	-	39.3	43.1	-	62.6



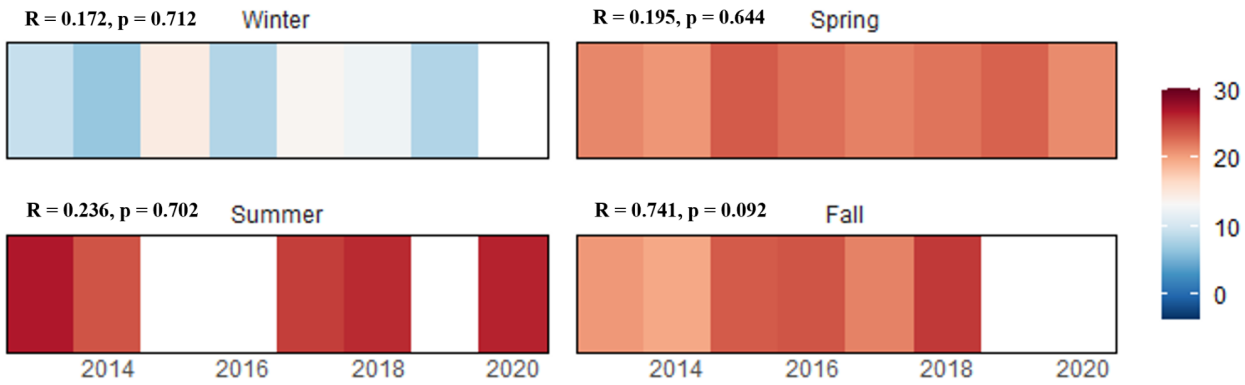
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Mattawoman Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Mattawoman Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Mattawoman Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Mattawoman Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.400, p = 0.065	2.71	3.86	3.86	4.14	3.00	4.43	4.14	4.71	5.00	4.43	4.71	5.00	4.71	4.71	3.57	4.43	5.00	4.43	3.00	4.43	4.71	4.43
# Taxa	R = 0.344, p = 0.117	12	15	23	32	15	19	21	27	23	24	23	22	20	27	15	18	26	22	16	21	33	28
# Ephemeroptera Taxa	R = 0.237, p = 0.288	0	3	1	2	0	5	3	6	7	2	3	5	4	5	2	2	5	2	0	2	6	4
# EPT Taxa	R = 0.408, p = 0.059	6	6	11	8	8	11	9	13	12	9	10	7	11	11	11	12	12	10	7	8	16	10
# Scraper Taxa	**R = 0.428, p = 0.047**	1	1	4	4	1	3	3	5	4	2	6	2	3	6	0	2	3	1	4	4	9	8
% Climbers	R = 0.293, p = 0.186	1.5	0.9	0.8	1.6	2.7	2.3	6.6	9.6	8.7	10.2	16.0	8.0	20.4	5.4	4.0	1.7	22.8	3.5	0.8	12.6	9.5	0.9
% Ephemeroptera	R = 0.268, p = 0.229	0	52.6	1.7	1.6	0	21.7	13.2	10.4	12.2	8.3	15.0	46.0	12.4	12.5	3.2	31.9	15.8	29.8	0	5.4	32.0	46.4
% Intolerant Urban Taxa	R = -0.113, p = 0.617	94.0	38.6	42.0	26.6	74.3	38.0	18.9	48.7	49.6	27.8	15.0	36.0	48.7	52.7	75.0	61.2	30.7	41.2	74.8	58.6	21.3	41.1

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.108, p = 0.633	3.67	3.33	3.67	3.67	3.67	4.67	3.00	2.33	2.67	3.00	3.33	3.67	3.00	4.00	3.67	3.67	4.67	3.67	3.33	3.33	3.67	3.67
Abundance per m2	R = -0.118, p = 0.600	0.69	1.07	0.7	0.26	0.57	0.77	0.63	0.36	0.32	0.42	0.29	0.76	0.25	1.04	1.3	1.41	1.01	0.25	0.29	0.27	0.37	0.34
# Benthic Sp. (Adjusted)	R = 0.204, p = 0.361	0.9	0.67	0.67	0.22	0.45	0.67	0.67	0.45	0.45	0.45	0.22	0.67	0.9	0.67	0.45	0.9	0.9	0.45	0.45	0.67	0.9	0.9
% Abundance of Dominant Species	R = -0.286, p = 0.196	51.4	63.9	33.8	26.7	21.4	29.3	51.3	52.9	55.8	39.3	35.0	62.9	41.3	34.2	40.3	46.0	39.9	35.5	26.1	40.7	36.6	23.9
% Generalists/ Omnivores/ Invertivores	**R = -0.534, p = 0.010**	97.1	98.9	93.3	93.3	85.2	88.7	93.4	100	95.4	97.8	94.2	94.1	92.9	93.4	96.1	93.5	74.1	91.0	92.4	52.6	86.6	71.4

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	R = -0.256, p = 0.250	0.8	0	0.6	6.7	0	0.5	0	0	0	0	0.5	0.2	0.8	0.3	0.6	1.3	0.4	0	0.5	0	0	0
% Tolerant	R = -0.138, p = 0.540	36.1	90.5	89.1	76.7	69.9	61.7	82.2	85.6	87.2	88.0	80.6	89.2	89.7	69.0	87.4	84.6	67.8	65.2	81.5	42.1	67.6	48.3

Fish

Cumulative list of fish species (with abundance) collected in Mattawoman Creek by year.

Species	*Tolerance*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Alewife	M	-	-	-	-	-	39	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
American Eel	M	35	26	5	2	20	18	5	1	3	23	19	10	3	27	12	20	11	8	14	19	31	18
American Shad	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	6	-	-	-	-	85	7	56
Black Crappie	M	2	-	-	-	-	-	-	-	-	-	-	-	-	-	20	3	-	-	-	1	3	-
Blacknose Dace	T	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bluegill	T	81	25	56	5	31	27	15	13	7	42	59	361	52	109	101	313	182	55	33	7	27	23
Bluespotted Sunfish	M	-	8	8	-	-	10	3	1	-	1	1	9	-	16	-	2	1	1	-	-	-	-
Brown Bullhead	T	6	18	3	2	13	36	12	1	5	5	-	5	21	30	1	4	61	21	26	12	4	11
Chain Pickerel	M	8	3	7	4	6	6	3	-	4	4	4	1	3	9	3	25	9	8	14	9	7	9
Channel Catfish	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	2
Creek Chub	T	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek Chubsucker	M	4	-	2	4	-	2	-	-	-	-	1	1	1	1	3	9	2	-	1	-	-	-
Eastern Mosquitofish	M	-	16	-	1	-	3	-	10	-	-	-	4	-	9	3	15	1	-	-	3	5	11
Eastern Mudminnow	T	10	20	49	16	67	11	3	2	12	55	19	14	2	8	41	75	7	4	2	2	1	-

Species	*Tolerance*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Eastern Silvery Minnow	M	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gizzard Shad	M	-	-	-	-	-	-	-	-	-	-	6	8	-	-	-	-	-	-	-	-	-	-
Golden Shiner	T	-	-	-	-	-	-	-	-	-	-	-	5	-	-	4	-	-	-	-	-	-	-
Green Sunfish	T	-	1	-	-	2	1	-	-	-	5	9	1	-	-	-	29	2	2	2	1	7	1
Largemouth Bass	T	-	-	9	-	51	-	-	-	-	2	2	22	2	10	11	11	20	6	1	3	7	-
Least Brook Lamprey	M	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-	1	1	-	-	-	2	-
Lepomis Hybrid	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	1	1	1
Longnose Gar	M	-	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Margined Madtom	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Pirate Perch	T	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumpkinseed	T	16	443	49	8	41	58	17	18	3	21	5	57	13	12	42	49	10	2	51	17	18	45
Redbreast Sunfish	M	1	-	-	-	-	-	-	-	-	-	-	-	-	3	-	4	-	1	-	1	3	6
Redfin Pickerel	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	1	-	1	-
Rosyside Dace	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-
Sea Lamprey	I	2	5	5	-	-	2	7	-	-	-	-	3	3	1	-	1	88	-	-	1	4	1
Spotfin Shiner	I	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Spottail Shiner	I	252	2	-	3	84	54	-	-	-	-	-	15	-	13	2	-	-	-	-	-	-	-
Striped Bass	M	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tadpole Madtom	M	3	5	2	-	1	24	9	3	1	2	-	3	2	14	1	2	8	1	1	1	3	3
Tessellated Darter	T	59	116	105	15	69	125	78	55	48	105	72	47	23	51	204	87	21	11	55	46	79	29

Species	*Tolerance*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Warmouth	M	2	-	4	-	1	1	-	-	-	-	-	2	-	4	2	10	9	2	4	-	-	4
White Catfish	M	-	-	-	-	4	-	-	-	-	1	7	3	-	-	2	2	-	-	-	-	-	-
White Perch	M	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	3	2
White Sucker	T	2	2	6	-	-	5	-	-	-	-	-	-	-	-	38	5	6	-	1	-	2	4
Yellow Bullhead	M	-	1	1	-	1	3	-	-	3	1	2	-	-	1	6	8	13	4	5	-	-	7
Yellow Perch	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	29	-	-	1	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Mattawoman Creek by sampling year.

Species	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Faxonius limosus	D	D	D	D	D	D	N	D	N	N	N	N	N	D
Lacunicambarus diogenes	N	N	D	N	N	N	D	N	N	N	N	N	N	N
Procambarus clarkii	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Procambarus sp.	N	D	N	D	N	D	N	N	N	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Mattawoman Creek by sampling year.

Species	*1995*	*2002*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Corbicula fluminea	N	D	D	D	N	D	D	D	D	D	D	D	N	N	N	D	D	D
Elliptio complanata	D	N	N	N	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Herpetofauna

Cumulative list of herpetofauna species collected in or near the Mattawoman Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Eastern cricket frog, Fowler's toad, Gray treefrog, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Upland chorus frog
Caudata (Salamanders and Newts)	Marbled salamander, Northern two-lined salamander, Spotted Salamander
Squamata (Snakes and Lizards)	Common five-linked skink, Eastern garter snake, Eastern rat snake, Northern watersnake, Northern black racer
Testudines (Turtles)	Eastern box turtle, Eastern painted turtle, Eastern snapping turtle, Stinkpot

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Mattawoman Creek by sampling year, RA = %Relative Abundance

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	0.9	-	1.6	-	-	0.9	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	0.8	1.8	-	7.8	0.9	1.6	-	-	2.6	12.0	1.0	-
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	7.0	-	-	-	-	-	-	1.0	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	3.1	-	-	0.9	-	-	0.9	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-	-	5.0
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	4.4	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	0.8	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	-	-	-	-	-	-	-	-	-	-	2.0
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-	-	3.0

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	1.8	10.1	2.3	9.7	7.8	46.2	20.9	28.7	-	5.0	1.0
Arthropoda	Coleoptera	Hydrophilidae	Sperchopsis	M	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	na	na	M	-	-	-	3.1	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	2.5	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	1.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	1.8	5.0	0.8	-	-	-	0.9	-	-	7.0	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	21.1	-	-	-	7.0	-	8.3	13.0	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	0.8	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	0.8	-	-	-	-	-	0.9	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	0.9	-	1.6	1.8	-	-	0.9	-	0.9	6.0	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.8	-	-	10.9	-	-	-	1.7	2.6	1.9	8.0	1.0
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	-	-	0.8	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	1.6	-	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	0.8	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	0.8	-	-	-	0.9	-	1.7	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	0.9	1.0	-
Arthropoda	Diptera	Chironomidae	Smittia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	0.9	1.7	1.7	-	1.0	2.0
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	0.8	-	-	-	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	0.8	-	-	-	-	-	-	1.0	2.0
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	0.9	-	-	-	-	1.9	0.9	3.5	-	-	1.0
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	1.9	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	1.7	-	-	-	-	2.6	-	11.1	2.0	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	0.8	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	0.8	0.8	-	2.3	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	81.2	-	31.9	4.7	63.7	-	-	11.3	-	4.6	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Simuliidae	Simulium	M	-	10.5	-	-	0.9	22.5	1.9	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	1.6	0.9	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	0.8	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	0.8	-	-	-	3.5	0.9	0.9	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	36.8	-	-	-	6.2	-	-	-	-	-	19.0
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	1.6	3.8	-	2.6	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	1.7	-	-	-	-	0.9	-	-	1.0	3.0
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	-	-	-	-	-	-	-	-	0.9	-	-	1.0
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-	15.0
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Attenella	I	-	14.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Dannella	I	-	-	-	-	-	-	-	-	-	-	-	6.0
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	0.9	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	0.8	-	-	-	1.7	4.3	-	3.0	-
Arthropoda	Ephemeroptera	Ephemerellidae	Timpanoga	I	-	-	-	-	-	12.4	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	0.8	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	0.8	6.6	-	1.7	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	1.7	-	-	-	1.0
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	2.8	1.7	-	7.4	11.0	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	8.8	-	1.6	1.8	1.6	-	-	-	-	-	21.0
Arthropoda	Lepidoptera	Noctuidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Basiaeschna	M	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Odonata	Corduliidae	na	I	-	-	-	-	-	-	-	-	0.9	-	-	2.0
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	7.9	0.8	-	-	-	-	0.9	1.7	4.6	1.0	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	1.8	-	-	3.5	-	5.6	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	5.3	-	5.5	-	10.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	0.8	-	-	0.9	1.7	-	-	1.0	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	0.8	-	-	-	3.5	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	0.9	1.7	1.6	3.5	10.9	8.5	24.3	38.3	15.7	8.0	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	-	3.1	0.9	-	3.8	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	9.8	-	2.5	3.1	0.9	-	-	-	0.9	-	3.0	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	7.6	-	5.3	-	-	4.3	-	14.8	7.0	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	0.8	-	-	0.8	0.9	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Padunia		-	-	-	-	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Glossosomatidae	Protoptila	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	17.6	-	-	11.6	11.3	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	5.9	-	-	3.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Leptoceridae	Ceraclea	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	0.8	0.9	-	0.9	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	0.8	-	-	0.9	-	-	-	13.0	1.0
Arthropoda	Trichoptera	Limnephilidae	na	M	1.5	-	0.8	-	2.7	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	1.6	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	1.5	-	-	-	-	-	-	0.9	0.9	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	0.8	-	-	-	0.9	-	-	-	1.0	-
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	-	0.9	3.0	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	0.8	-	-	-	0.9	-	-	1.0	-
Mollusca	Veneroida	Corbiculidae	Corbicula	M	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Nematoda	na	na	na		-	-	-	-	-	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	0.8	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Spirosperma	M	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	1.2	2.7
Arthropoda	Amphipoda	Hyalellidae	Hyalella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	0.9	-	0.9
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	0.6	0.9
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	1.2	0.9
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	-	-	-	-	-	-	3.6	0.9
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	1.8	0.9	-	1.7	4.4	7.0	1.7	9.0	13.0	7.1
Arthropoda	Coleoptera	Hydrophilidae	Sperchopsis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	0.9	-	-	1.8	0.9	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	2.4	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	0.9	-	-	-	-	-	-	3.0	0.9
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	2.7	-	-	-	-	-	0.9	-	0.9
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	0.9	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.9	-	-	1.8	-	2.5	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	4.4	0.9	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	-	5.4
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	1.8	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	2.7	-	6.5	-	-	1.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.9	8.9	-	-	0.9	4.4	0.8	-	2.4	0.9
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	0.6	0.9
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	1.8	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.9	-	0.9	1.8	-	-	-	7.7	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	1.2	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	0.9	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	0.9	6.3	-	-	-	-	0.8	0.9	1.8	-
Arthropoda	Diptera	Chironomidae	Smittia	M	-	-	0.8	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Stempellinella	M	2.7	-	-	-	7.0	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	1.8	-	-	-	0.9	-	1.8	-	0.9
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	2.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	4.4	-	-	-	1.2	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	8.0	-	4.8	-	-	0.9	0.8	0.9	-	0.9
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	0.8	-	-	-	65.5	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	7.8	1.8	1.8	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.9	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	5.3	-	0.8	-	0.9	0.9	-	3.6	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	1.8	5.4	-	-	1.8	-	-	-	1.2	-
Arthropoda	Ephemeroptera	Baetidae	na	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	0.9	2.7	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	5.3	9.8
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	24.1	-	28.9	-	-	17.8	18.8
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	0.9	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Ephemerellidae	Attenella	I	-	-	-	7.8	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Dannella	I	-	-	-	-	-	-	-	-	1.8	17.0
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	4.4	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Timpanoga	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	0.9	-	-	-	-	-	-	1.2	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	2.7	-	-	-	-	-	-	4.7	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	3.5	0.9	2.4	-	7.9	-	-	1.8	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.9	3.2	0.9	0.9	-	-	6.3	1.2	3.6
Arthropoda	Lepidoptera	Noctuidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Aeshna	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Basiaeschna	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Corduliidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Corduliidae	Somatochlora	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	0.9	-	-	-	-	0.6	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	0.8	0.9	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	1.8	8.0	30.6	40.5	9.6	15.8	5.0	1.8	-	0.9
Arthropoda	Plecoptera	Nemouridae	na	I	2.7	-	0.8	-	-	-	-	1.8	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	1.8	-	-	1.8	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	4.4	3.6	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	4.4	-	3.2	-	-	3.5	-	-	1.8	8.0
Arthropoda	Plecoptera	Perlidae	na	I	4.4	-	-	0.9	-	1.8	-	0.9	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	26.5	31.3	33.9	6.9	10.5	14.9	0.8	38.7	3.0	7.1
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.9	-	-	-	2.6	-	3.6	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	8.8	8.0	8.9	-	7.0	4.4	15.1	8.1	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	2.7	1.8	0.8	0.9	-	-	0.8	-	1.2	1.8
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Glossosomatidae	Padunia		-	-	-	-	-	-	-	-	6.5	0.9
Arthropoda	Trichoptera	Glossosomatidae	Protoptila	I	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	-	-	6.5	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	-	-	-	2.4	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Ceraclea	M	-	-	-	0.9	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	0.9	20.2	1.8	-	6.3	-	1.8
Arthropoda	Trichoptera	Limnephilidae	na	M	8.0	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	0.8	0.9	2.6	-	1.7	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	-	-	-	0.8	-	-	-
Mollusca	Architaenioglossa	Viviparidae	Campeloma	M	0.9	0.9	-	-	-	-	0.8	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Basommatophora	Physidae	Physa	T	-	0.9	-	-	3.5	-	-	5.4	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Corbiculidae	Corbicula	M	-	-	-	-	-	-	-	0.9	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	0.9
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	0.9	-	-	-	-	-	-	0.6	-
Nematoda	na	na	na		-	-	-	-	-	-	-	-	1.2	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	0.9	-	0.9	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Mattawoman Creek (MATT-102-S)

Site MATT-102-S is located on an unnamed tributary to Mattawoman Creek in the Coastal Plain – western shore region of Maryland. It is in the Mattawoman Creek watershed in Charles County. This site was sampled from 2017 to 2020.

Unnamed tributary to Mattawoman Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	75.01	74.82	75.54	75.50	76.63	76.82	76.70
Urban	11.48	11.48	11.48	11.48	11.48	11.48	11.48
Agriculture	10.95	10.95	10.95	10.95	10.95	10.95	10.95
Other	2.56	2.75	2.03	2.07	0.94	0.75	0.87

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Mattawoman Creek (2017 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
pH	**R = -0.999, p = 0.028**	7.11	6.99	6.85	
Specific Conductance (µS/cm)	**R = -0.998, p = 0.038**	134.3	107.1	85.0	
Acid Neutralizing Capacity (µeq/L)	R = -0.915, p = 0.265	332.1	230.0	216.4	
Dissolved Organic Carbon (mg/L)	R = 0.447, p = 0.705	3.509	2.920	3.986	
Chloride (mg/L)	**R = -0.998, p = 0.036**	22.67	17.28	12.85	
Sulfate (mg/L)	R = -0.499, p = 0.667	7.40	8.42	6.39	Not sampled due to COVID-19 Pandemic
Total Nitrogen (mg/L)	R = -0.853, p = 0.349	0.661	0.665	0.526	
Nitrate-Nitrogen (mg/L)	R = -0.631, p = 0.566	0.4873	0.5427	0.3894	
Nitrite-Nitrogen (mg/L)	R = 0.880, p = 0.315	0.0022*	0.0023	0.0052*	
Ammonia-Nitrogen (mg/L)	R = 0.277, p = 0.821	0.0106	0.0071	0.0120	
Total Phosphorus (mg/L)	R = -0.655, p = 0.546	0.0179	0.0098	0.0125	
Ortho-phosphate (mg/L)	**R = -0.998, p = 0.037**	0.0052	0.0041	0.0032*	
Bromide (mg/L)	R = -0.315, p = 0.796	0.0320	0.0202	0.0282	
Magnesium (mg/L)	R = -0.164, p = 0.895	1.563	1.237	1.506	
Calcium (mg/L)	R = -0.844, p = 0.361	4.275	3.186	3.239	
Copper (µg/L)	R = 0.985, p = 0.109	0.336	0.349	0.356	
Zinc (µg/L)	**R = 0.999, p = 0.031**	1.156	2.041	3.088	

Physical Habitat

Physical habitat measurements collected at the unnamed tributary to Mattawoman Creek (2017 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.211, p = 0.789	16	11	16	13
Epifaunal substrate (0-20)	R = -0.111, p = 0.889	18	7	15	14
Velocity/Depth Diversity (0-20)	R = -0.316, p = 0.684	14	12	13	13
Pool Quality (0-20)	R = -0.674, p = 0.326	17	13	15	13

Parameter	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
Riffle Quality (0-20)	R = -0.516, p = 0.484	14	8	12	9
Shading (%)	R = -0.939, p = 0.061	90	75	75	65
Embeddedness (%)	R = -0.054, p = 0.946	30	55	0	45
Discharge (cfs)	R = 0.498, p = 0.502	0.37	0.32	0.94	0.52
Stream Area (m2)	R = -0.107, p = 0.893	136.9	188.3	152.3	142.5

Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at the unnamed tributary to Mattawoman Creek (only calculated for summers missing no less than 2 weeks of data).

Parameter	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = -0.370, p = 0.630	84.8	78.1	71.8	81.6
% above 24°C	R = -0.265, p = 0.735	24.1	0	6.3	14.8

Average daily mean water and air temperature measurements by season collected at the unnamed tributary to Mattawoman Creek (2017 to 2020).

Water Temperatures	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
Average Daily Mean Winter Water Temperature	-	-	-	5.10	-
Average Daily Mean Winter Water Temperature (Warmest Week)	-	-	-	8.96	-
Average Daily Mean Spring Water Temperature	R = -0.987, p = 0.103	13.17	-	12.29	12.10
Average Daily Mean Spring Water Temperature (Warmest Week)	R = -0.380, p = 0.752	19.46	-	19.44	18.28
Average Daily Mean Summer Water Temperature	R = -0.225, p = 0.775	22.30	20.89	21.18	21.84
Average Daily Mean Summer Water Temperature (Warmest Week)	R = -0.209, p = 0.791	25.78	22.96	24.30	24.59
Average Daily Mean Fall Water Temperature	R = -0.958, p = 0.185	15.63	15.45	14.88	-
Average Daily Mean Fall Water Temperature (Warmest Week)	R = -0.151, p = 0.904	21.91	23.01	21.83	-

Air Temperatures	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
Average Daily Mean Winter Air Temperature	-	-	-	-	-
Average Daily Mean Winter Air Temperature (Warmest Week)	-	-	-	-	-
Average Daily Mean Spring Air Temperature	-	-	-	-	13.64

Air Temperatures	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
Average Daily Mean Spring Air Temperature (Warmest Week)	-	-	-	-	22.69
Average Daily Mean Summer Air Temperature	-	-	-	-	23.90
Average Daily Mean Summer Air Temperature (Warmest Week)	-	-	-	-	27.94
Average Daily Mean Fall Air Temperature	-	-	-	-	-
Average Daily Mean Fall Air Temperature (Warmest Week)	-	-	-	-	-

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.400, p = 0.600	5.00	4.14	4.71	4.43
# Taxa	R = -0.049, p = 0.951	38	20	35	32
# Ephemeroptera Taxa	R = -0.602, p = 0.398	4	1	3	1
# EPT Taxa	R = -0.400, p = 0.600	16	7	13	10
# Scraper Taxa	R = -0.580, p = 0.420	11	4	9	4
% Climbers	R = -0.463, p = 0.537	17.2	45.2	9.8	8.6
% Ephemeroptera	R = -0.891, p = 0.109	14.7	4.8	4.9	1.6
% Intolerant Urban Taxa	R = -0.177, p = 0.823	40.5	32.5	52.9	28.9

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.359, p = 0.641	5.00	4.33	3.33	4.67
Abundance per m2	R = 0.297, p = 0.703	0.89	1.21	0.39	1.54
# Benthic Sp. (Adjusted)	R = 0.775, p = 0.225	1.48	1.48	1.48	1.48
% Abundance of Dominant Species	R = 0.722, p = 0.278	21.3	28.1	39.0	31.4
% Generalists/Omnivores/Invertivores	R = 0.106, p = 0.894	77.9	92.5	96.6	79.1
% Round-bodied Suckers	R = -0.684, p = 0.316	5.7	1.3	0	1.8
% Tolerant	R = -0.002, p = 0.998	38.5	49.6	49.2	38.6

Fish

Cumulative list of fish species (with abundance) collected at the unnamed tributary to Mattawoman Creek by sampling year.

Species	*Tolerance*	*2017*	*2018*	*2019*	*2020*
American Eel	M	17	25	4	9
Blacknose Dace	T	24	63	23	69
Creek Chub	T	11	33	3	12
Creek Chubsucker	M	7	3	-	4
Eastern Mosquitofish	M	1	-	-	-
Eastern Mudminnow	T	9	15	1	2
Fallfish	I	10	6	2	13
Largemouth Bass	T	1	-	-	-
Least Brook Lamprey	M	26	17	2	46
Rosyside Dace	M	14	64	22	62
Tessellated Darter	T	2	2	2	2
Yellow Bullhead	M	-	-	-	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Mattawoman Creek by sampling year.

Species	*2017*	*2018*	*2019*	*2020*
Procambarus clarkii	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Mattawoman Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected at or near the unnamed tributary to Mattawoman Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Eastern American toad, Northern green frog, Pickerel frog, Southern leopard frog
Caudata (Salamanders and Newts)	Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern watersnake, Queensnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected at the unnamed tributary to Mattawoman Creek by sampling year, RA = %Relative Abundance.

					2017	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	0.9	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	0.9	0.8	0.8	-
Arthropoda	Coleoptera	Dytiscidae	na	M	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	0.8	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	0.8	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Microcylloepus	M	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	6.0	4.8	2.4	14.1
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.6	4.8	0.8	1.6
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	1.7	2.4	0.8	9.4
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	5.2	4.0	0.8	3.9
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	8.1	1.6
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	2.6	0.8	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Corynoneura	M	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	1.6	0.8
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	3.3	3.9
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Krenosmittia	I	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Micropsectra	I	5.2	0.8	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	6.9	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.9	5.6	2.4	4.7

PHYLUM	ORDER	FAMILY	TAXON	TOL	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	1.6
Arthropoda	Diptera	Chironomidae	Polypedilum	M	3.4	44.4	5.7	6.3
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.8	0.8	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	2.6	-	-	3.9
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	7.8	-	1.6	0.8
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Tvetenia	M	1.7	-	-	1.6
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	0.8
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	8.9	0.8
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	0.8
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.6	3.1
Arthropoda	Diptera	Tipulidae	Tipula	M	-	0.8	0.8	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	0.8
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	8.6	4.8	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	1.7	-	1.6	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	1.6
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	3.4	-	0.8	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.9	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	6.9	-	0.8	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	0.8
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	2.6	15.1	29.3	14.1
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	0.8	6.5	0.8
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	1.6	2.4	1.6
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	0.9	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	0.8	1.6	1.6
Arthropoda	Plecoptera	Perlidae	na	I	0.9	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.9	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	0.9	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	1.7	-	0.8	7.0
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	0.9	3.2	1.6	2.3
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	0.9	-	-	4.7
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	0.8
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	1.6	0.8
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	0.8	-
Arthropoda	Trichoptera	Odontoceridae	na	I	-	-	-	0.8
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	3.4	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	1.6	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	0.9	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.9	0.8	1.6	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	1.7	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	8.6	-	-	-
Nematoda	na	na	na		-	0.8	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Mill Run (Nanjemoy Creek, NANJ-331-S)

Site NANJ-331-S is located on Mill Run in the Coastal Plain – western shore region of Maryland. It is in the Nanjemoy Creek watershed in Charles County. This site was sampled from 2000 to 2020.

Mill Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	84.05	83.97	84.05	83.53	82.88	83.46	83.53
Urban	6.52	6.52	6.53	6.53	6.53	6.53	6.53
Agriculture	8.04	8.04	8.03	8.07	7.95	7.95	7.94
Other	1.40	1.47	1.39	1.88	2.64	2.06	2.00

Water Chemistry

Water chemistry measurements collected at Mill Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.169, p = 0.476	6.47	6.66	6.60	6.14	5.97	6.55	6.77	6.63	6.26	6.78	6.52	6.36
Specific Conductance (µS/cm)	R = 0.107, p = 0.653	58.7	71.7	77.6	70.0	57.3	63.6	72.8	68.2	64.6	91.9	60.5	66.8
Acid Neutralizing Capacity (µeq/L)	R = 0.326, p = 0.161	83.3	89.4	131.5	44.7	34.5	72.9	111.5	86.3	58.9	116.1	84.6	57.0
Dissolved Organic Carbon (mg/L)	**R = 0.482, p = 0.032**	3.100	1.600	3.100	2.000	4.200	3.099	2.863	2.706	3.544	3.252	4.193	4.433
Chloride (mg/L)	R = 0.243, p = 0.302	5.28	7.27	9.85	7.91	5.16	6.43	9.15	7.36	6.81	12.93	6.88	9.37
Sulfate (mg/L)	R = -0.422, p = 0.064	10.63	10.84	9.92	14.91	10.95	11.35	10.68	11.02	11.29	10.87	10.27	11.06
Total Nitrogen (mg/L)	R = 0.175, p = 0.460	0.511	0.242	0.197	0.528	0.343	0.381	0.314	0.455	0.383	0.287	0.437	0.400
Nitrate-Nitrogen (mg/L)	R = -0.018, p = 0.940	0.1640	0.2360	0.0900	0.3880	0.1870	0.2904	0.1287	0.2686	0.1608	0.0275	0.1895	0.1753
Nitrite-Nitrogen (mg/L)	**R = 0.565, p = 0.009**	0*	0.0006*	0.0021	0.0004*	0.0004*	0.0019*	0.0027	0.0016	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.144, p = 0.544	0.0182*	0.0065*	0.0127	0.0058	0.0237	0.0145	0.0125	0.0090	0.0114	0.0059	0.0065	0.0112
Total Phosphorus (mg/L)	R = 0.073, p = 0.760	0.0250	0.0210	0.0410	0.0140	0.0500	0.0276	0.0293	0.0280	0.0203	0.0330	0.0385	0.0200
Ortho-phosphate (mg/L)	**R = 0.720, p < 0.001**	0*	0.0007*	0.0045	0.0007*	0.0035	0.0031	0.0059	0.0023	0.0051	0.0036	0.0055	0.0045
Bromide (mg/L)	**R = 0.781, p = 0.038**												
Magnesium (mg/L)	R = 0.479, p = 0.337										1.686		
Calcium (mg/L)	R = 0.592, p = 0.216										4.688		
Copper (µg/L)	R = -0.677, p = 0.140												
Zinc (µg/L)	R = -0.777, p = 0.069												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.61	6.37	6.23	6.22	6.91	6.81	6.51	6.56	
Specific Conductance (µS/cm)	67.3	55.6	61.5	83.6	76.1	80.5	68.5	60.7	
Acid Neutralizing Capacity (µeq/L)	114.6	66.6	54.0	61.0	138.3	160.0	98.0	125.7	
Dissolved Organic Carbon (mg/L)	3.088	3.528	5.156	3.600	3.943	2.899	3.045	4.224	
Chloride (mg/L)	7.13	5.96	7.66	13.87	10.31	10.62	7.36	5.42	Not sampled due to COVID-19 Pandemic
Sulfate (mg/L)	11.17	10.90	9.79	10.64	9.44	9.26	11.33	9.47	
Total Nitrogen (mg/L)	0.406	0.346	0.442	0.380	0.322	0.387	0.423	0.453	
Nitrate-Nitrogen (mg/L)	0.2162	0.1790	0.2081	0.2246	0.1085	0.2047	0.2401	0.2463	
Nitrite-Nitrogen (mg/L)	0.0026	0.0029	0.0031	0.0011*	0.0006*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0082	0.0083	0.0168	0.0114	0.0058	0.0170	0.0131	0.0084*	
Total Phosphorus (mg/L)	0.0266	0.0215	0.0351	0.0206	0.0387	0.0420	0.0134	0.0393	
Ortho-phosphate (mg/L)	0.0037	0.0038	0.0071	0.0048	0.0065	0.0069	0.0061	0.0044	
Bromide (mg/L)		0.0106	0.0099	0.0129	0.0229	0.0234	0.0162	0.0239	
Magnesium (mg/L)			1.380	0.932	1.510	1.735	1.458	1.496	
Calcium (mg/L)			2.944	2.214	3.828	4.400	3.952	3.526	
Copper (µg/L)			3.116	0.508	0.245	0.358	0.367	0.319	
Zinc (µg/L)			14.009	9.496	4.510	2.886	5.185	4.846	

Physical Habitat

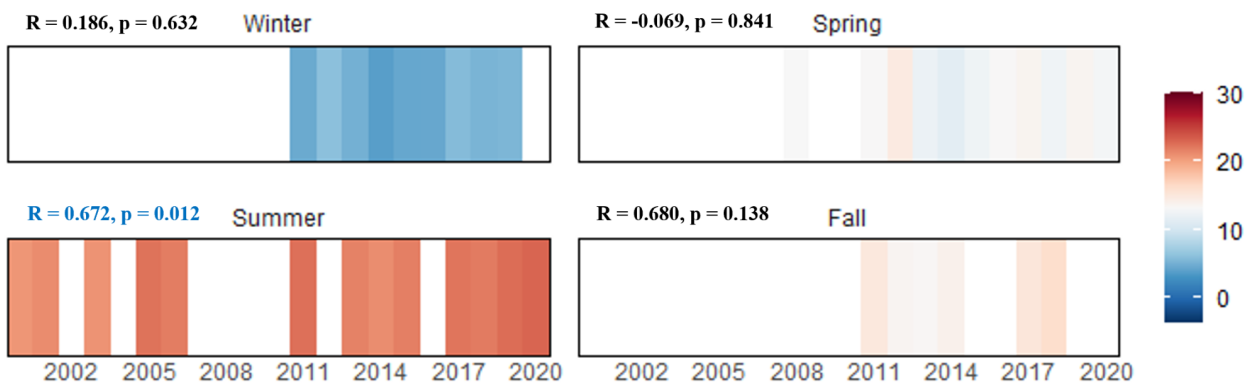
Physical habitat measurements collected at Mill Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = 0.398, p = 0.074	13	15	7	13	11	15	12	14	10	14	14	15	15	14	16	15	17	14	14	12	14
Epifaunal substrate (0-20)	**R = 0.558, p = 0.009**	11	10	7	14	13	10	9	8	7	9	12	12	16	17	14	17	17	16	16	11	12
Velocity/Depth Diversity (0-20)	R = 0.313, p = 0.167	15	13	2	14	12	7	11	11	11	12	14	14	14	13	15	14	14	15	15	10	11
Pool Quality (0-20)	R = 0.257, p = 0.260	16	15	6	15	16	16	11	14	12	14	15	16	17	17	16	16	17	16	17	11	14
Riffle Quality (0-20)	**R = 0.458, p = 0.037**	7	8	0	12	12	0	6	8	11	7	12	13	8	10	8	9	15	14	13	7	11
Shading (%)	**R = -0.769, p < 0.001**	94	95	95	92	85	93	90	95	85	85	95	90	90	80	75	75	85	85	80	80	65
Embeddedness (%)	R = -0.189, p = 0.412	80	40	100	40	30	40	80	60	40	45	75	20	40	85	85	85	45	55	55	30	20
Discharge (cfs)	R = -0.099, p = 0.669	1.32	0.74	0	12.07	1.4	0	3.1	1.34	1.76	1.06	2.11	0.47	0.92	0.73	0.65	0.48	1.81	3.3	2.82	0.46	3.22
Stream Area (m2)	R = 0.383, p = 0.086	339.4	408.8	53.9	528.8	446.3	241.9	545.6	292.5	294.4	311.3	369.4	240.0	451.9	435.0	476.3	405.0	390.0	380.6	502.5	448.5	523.1

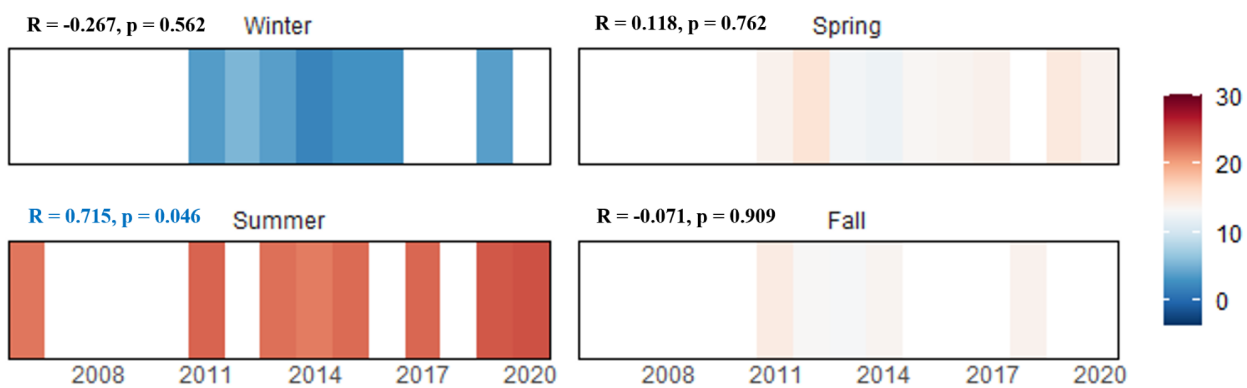
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Mill Run (only calculated for summers missing no less than 2 weeks of data).

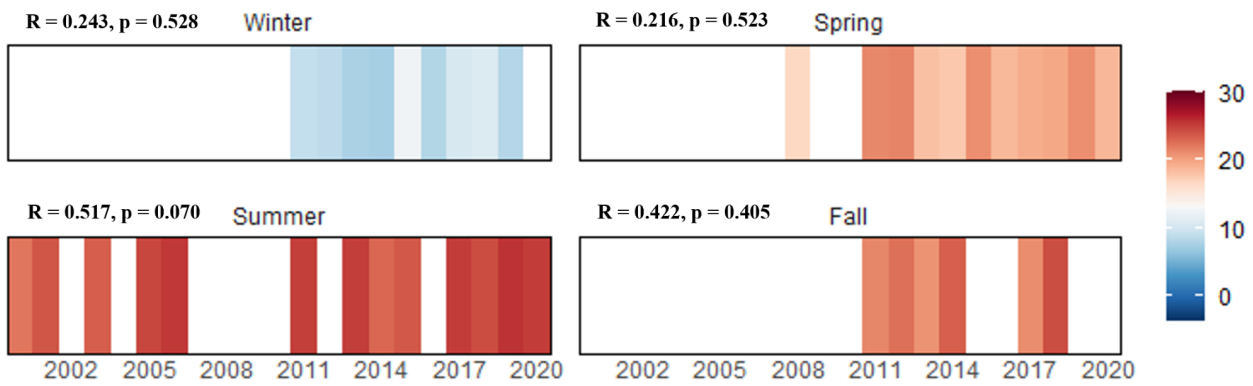
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.737, p = 0.004**	65.9	74.9	-	68.5	-	84.9	80.9	-	-	-	-	89.7	-	78.4	78.1	82.0	-	83.5	84.7	87.0	91.6
% above 24°C	**R = 0.617, p = 0.025**	0.7	4.7	-	3.5	-	23.1	18.1	-	-	-	-	23.5	-	11.8	2.7	12.0	-	21.5	13.8	33.5	38.1



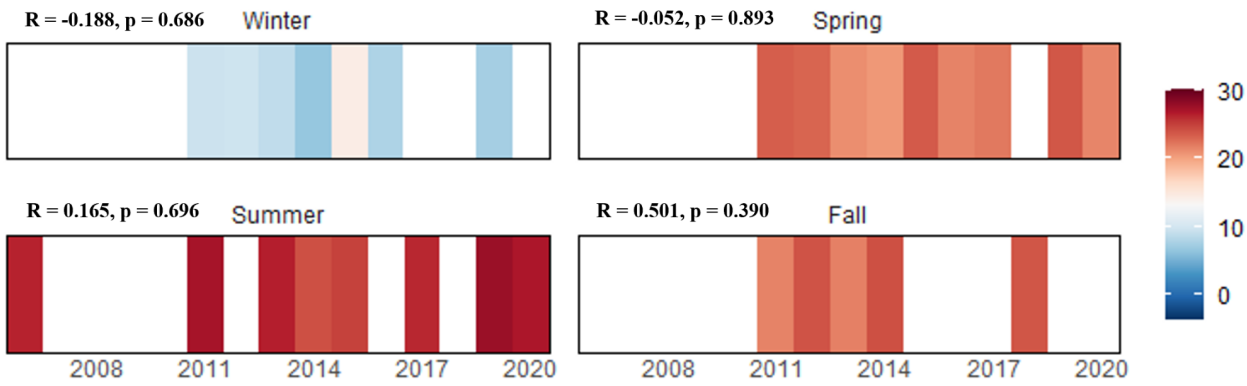
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.285, p = 0.210	3.86	4.71	4.71	3.29	5.00	5.00	4.71	4.71	4.71	4.43	4.71	5.00	4.71	4.14	4.14	4.71	4.71	4.71	4.71	4.71	5.00
# Taxa	R = 0.202, p = 0.380	10	27	26	19	35	37	37	41	35	21	27	32	30	19	20	36	25	28	32	36	30
# Ephemeroptera Taxa	R = 0.229, p = 0.318	4	3	4	1	5	4	5	6	6	6	3	3	7	1	4	5	4	5	3	5	7
# EPT Taxa	R = 0.159, p = 0.492	5	11	9	8	13	12	15	15	9	8	14	9	17	7	9	13	9	14	8	13	11
# Scraper Taxa	**R = 0.543, p = 0.011**	3	5	5	3	4	6	5	8	3	3	5	6	5	3	6	7	6	8	5	8	7
% Climbers	R = 0.021, p = 0.929	0	1.0	7.0	0.8	13.2	9.4	12.2	6.8	19.1	56.1	7.6	16.2	6.0	0.9	0	6.2	1.8	2.5	14.7	10.3	9.1
% Ephemeroptera	R = -0.065, p = 0.779	79.6	27.1	33.3	0.8	32.1	34.9	20.9	27.2	18.1	77.2	22.0	13.7	34.5	52.3	71.1	15.9	40.4	20.8	10.1	29.7	44.6
% Intolerant Urban Taxa	R = 0.003, p = 0.990	71.3	70.8	47.4	51.6	37.7	32.1	24.4	29.1	21.9	18.7	73.7	35.9	79.3	71.2	86.0	42.5	70.2	69.2	40.4	26.9	29.8

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.125, p = 0.588	4.00	3.67	3.67	2.33	4.00	4.67	4.00	3.67	2.67	4.00	3.33	3.00	4.00	4.00	3.67	4.00	4.00	3.00	3.67	4.33	4.00
Abundance per m2	R = -0.273, p = 0.231	0.34	0.15	6.23	0.06	0.5	0.84	0.19	0.15	0.22	0.49	0.18	0.36	0.14	0.7	0.41	0.64	0.22	0.43	0.32	0.43	0.2
# Benthic Sp. (Adjusted)	R = 0.392, p = 0.079	0.65	0.32	0.97	0	0.97	0.97	0.97	0.65	0.65	0.65	0.97	0	0.65	0.65	0.97	0.97	0.97	0.97	0.97	0.97	0.97
% Abundance of Dominant Species	R = -0.419, p = 0.059	36.2	22.6	42.3	28.1	17.0	19.6	37.3	33.3	40.9	35.1	47.8	36.8	17.2	23.7	25.4	18.2	16.1	26.1	15.4	26.2	18.3
% Generalists/ Omnivores/ Invertivores	R = 0.092, p = 0.693	93.1	98.4	99.1	96.9	80.4	76.5	91.2	73.3	92.4	98.7	92.5	100	98.4	98.4	93.9	90.3	93.1	97.6	84.6	91.8	94.2

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	R = 0.075, p = 0.747	2.6	11.3	1.5	0	0.5	0.5	1.0	0	0	4.6	6.0	36.8	7.8	3.0	3.6	1.9	4.6	0	1.9	4.6	5.8
% Tolerant	R = 0.104, p = 0.655	53.5	79.0	76.2	71.9	75.9	59.8	41.2	64.4	84.9	82.8	82.1	50.6	67.2	88.8	77.2	76.4	59.8	77.6	70.4	67.7	66.4

Fish

Cumulative list of fish species (with abundance) collected in Mill Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	4	-	1	-	3	2	1	4	5	5	-	8	4	6	16	10	14	17	12	16	4
Blacknose Dace	T	-	4	-	-	31	-	-	2	-	23	3	7	1	7	20	5	9	16	4	4	16
Bluegill	T	3	3	5	3	8	5	13	1	2	53	8	8	8	10	9	1	5	-	10	13	3
Bluespotted Sunfish	M	-	-	3	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brown Bullhead	T	2	2	72	3	4	2	-	1	-	-	-	2	-	2	-	1	-	-	3	4	5
Chain Pickerel	M	1	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek Chub	T	3	4	23	-	-	5	4	-	2	2	2	4	3	46	4	25	1	32	9	6	17
Creek Chubsucker	M	3	7	5	-	1	1	1	-	-	7	4	32	5	9	7	5	4	-	3	9	6
Eastern Mosquitofish	M	42	1	55	-	-	8	38	-	-	-	2	-	-	4	-	-	-	8	-	-	5
Eastern Mudminnow	T	2	14	142	9	24	19	4	15	27	12	32	13	11	64	50	46	9	12	9	4	1
Eastern Silvery Minnow	M	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Flier	I	-	-	-	-	-	-	-	-	1	4	1	1	-	-	-	-	-	-	-	-	-
Golden Shiner	T	-	-	1	1	31	28	-	-	-	-	-	2	-	19	1	8	4	1	6	6	-
Green Sunfish	T	-	-	-	-	-	-	-	-	-	-	-	-	1	8	9	14	5	13	25	23	19

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Largemouth Bass	T	7	-	-	-	4	2	-	-	2	1	-	-	-	4	8	8	-	-	1	5	1
Least Brook Lamprey	M	-	-	3	-	10	10	2	-	-	1	3	-	1	1	3	8	1	2	5	7	3
Margined Madtom	I	2	-	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pirate Perch	T	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pumpkinseed	T	4	5	2	-	17	40	10	5	-	8	6	4	1	-	-	1	-	2	-	4	3
Redbreast Sunfish	M	1	2	-	-	-	-	1	-	-	2	-	1	-	-	1	3	4	2	2	8	6
Rosyside Dace	M	-	2	4	-	2	-	-	-	-	-	-	-	-	5	1	1	-	3	2	3	6
Satinfin Shiner	I	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sea Lamprey	I	-	-	-	-	30	36	7	11	3	-	2	-	-	-	1	9	5	2	19	4	2
Spottail Shiner	I	-	-	-	5	3	23	-	-	-	-	-	-	10	-	8	20	4	-	-	9	-
Swallowtail Shiner	M	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tessellated Darter	T	24	13	1	-	38	12	9	5	21	16	4	-	8	72	29	47	10	43	23	51	4
Warmouth	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1
White Sucker	T	17	4	9	7	13	9	2	-	2	10	-	4	10	38	22	41	9	9	24	12	-
Yellow Bullhead	M	1	-	3	2	4	2	9	-	1	7	-	1	1	9	8	5	3	3	5	6	2

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Mill Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	N	N	N	D	N	N	D	D	D	N	N	N	N	N	N

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Creaserinus fodiens	N	N	N	N	N	N	D	N	N	N	N	N	N	N	N
Faxonius limosus	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Lacunicambarus diogenes	N	N	D	N	D	N	N	D	D	N	N	N	N	N	N
Procambarus clarkii	D	D	N	D	D	D	D	D	D	N	N	D	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Mill Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Mill Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's Gray Treefrog, Eastern American toad, Eastern cricket frog, Fowler's toad, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Upland chorus frog, Wood frog
Caudata (Salamanders and Newts)	Northern two-lined salamander
Squamata (Snakes and Lizards)	Common five-linked skink, Eastern rat snake, Northern ring-necked snake, Northern watersnake
Testudines (Turtles)	Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Mill Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	1.0	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	1.9	-	-	1.0	1.0	0.8	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	-	-	1.0	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	0.8	-	1.9	-	-	1.0	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	1.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	0.9	0.8	0.9	-	0.9	1.9	1.0	1.6	0.8
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	1.9	3.5	6.8	-	-	3.4
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	0.9	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	0.9	-	4.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	4.2	8.8	0.8	-	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.8	16.7	9.6	5.5	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	1.0	-	-	-	0.9	-	1.0	-	-	0.8
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	1.9	-	-	-	-	-	-
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Decapoda	Palaemonidae	Palaemonetes	T	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	0.9	-	1.9	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	3.9	3.8	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	2.8	0.9	1.7	1.0	1.9	0.8	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	5.3	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	0.9	1.0	5.8	0.8	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	3.1	-	0.8	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	0.9	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	0.9	-	0.9	0.9	22.6	6.8	26.9	0.8	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	3.5	-	-	0.9	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	1.8	-	-	-	1.7	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilothauma	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	3.1	2.6	0.8	-	-	-	1.9	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	5.3	-	1.9	-	12.2	4.9	5.8	2.4	-
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	-	0.9	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	0.9	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	7.0	-	1.9	-	3.5	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	0.9	-	1.7	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	0.9	-	-	-	-	1.0	1.0	0.8	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	1.9	1.0	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	1.0	-	-	0.9	-	-	1.9	-	-	2.5
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	1.0	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	1.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	0.9	-	2.8	1.9	2.6	5.8	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	8.3	-	-	1.9	7.5	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	0.9	-	-	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	2.8	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	3.5	-	7.5	1.9	0.9	-	1.9	-	2.5
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	0.8	7.5	1.9	1.7	1.9	1.0	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	1.0	0.9	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	0.9	0.9	0.9	3.9	-	-	1.7
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Unniella	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	0.9	-	1.9	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	5.2	-	9.4	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	12.0	-	-	-	-	0.9	-	-	-	-	7.6
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	1.9	-	0.8
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	2.1	0.9	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	-	-	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	1.0	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	0.8	-	-	-	1.0	1.9	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	10.2	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	11.5	26.3	-	11.3	7.5	-	8.7	-	1.6	-
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	3.5	-	1.0	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	-	-	-	-	-	-	-	-	-	1.6	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	66.7	13.5	0.9	-	6.6	5.7	-	2.9	3.8	-	14.4
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	0.9	-	-	-	0.8
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	1.9	-	0.9	-	4.7	7.5	0.9	11.7	1.9	12.2	1.7
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	2.1	-	-	-	6.6	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	5.1

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.9	-	5.3	-	8.5	7.5	-	1.0	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	0.9	-	-	-	-	8.1	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	7.8	-	1.9	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Metretopodidae	Siphloplecton	I	-	-	-	-	-	-	-	1.9	-	-	-
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	7.8	-	7.7	52.8	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Hemiptera	Nepidae	Ranatra	M	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	1.0	-	0.8	-	2.8	-	1.0	-	3.3	0.8
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	0.8	0.8
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	1.9	0.9	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Corduliidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Dromogomphus	I	-	-	-	-	-	1.9	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	0.9	-	-	-	-	1.0	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	2.3	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	2.1	2.6	-	1.9	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.0	-	-	-	-	0.9	1.0	-	-	2.5
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	1.9	-	1.8	0.8	1.9	3.8	3.5	-	-	-	33.1
Arthropoda	Plecoptera	Nemouridae	na	I	-	4.2	-	25.8	-	-	-	-	1.0	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	1.8	39.1	-	-	3.5	1.0	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	2.1	-	-	10.4	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	1.0	-	-	0.9	-	0.9	-	-	-	0.8
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	4.2	-	-	0.9	-	2.6	1.0	2.9	-	11.0
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.0	-	4.7	0.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	0.9	2.3	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	2.1	4.4	-	-	12.3	-	1.9	-	-	0.8
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	0.9	-	0.9	1.0	-	-	0.8
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	-	-	-	-	-	-	-	5.7	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	1.9	0.9	1.0	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	2.8	0.9	0.9	-	-	-	0.8
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	0.9	-	4.8	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	1.9	0.9	-	1.9	-	-	0.8
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	0.9	0.9	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	2.1	-	1.6	-	-	-	1.0	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	1.0	0.8	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	0.9	1.0	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	-	-	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	0.9	0.9	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	2.6	-	0.9	0.9	-	1.8	1.7	-	-	1.7
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	1.8	-	-	-	-	1.8	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	0.9	-	-	-	-	-	0.9	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	0.9	1.7	-	1.8	3.5	0.9	0.8	4.6	5.5	8.3
Arthropoda	Coleoptera	Dryopidae	Helichus	M	0.9	-	-	-	-	-	-	0.9	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	0.8	0.9	1.4	1.7
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	0.9	-	-	-	0.7	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	1.7	-	-	-	-	-	-	-	-	0.8
Arthropoda	Coleoptera	Elmidae	Optioservus	M	2.6	-	-	0.9	3.5	1.8	1.7	-	0.7	2.5
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	0.9	-	0.9	6.2	2.6	6.7	1.8	0.7	3.3
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	0.9	-	0.9	0.9	0.9	2.6	1.7	0.9	0.7	-
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Gyrinidae	Gyrinus	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Palaemonidae	Palaemonetes	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	0.9	-	-	-	0.8	-	2.1	0.8
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	0.9	-	-	-	-	0.9	-	3.7	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	1.4	0.8
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.9	1.8	-	-	-	-	-	2.8	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	8.5	1.7	4.5	-	0.9	3.5	1.7	-	2.1	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	3.5	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Nilothauma	M	-	-	-	-	-	-	-	-	-	2.5

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	0.9	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	2.6	0.9	5.4	0.9	-	4.4	1.7	0.9	13.8	-
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	1.4	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.9	-	1.8	-	0.9	0.9	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	8.8	-	-	4.6	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.9	-	-	-	-	1.7	2.8	4.8	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Procladius	I	0.9	-	-	-	-	-	-	-	-	2.5
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.9	-	-	-	0.9	-	5.5	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.7	1.7	0.9	0.9	9.7	-	-	9.2	1.4	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	0.9	-	-	-	-	0.9	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	1.7	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	6.0	-	-	-	-	-	-	0.9	2.1	0.8
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	1.8	2.8	3.3
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.9	-	-	-	-	-	-	7.3	3.4	7.4
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	6.8	-	1.8	-	-	0.9	-	2.8	0.7	0.8
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	0.9	-	-	0.9	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	0.9	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Unniella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelia	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	0.9	-	-	-	0.9	-	-	-	2.5
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	2.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	2.6	-	-	-	-	-	0.8	0.9	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	5.3	3.3	-	2.8	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	0.9	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	4.3	-	1.8	5.3	2.6	11.7	5.5	1.4	0.8
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	0.9	-	0.8	-	-	0.8
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	-	2.6	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	10.7
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	21.4	29.8

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	1.7	23.3	52.3	66.7	3.5	36.0	6.7	1.8	2.1	0.8
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	1.7	-	-	-	3.5	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	1.8	-	0.9	-	2.8	1.4	0.8
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	-	0.9	1.8	-	0.8	-	3.4	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	0.9	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Metretopodidae	Siphloplecton	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	7.7	1.7	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Nepidae	Ranatra	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	6.0	-	-	0.9	4.4	4.4	2.5	20.2	1.4	5.0
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.9	-	-	-	0.9	-	-	0.9	0.7	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Odonata	Corduliidae	na	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Odonata	Gomphidae	Dromogomphus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	6.2	-	0.8	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	2.6	-	-	0.9	-	2.5	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	2.8	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	0.9	8.6	1.8	1.8	-	11.4	4.2	1.8	3.4	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	1.7	-	-	2.7	-	5.8	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	6.0	-	0.9	-	1.8	0.9	7.5	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	-	-	-	-	0.9	-	-	0.7	1.7
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	17.1	30.2	15.3	4.4	4.4	9.6	15.0	0.9	0.7	1.7
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	-	-	0.9	-	5.0	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	0.9	1.7	0.9	-	6.2	-	5.0	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	0.9	-	-	-	-	-	2.5	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	1.7	-	0.9	1.8	-	-	3.7	2.1	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	1.7	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	5.1	1.7	-	-	-	-	-	0.9	-	0.8
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	1.8	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	0.9	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	0.9	-	-	-	-	1.7	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	2.8	0.8
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.9	-	1.8	7.0	-	1.8	1.7	-	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	2.7	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	0.9	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	4.4	-	-	-	0.9	-	-
Mollusca	Veneroida	Pisidiidae	Pisidium	M	-	-	-	-	-	1.8	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	0.9	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	0.9	-	0.9	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Reeder Run (PRMT-177-S)

Site PRMT-177-S is located on Reeder Run in the Coastal Plain Western Shore region of Maryland. It is in the Potomac River Middle Tidal watershed in Charles County. This site was first sampled in 2012.

Reeder Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	89.29	91.52	91.60	91.60	86.66	85.83	85.91
Urban	6.01	6.01	6.10	6.10	6.10	6.10	6.10
Agriculture	2.31	2.31	2.31	2.31	2.31	2.31	2.31
Other	2.39	0.16	0.00	0.00	4.94	5.77	5.68

Water Chemistry

Water chemistry measurements collected at Reeder Run (2012 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	R = 0.561, p = 0.148	6.23	6.07	6.07	6.08	6.38	6.49	6.51	6.20	Not sampled due to COVID-19 Pandemic
Specific Conductance (µS/cm)	R = 0.588, p = 0.125	44.2	38.2	37.9	40.9	50.3	53.7	53.3	43.8	
Acid Neutralizing Capacity (µeq/L)	R = 0.194, p = 0.645	134.3	71.1	56.7	69.8	135.9	121.2	126.3	88.6	
Dissolved Organic Carbon (mg/L)	R = -0.014, p = 0.974	3.317	5.642	4.934	5.717	2.942	2.388	1.758	7.446	
Chloride (mg/L)	R = 0.585, p = 0.128	6.89	3.81	4.32	4.31	8.49	9.99	9.41	6.81	
Sulfate (mg/L)	R = -0.565, p = 0.144	2.28	5.91	4.71	5.71	1.64	1.20	1.58	2.00	
Total Nitrogen (mg/L)	R = 0.344, p = 0.404	0.429	0.330	0.290	0.328	0.323	0.421	0.415	0.406	

Parameter	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Nitrate-Nitrogen (mg/L)	R = 0.270, p = 0.518	0.2419	0.1367	0.1476	0.1556	0.1793	0.2653	0.3123	0.1496	
Nitrite-Nitrogen (mg/L)	R = 0.396, p = 0.331	0.0022	0.0025	0.0024	0.0011*	0.0006*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	R = -0.497, p = 0.210	0.0368	0.0194	0.0127	0.0115	0.0272	0.0210	0.0136	0.0138	
Total Phosphorus (mg/L)	R = 0.491, p = 0.216	0.0121	0.0093	0.0079	0.0078	0.0164	0.0093	0.0101	0.0208	
Ortho-phosphate (mg/L)	**R = 0.872, p = 0.005**	0.0012	0.0014	0.0012	0.0030*	0.0030*	0.0031*	0.0031*	0.0032*	
Bromide (mg/L)	**R = 0.930, p = 0.002**		0.0126	0.0118	0.0132	0.0233	0.0261	0.0238	0.0319	
Magnesium (mg/L)	R = -0.453, p = 0.367			0.872	1.530	0.862	0.857	0.821	0.825	
Calcium (mg/L)	R = -0.432, p = 0.392			1.665	3.596	1.728	1.717	1.650	1.555	
Copper (µg/L)	R = -0.586, p = 0.222			0.848	0.675	0.185	0.269	0.116	0.525	
Zinc (µg/L)	R = -0.333, p = 0.519			6.739	7.050	3.435	2.256	2.582	6.806	

Physical Habitat

Physical habitat measurements collected at Reeder Run (2012 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

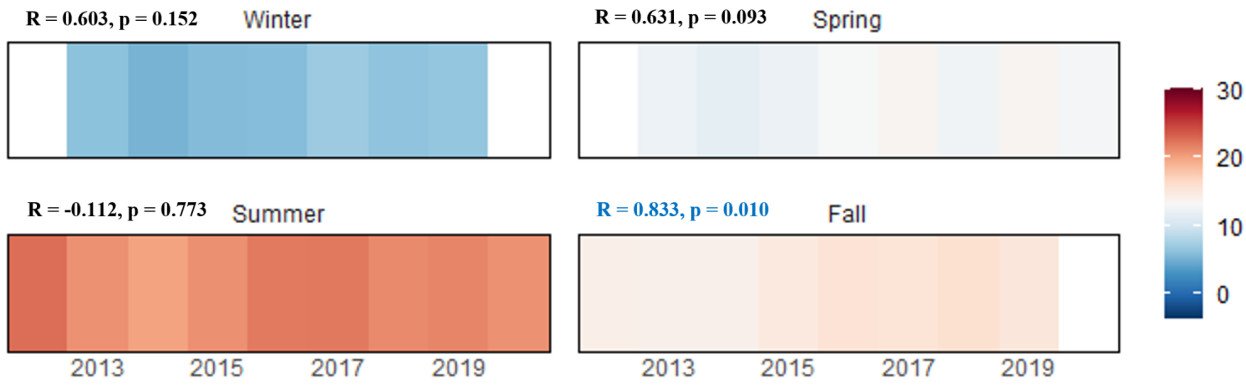
Parameter	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.073, p = 0.852	12	18	13	11	16	12	13	11	16
Epifaunal substrate (0-20)	R = 0.120, p = 0.758	13	17	14	15	16	15	14	12	18
Velocity/Depth Diversity (0-20)	R = -0.372, p = 0.324	12	12	13	13	8	11	9	12	11
Pool Quality (0-20)	R = -0.421, p = 0.259	12	17	11	12	9	13	9	12	11
Riffle Quality (0-20)	**R = 0.693, p = 0.039**	8	11	8	9	12	11	11	11	12
Shading (%)	R = 0.345, p = 0.364	65	50	70	35	35	45	60	65	90
Embeddedness (%)	R = -0.155, p = 0.690	20	40	80	75	55	70	35	40	25
Discharge (cfs)	R = 0.314, p = 0.411	0.24	0.11	0.2	0.1	0.17	0.19	0.18	0.4	0.16
Stream Area (m2)	**R = -0.860, p = 0.003**	159.4	144.4	121.9	120.0	112.5	97.5	103.5	112.5	101.3

Temperature

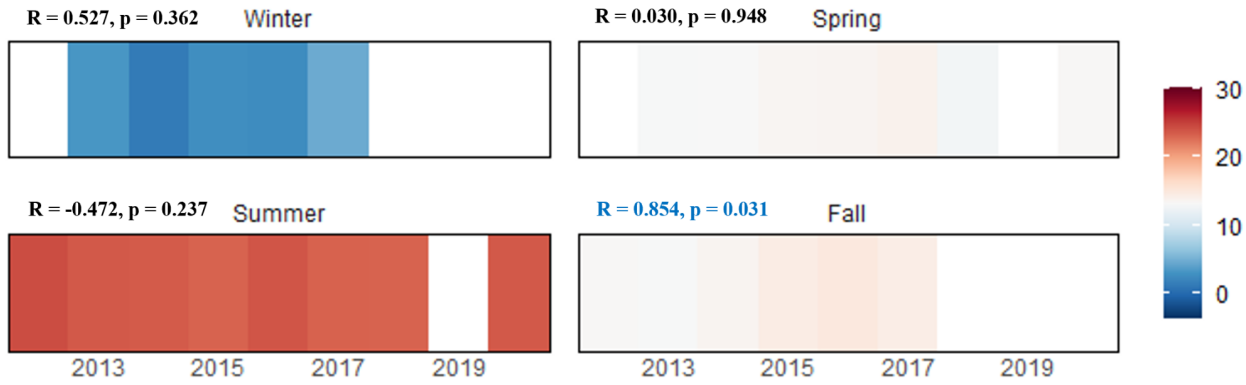
Percentage summer water temperature readings falling above 20°C/above 24°C at Reeder Run (only calculated for summers missing no less than 2 weeks of data).

Parameter	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.242, p = 0.530	83.5	62.4	46.1	73.5	80.9	85.0	76.3	74.9	72.2

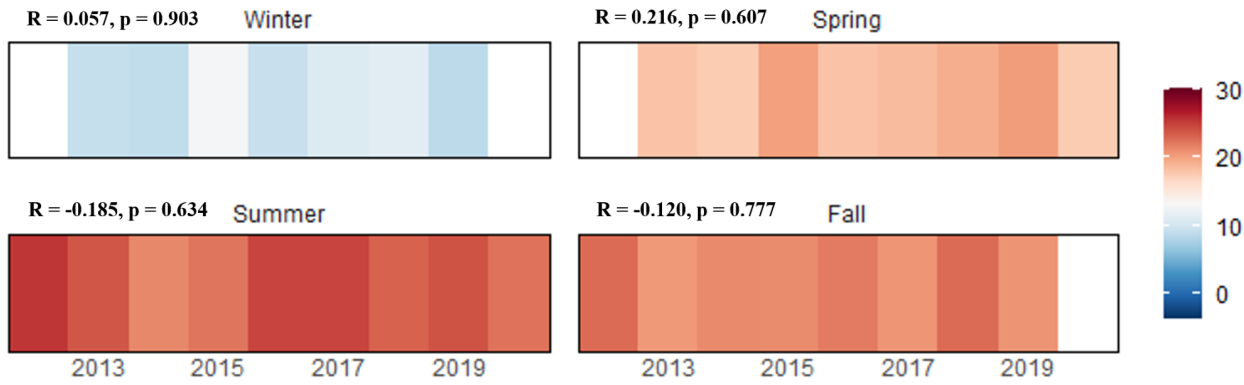
Parameter	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 24°C	R = -0.420, p = 0.260	33.7	9.4	1.7	2.6	18.6	16.2	7.6	12.0	1.5



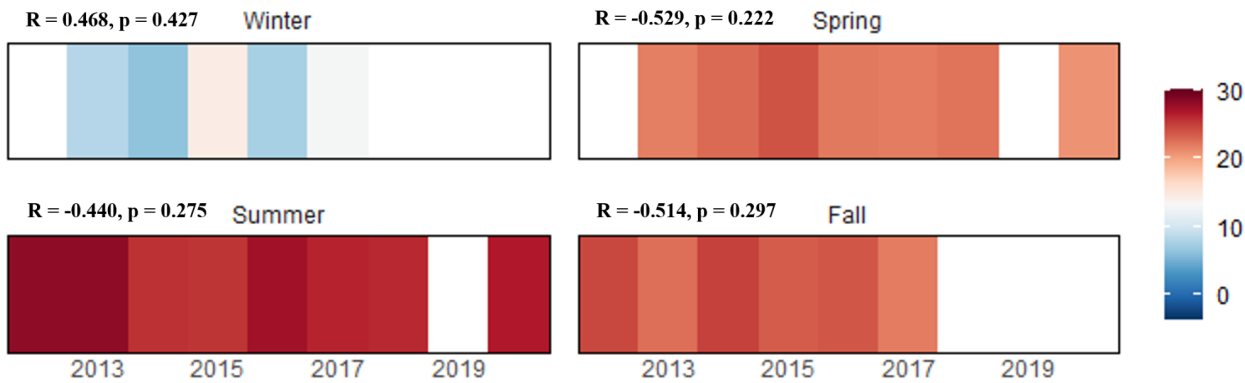
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Reeder Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Reeder Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Reeder Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Reeder Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.073, p = 0.852	3.86	4.71	5.00	5.00	4.14	4.14	4.43	3.57	5.00
# Taxa	R = -0.126, p = 0.746	25	27	31	34	18	31	36	14	28
# Ephemeroptera Taxa	R = 0.149, p = 0.702	1	2	4	4	2	3	4	1	3
# EPT Taxa	R = 0.346, p = 0.362	6	8	10	11	6	12	13	6	11
# Scraper Taxa	R = 0.466, p = 0.206	1	2	3	3	2	3	4	3	2
% Climbers	R = 0.036, p = 0.927	5.8	9.8	13.0	10.3	27.5	3.3	26.8	0.8	9.3
% Ephemeroptera	R = 0.056, p = 0.885	1.7	10.7	13.0	20.6	2.3	5.8	6.3	1.6	17.8
% Intolerant Urban Taxa	R = 0.182, p = 0.639	40.0	53.6	34.2	42.1	11.5	20.8	24.1	78.7	51.7

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.274, p = 0.476	5.00	4.67	4.67	5.00	4.67	4.67	5.00	4.67	4.67
Abundance per m2	R = 0.129, p = 0.742	0.81	1.25	1.1	2.76	1.88	1.76	1.59	0.89	1.5
# Benthic Sp. (Adjusted)	R = 0.183, p = 0.638	3.83	2.55	3.83	3.83	2.55	2.55	3.83	3.83	3.83
% Abundance of Dominant Species	R = -0.339, p = 0.372	28.7	53.3	32.1	27.2	19.0	19.2	18.2	29.0	35.5
% Generalists/ Omnivores/ Invertivores	R = 0.504, p = 0.166	79.1	88.3	97.0	84.9	92.9	92.4	81.8	97.0	97.4
% Round-bodied Suckers	R = 0.063, p = 0.871	14.0	8.3	10.5	7.6	19.0	18.0	15.2	10.0	9.2
% Tolerant	**R = 0.848, p = 0.004**	33.3	21.7	34.3	35.1	38.4	44.8	39.4	43.0	55.9

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Red Run by sampling year.

Species	*Tolerance*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	*M*	*3*	*8*	*17*	*15*	*9*	*5*	*10*	*7*	*5*
Blacknose Dace	T	2	6	12	52	35	33	20	29	54
Chain Pickerel	M	1	1	-	-	-	-	-	-	-
Creek Chub	T	-	2	1	27	30	24	12	5	21

Species	*Tolerance*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Creek Chubsucker	M	18	15	14	25	40	31	25	10	14
Eastern Mudminnow	T	20	17	30	21	3	12	26	4	5
Fallfish	I	-	-	-	-	1	-	-	-	1
Golden Shiner	T	15	8	1	-	-	2	1	3	2
Green Sunfish	T	-	-	-	-	-	-	1	-	-
Least Brook Lamprey	M	26	17	3	49	15	13	30	3	4
Lepomis Hybrid	M	-	3	1	1	-	-	-	-	-
Margined Madtom	I	1	-	1	1	-	-	3	4	2
Pumpkinseed	T	-	2	-	-	-	-	-	-	-
Redbreast Sunfish	M	37	96	43	90	30	22	10	15	12
Rosyside Dace	M	-	1	8	34	35	24	22	18	28
Swallowtail Shiner	M	-	-	-	-	-	-	-	-	1
Tessellated Darter	T	6	4	2	16	13	6	5	2	3
Yellow Bullhead	M	-	-	1	-	-	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Red Run by sampling year

Species	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	N	N	N	N	N	N	N	N	D
Faxonius limosus	D	D	D	D	N	N	N	N	D
Procambarus clarkii	D	D	N	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Reeder Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Reeder Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Eastern cricket frog, Fowler's toad, Northern green frog, Northern spring peeper, Gray treefrog or Cope's gray treefrog, Pickerel frog, Southern leopard frog
Caudata (Salamanders and Newts)	Northern two-lined salamander
Squamata (Snakes and Lizards)	Common five-lined skink, Eastern fence lizard, Eastern wormsnake, Northern watersnake
Testudines (Turtles)	Eastern box turtle, Stinkpot, Red-eared slider

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Reeder Run by sampling year, RA = %Relative Abundance.

					2012	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	*T*	-	-	-	-	-	-	*0.89*	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	*0.89*	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	0.83	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	-	0.79	-	1.67	0.89	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	0.81	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	0.83	-	0.81	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	*0.76*	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	*0.89*	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	1.57	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	*0.81*	*5.56*	-	*4.17*	*0.89*	*1.57*	-
Arthropoda	Collembola	na	na	M	-	-	-	-	-	-	0.89	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	0.79	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	4.46	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	1.79	-	-	-	-	0.89	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	0.81	1.59	-	1.67	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	2.29	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	0.83	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladopelma	M	*0.83*	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	0.79	-	0.83	0.89	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	0.89	0.81	-	-	-	4.46	-	0.85
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	*1.67*	*0.89*	-	-
Arthropoda	Diptera	Chironomidae	Endochironomus	M	-	-	-	0.79	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	1.59	-	0.83	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	0.89	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	2.50	0.89	-	-	-	0.83	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.89	-	0.79	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	0.79	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	*1.67*	-	-	-	*3.82*	-	*1.79*	*0.79*	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	0.89	-	2.38	-	1.67	-	8.66	0.85
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	26.67	4.46	5.69	3.17	5.34	4.17	-	-	0.85
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	0.83	0.89	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.83	2.68	0.81	0.79	25.95	-	21.43	0.79	0.85
Arthropoda	Diptera	Chironomidae	Psectrocladius	M	-	-	-	-	1.53	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	0.83	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	0.79	4.58	7.50	15.18	0.79	2.54
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	0.83	-	-	2.38	0.76	1.67	-	-	1.69
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	2.68	4.07	-	0.76	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stictochironomus	T	-	-	-	0.79	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	0.89	-	0.79	-	-	-	0.79	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	0.85
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	0.89	4.88	4.76	-	-	4.46	-	2.54
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	0.81	1.59	-	0.83	-	-	1.69
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	4.17	0.89	-	0.79	3.05	0.83	0.89	1.57	0.85
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	0.89	-	-	-	-	0.89	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	1.67	0.89	0.81	-	-	0.83	1.79	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	0.79	0.76	-	-	-	0.85
Arthropoda	Diptera	Chironomidae	Unniella	M	6.67	-	0.81	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.83	-	-	-	-	-	1.79	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	2.68	1.63	-	-	2.50	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	7.50	2.68	6.50	2.38	5.34	32.50	2.68	0.79	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	2.50	29.46	1.63	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	0.89	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	0.81	-	-	-	1.79	-	1.69
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	4.07	3.17	-	-	0.89	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	0.79	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	8.04	7.32	14.29	0.76	0.83	2.68	-	4.24
Arthropoda	Ephemeroptera	Baetidae	Centroptilum	I	-	-	1.63	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	1.67	-	0.81	1.59	-	3.33	1.79	1.57	3.39
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	0.79	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	2.68	3.25	2.38	1.53	1.67	0.89	-	10.17
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	0.79	-	-	0.89	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	0.79	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	1.67	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	-	-	0.85
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.83	2.68	0.81	3.97	0.76	1.67	-	-	2.54
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	1.63	-	-	-	-	-	0.85
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	1.67	-	-	-	-	-	-	-	0.85

					2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Odonata	Coenagrionidae	Argia	T	-	-	-	-	-	-	0.89	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	0.83	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	1.63	0.79	-	0.83	-	-	-
Arthropoda	Odonata	Gomphidae	Hagenius	I	-	-	-	-	-	-	-	-	0.85
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	0.85
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	28.33	-	-	2.38	-	0.83	8.93	76.38	19.49
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	3.25	7.94	4.58	4.17	0.89	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	1.67	-	3.25	-	1.53	0.83	0.89	0.79	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	3.33	1.79	-	0.85
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	4.24
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	0.89	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	-	-	-	-	0.83	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.83	13.39	8.13	5.56	19.85	13.33	8.93	-	14.41
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	2.68	4.07	2.38	-	-	0.89	-	4.24
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	8.04	26.02	7.94	16.03	0.83	0.89	0.79	11.86
Arthropoda	Trichoptera	Hydroptilidae	Hydroptila	M	-	-	-	-	-	-	-	0.79	-
Arthropoda	Trichoptera	Hydroptilidae	Oxyethira	I	-	-	0.81	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	0.85
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	0.83	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	0.79	-	0.83	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	0.89	-	0.79	-	0.83	0.89	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	0.89	-	8.73	-	-	-	-	1.69
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	1.67	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	0.89	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	0.83	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	1.57	1.69
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	0.81	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to St. Clements Creek (STCL-051-S)

Site STCL-051-S is located on an unnamed tributary to St. Clements Creek in the Coastal Plain – western shore region of Maryland. It is in the St. Clements Bay watershed in St. Mary's County. This site was sampled in 1995 and from 2000 to 2020.

Unnamed tributary to St. Clements Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	75.13	75.22	75.22	75.22	75.22	75.22	75.22
Urban	5.89	5.89	5.89	5.89	5.89	5.89	5.89
Agriculture	15.29	15.29	15.29	15.29	15.29	15.29	15.29
Other	3.69	3.60	3.60	3.60	3.60	3.60	3.60

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to St. Clements Creek (1995, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.055, p = 0.811	6.86	7.03	6.96	7.06	6.77	6.38	6.86	7.09	6.99	7.09	7.02	6.98	6.90
Specific Conductance (µS/cm)	R = 0.078, p = 0.738	61.5	64.4	70.7	88.2	60.0	50.8	55.6	74.2	60.9	105.3	79.7	53.1	80.8
Acid Neutralizing Capacity (µeq/L)	R = 0.065, p = 0.779	313.9	318.0	303.6	530.4	214.2	84.4	187.1	395.8	293.4	508.3	346.4	223.8	315.1
Dissolved Organic Carbon (mg/L)	R = 0.285, p = 0.211	4.000	3.400	2.600	3.400	2.900	5.900	3.392	3.146	2.433	2.100	3.146	4.730	4.290
Chloride (mg/L)	R = 0.242, p = 0.305		4.75	5.28	5.32	5.30	3.56	3.96	5.73	4.41	6.20	6.05	4.40	9.11
Sulfate (mg/L)	R = -0.247, p = 0.281	7.05	6.05	6.56	5.58	8.78	8.33	7.44	5.35	5.51	13.68	8.25	6.38	8.15
Total Nitrogen (mg/L)	R = 0.075, p = 0.754		0.258	0.125*	0.146	0.135	0.562	0.153	0.082*	0.128	0.279	0.139	0.259	0.188
Nitrate-Nitrogen (mg/L)	R = -0.314, p = 0.166	0.2000	0*	0.0010*	0.0010*	0.0210	0.3030	0.0510	0.0019*	0.0244	0.0019*	0.0019*	0.0172	0.0029
Nitrite-Nitrogen (mg/L)	**R = 0.634, p = 0.003**		0*	0.0017*	0.0007	0.0004*	0.0024	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0015
Ammonia-Nitrogen (mg/L)	R = -0.175, p = 0.460		0.0093*	0.0103	0.0169	0.0047	0.0157	0.0073	0.0060	0.0053	0.0020*	0.0036	0.0047	0.0034
Total Phosphorus (mg/L)	**R = 0.456, p = 0.043**		0.0170	0.0160	0.0250	0.0120	0.0330	0.0194	0.0274	0.0282	0.0160	0.0338	0.0330	0.0158
Ortho-phosphate (mg/L)	**R = 0.559, p = 0.010**		0*	0.0076	0.0121	0.0049	0.0046	0.0073	0.0124	0.0098	0.0084	0.0091	0.0101	0.0078
Bromide (mg/L)	R = 0.517, p = 0.235													
Magnesium (mg/L)	R = -0.570, p = 0.238											1.469		
Calcium (mg/L)	R = 0.477, p = 0.339											8.004		
Copper (µg/L)	R = -0.740, p = 0.092													
Zinc (µg/L)	R = -0.810, p = 0.051													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.77	6.85	6.56	6.73	7.12	7.13	6.89	6.99	
Specific Conductance (µS/cm)	59.8	56.3	62.4	82.3	73.0	84.4	58.9	63.4	
Acid Neutralizing Capacity (µeq/L)	250.9	227.0	123.8	178.2	440.6	540.8	275.5	389.7	
Dissolved Organic Carbon (mg/L)	5.085	3.930	7.277	4.741	3.974	2.468	4.895	3.871	
Chloride (mg/L)	5.04	4.91	8.49	12.66	5.06	5.11	4.60	4.12	
Sulfate (mg/L)	6.69	7.24	6.72	7.89	4.54	4.50	5.75	4.37	
Total Nitrogen (mg/L)	0.260	0.178	0.382	0.306	0.150	0.181	0.226	0.204	Not sampled due to COVID-19 Pandemic
Nitrate-Nitrogen (mg/L)	0.0537	0.0217	0.0531	0.0880	0.0061	0.0029	0.0249	0.0093	
Nitrite-Nitrogen (mg/L)	0.0016	0.0011*	0.0034	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0199	0.0057	0.0110	0.0075	0.0057	0.0054	0.0086	0.0084*	
Total Phosphorus (mg/L)	0.0502	0.0174	0.0416	0.0297	0.0339	0.0264	0.0274	0.0327	
Ortho-phosphate (mg/L)	0.0074	0.0058	0.0084	0.0150	0.0144	0.0149	0.0090	0.0113	
Bromide (mg/L)		0.0122	0.0072	0.0141	0.0218	0.0235	0.1390	0.0249	
Magnesium (mg/L)			1.277	1.428	1.198	1.305	1.193	1.201	
Calcium (mg/L)			3.258	4.827	7.937	10.630	5.645	6.829	
Copper (µg/L)			1.258	0.995	0.304	0.160	0.647	0.267	
Zinc (µg/L)			10.233	9.332	2.634	1.870	3.894	2.314	

Physical Habitat

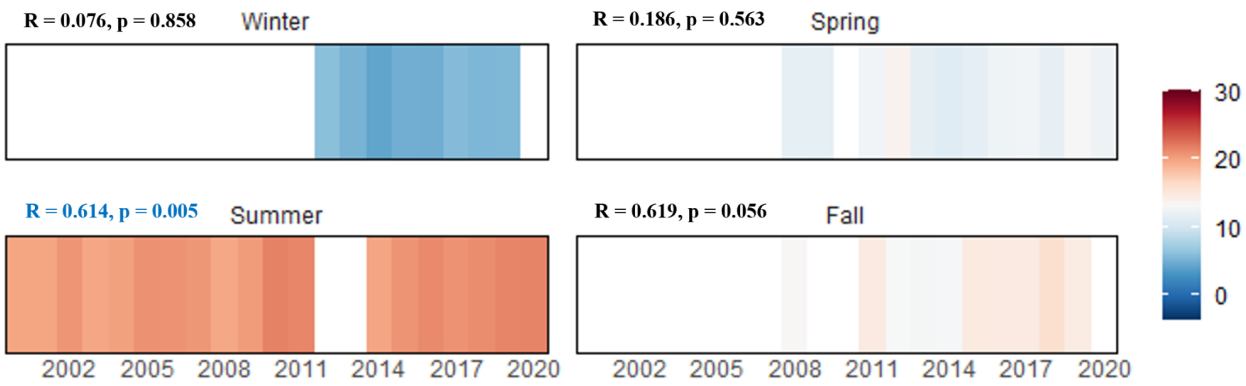
Physical habitat measurements collected at the unnamed tributary to St. Clements Creek (1995, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.164, p = 0.465	12	14	18	14	14	11	14	14	13	17	15	12	13	13	17	15	16	14	13	7	11	15
Epifaunal substrate (0-20)	R = 0.013, p = 0.953	11	13	16	15	14	13	14	15	16	14	9	12	12	15	17	17	18	15	16	6	13	13
Velocity/Depth Diversity (0-20)	R = 0.276, p = 0.213	12	5	13	8	12	11	8	6	4	7	6	10	10	5	11	12	13	14	12	11	11	11
Pool Quality (0-20)	R = 0.193, p = 0.390	11	10	15	7	15	12	10	10	10	10	10	10	10	10	15	12	14	13	13	11	11	12
Riffle Quality (0-20)	R = 0.030, p = 0.894	9	6	11	7	14	11	8	7	6	7	7	10	10	7	10	8	11	14	7	9	8	8
Shading (%)	**R = -0.613, p = 0.002**	90	95	95	95	95	92	91	92	95	75	80	90	90	90	90	60	85	85	80	75	80	80
Embeddedness (%)	R = 0.393, p = 0.070	5	40	25	30	40	20	30	40	15	40	45	85	20	20	55	50	50	35	25	45	35	50
Discharge (cfs)	R = -0.091, p = 0.687	0.06	0.11	0.16	0.01	0.4	0.12	0.16	0.09	0.02	0.11	0.02	0.02	0.03	0.04	0.08	0.08	0.04	0.1	0.11	0.28	0.11	0.03
Stream Area (m2)	**R = 0.450, p = 0.036**	101.3	106.9	103.1	105.0	151.9	120.0	114.4	133.1	116.3	142.5	69.4	121.9	110.6	103.1	142.5	127.5	144.4	123.8	118.1	161.3	141.8	135.0

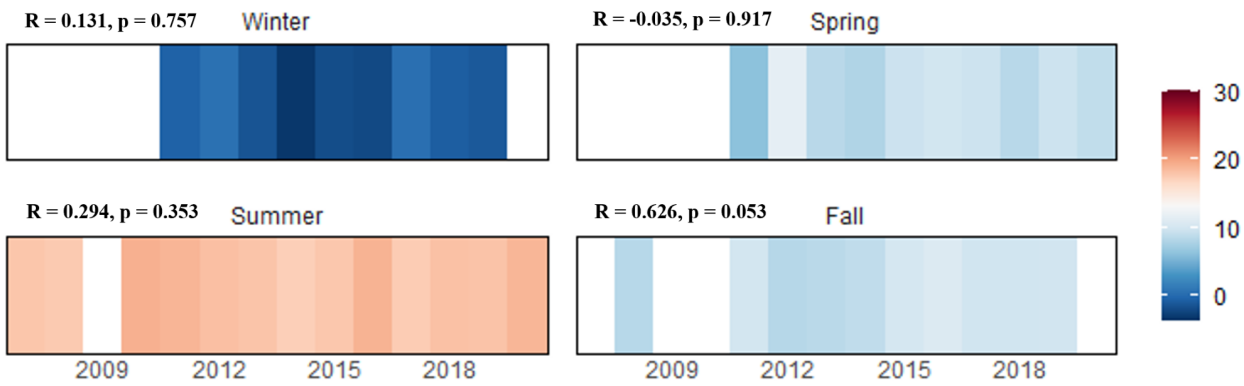
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at St. Clements Creek (only calculated for summers missing no less than 2 weeks of data).

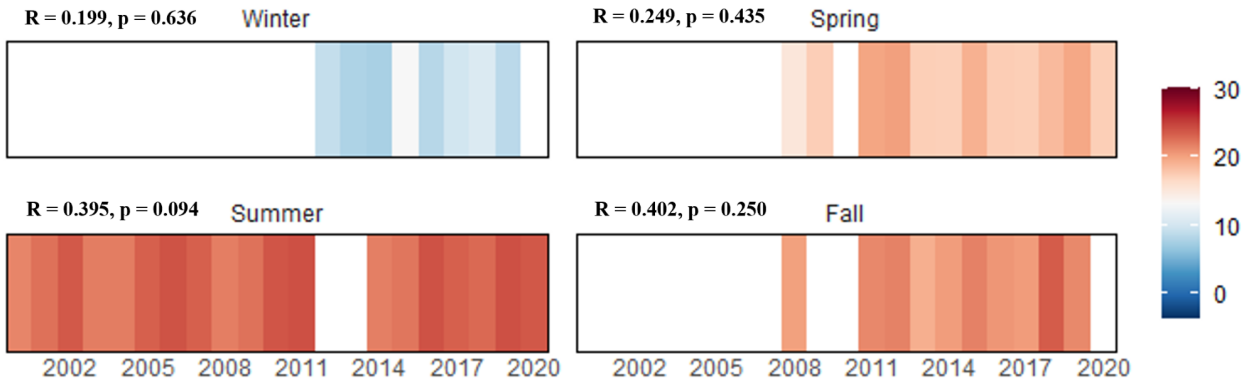
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.521, p = 0.022**	47.5	50.9	60.2	57.8	57.9	71.1	69.8	64.7	41.8	54.5	84.9	79.7	-	-	43.9	72.5	67.9	69.6	74.8	77.4	77.4
% above 24°C	R = 0.367, p = 0.122	0	0.2	5.4	0	0	2.7	6.0	2.2	0	0	6.9	6.7	-	-	0	0.2	10.7	0.8	0.8	7.2	7.5



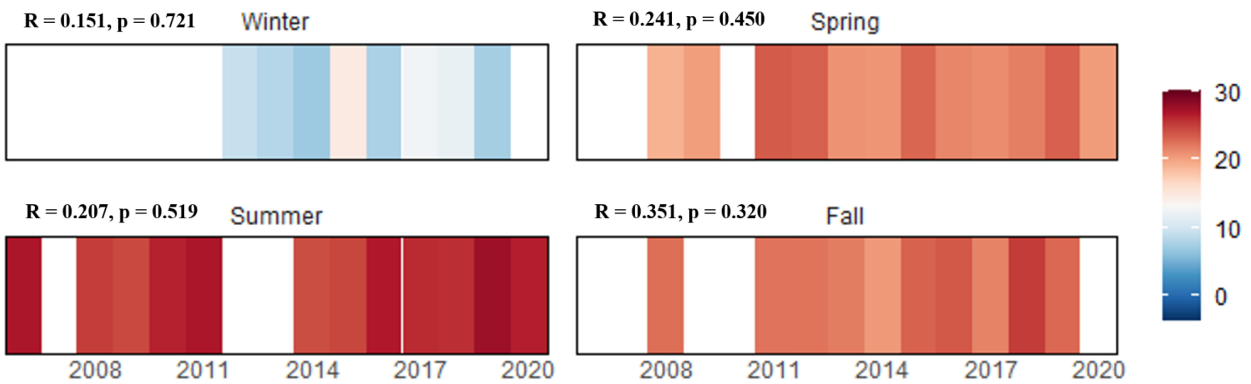
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to St. Clements Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to St. Clements Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to St. Clements Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to St. Clements Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.111, p = 0.624	4.43	4.43	5.00	4.14	4.43	5.00	4.71	4.71	5.00	4.14	4.43	4.71	3.29	4.71	4.14	5.00	4.71	5.00	4.71	4.71	4.14	3.86
# Taxa	R = 0.033, p = 0.883	22	28	26	21	22	36	35	38	40	26	21	32	13	30	21	31	35	24	27	21	27	34
# Ephemeroptera Taxa	**R = -0.425, p = 0.049**	4	5	5	5	2	5	6	5	5	4	3	3	1	6	2	4	4	4	5	3	2	1
# EPT Taxa	R = -0.289, p = 0.193	11	8	12	11	11	14	16	16	16	9	10	11	5	13	4	14	15	12	12	7	7	6
# Scraper Taxa	R= -0.049, p = 0.830	5	4	3	5	2	3	5	7	8	1	4	6	3	3	1	9	5	4	6	3	4	2
% Climbers	R = 0.405, p = 0.061	0	0.9	13.3	0.8	2.6	15.1	7.4	5.9	14.4	6.3	5.0	5.3	0.8	2.6	8.2	15.2	7.9	8.1	4.1	32.7	5.1	16.4
% Ephemeroptera	R = -0.171, p = 0.446	33.3	22.2	22.1	46.7	7.7	13.2	32.4	37.8	14.4	10.5	46.2	11.5	0.8	14.7	36.9	19.2	21.9	37.9	53.7	18.6	4.2	0.9
% Intolerant Urban Taxa	R = -0.245, p = 0.271	68.1	41.9	84.1	77.1	80.3	36.8	58.3	63.0	58.6	54.7	89.1	59.3	92.7	87.9	84.4	74.4	43.0	70.2	85.1	51.3	24.6	9.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.398, p = 0.067	4.33	3.33	3.67	3.33	3.67	3.67	3.67	3.33	4.00	1.67	3.67	3.00	3.67	4.00	4.00	4.00	4.33	3.67	4.33	4.67	4.33	4.67
Abundance per m2	R = -0.316, p = 0.152	3.36	0.8	1.84	0.87	0.42	2.29	1.91	0.81	1.63	0.4	1.38	1.53	0.71	1.15	2.53	1.67	1.48	1.62	1.23	0.49	0.85	1.01
# Benthic Sp. (Adjusted)	R = 0.040, p = 0.861	4.11	1.37	2.74	1.37	1.37	2.74	2.74	1.37	2.74	1.37	1.37	2.74	1.37	2.74	2.74	2.74	2.74	2.74	2.74	1.37	2.74	2.74
% Abundance of Dominant Species	R = -0.414, p = 0.056	47.7	60.0	50.0	59.3	65.6	65.1	65.3	54.6	62.4	71.9	85.4	70.4	46.2	50.4	56.1	56.3	51.6	66.5	42.1	34.2	35.0	35.8

Metric	*Pearson's Correlation Coefficients*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Generalists/ Omnivores/ Invertivores	R = -0.320, p = 0.147	90.6	94.1	99.0	96.7	89.1	92.7	95.0	93.5	85.2	100	99.0	98.9	93.6	97.5	96.7	96.7	88.7	93.5	84.1	78.5	88.3	92.0
% Round-bodied Suckers	R = 0.333, p = 0.129	3.5	0	1.1	0	3.1	0.7	1.8	0	1.1	0	2.1	0	5.1	3.4	10.3	3.8	2.8	1.5	3.5	3.8	1.7	2.9
% Tolerant	**R = -0.567, p = 0.006**	81.5	90.6	93.7	96.7	85.9	92.0	93.2	93.5	83.1	100	96.9	90.9	85.9	92.4	85.0	88.3	81.7	90.0	78.6	67.1	70.0	71.5

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to St. Clements Creek by sampling year.

Species	*Tolerance*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	1	1
Blacknose Dace	T	97	26	95	34	13	179	143	59	118	41	82	131	31	60	98	63	110	133	61	26	42	49
Creek Chubsucker	M	12	-	2	-	2	2	4	-	2	-	2	-	4	4	37	8	6	3	5	3	2	4
Eastern Mudminnow	T	162	51	80	54	42	73	59	42	37	12	11	35	36	49	202	120	60	38	50	27	34	43
Fallfish	I	16	2	8	-	-	-	-	-	2	-	-	15	2	1	2	8	7	2	2	5	13	20
Least Brook Lamprey	M	31	5	2	3	7	20	11	7	28	-	1	-	5	3	12	7	24	13	23	17	14	11
Pirate Perch	T	9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Redbreast Sunfish	M	2	-	-	-	-	-	-	-	-	-	-	-	-	1	3	2	2	-	1	1	6	3
Sea Lamprey	I	1	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-
Tessellated Darter	T	9	-	3	-	-	1	2	-	2	4	-	3	-	1	6	5	4	9	3	-	8	6

I indicates in tolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to St. Clements Creek by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Faxonius limosus	D	D	D	N	D	D	D	D	D	D	D	D	D	D	D
Lacunicambarus diogenes	N	D	N	D	N	N	D	D	N	D	D	D	D	D	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to St. Clements Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the unnamed tributary to St. Clements Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Fowler's toad, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Wood frog
Caudata (Salamanders and Newts)	Northern red salamander, Northern two-lined salamander, Spotted salamander
Squamata (Snakes and Lizards)	Northern black racer, Northern watersnake, Eastern wormsnake
Testudines (Turtles)	Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to St. Clements Creek by sampling year, RA = %Relative Abundance

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	-	6.0	-	-	-	-	-	-	-	1.1	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	2.6	0.9	-	-	0.9	-	-	-	-	-	0.9
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-	-	4.4
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	4.3	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	-	1.8	-	6.0	5.7	0.9	-	1.8	-	-	0.9
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	17.4	-	0.9	-	-	4.7	2.8	-	4.5	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	0.8	0.9	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	1.1	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporous	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	0.9	-	-	1.7	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Microcylloepus	M	-	-	-	-	-	-	2.8	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.9	8.5	5.3	17.2	6.8	-	4.6	1.7	0.9	-	10.9	2.7
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	1.7	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrochidae	Hydrochus	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Helochares		-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	-	-	-	-	-	-	-	1.1	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	4.3	0.9	-	1.6	1.7	-	-	0.8	1.8	-	0.8	1.8
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	1.7	1.8	8.2	-	1.9	7.4	5.9	3.6	4.2	4.2	0.9
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-

					1995	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	1.1	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	0.9	-	-	-	-	0.8	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	1.7	-	-	-	-	2.1	-	-
Arthropoda	Diptera	Ceratopogonidae	Culicoides	M	-	-	-	-	-	-	-	-	-	2.1	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	0.9	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	1.9	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	4.3	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	1.8	-	-	-	-	-	1.8	5.3	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.9	2.7	-	1.7	-	-	-	-	1.1	-	0.9
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	0.9	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	10.6	-	-	-	0.9	0.8	1.8	-	2.5	0.9
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	2.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Monodiamesa	T	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	0.8	-	-	-	-

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	2.6	-	-	0.8	2.7	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	2.8	0.9	0.8	1.8	-	-	3.5
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	6.8	1.8	-	-	0.9	-	1.7	0.9	-	0.8	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	3.2	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.9	0.9	-	-	2.8	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	4.7	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	1.7	-	-	0.8	1.8
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	4.3	-	-	-	-	0.9	1.7	1.8	3.2	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	6.6	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	0.9	7.5	4.6	0.8	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	0.8	-	9.4	1.9	0.8	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	1.4	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	5.1	-	-	-	-	-	0.8	0.9	9.5	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixella	M	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	4.3	-	24.8	-	9.4	-	-	1.7	0.9	24.2	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Simuliidae	Simulium	M	2.9	12.8	-	-	-	2.8	-	-	0.9	-	-	15.9
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	7.1	0.8	17.9	-	-	1.7	0.9	2.1	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	2.1	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	2.5	-	-	-	-	-	1.1	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	0.8	-	0.9	-	0.8	2.7	-	-	3.5
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	-	-	-	-	-	-	-	-	2.1	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	0.9	-	-	-	0.9	2.8	-	-	-	1.7	-
Arthropoda	Diptera	Tipulidae	Tipula	M	1.4	1.7	0.9	-	7.7	0.9	0.9	0.8	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	0.9	2.1	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	1.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	5.8	-	8.0	8.2	-	4.7	8.3	1.7	2.7	-	16.8	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	0.9	-	-	-	-	-	2.5	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	21.7	4.3	8.0	32.8	6.0	3.8	13.0	29.4	4.5	1.1	27.7	6.2
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	1.1	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	1.4	0.9	-	1.6	-	0.9	0.9	2.5	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	1.7	1.8
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	0.9	1.6	-	1.9	5.6	0.8	0.9	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	4.3	-	-	2.5	-	-	1.9	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	0.9	-	0.9	0.9	-	0.8	-	5.3	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	0.9	0.9	-	-	1.8	-	-	2.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	14.5	4.4	-	-	-	2.8	-	3.6	-	-	-
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	-	-	-	1.1	-	-
Arthropoda	Hemiptera	Gerridae	Trepobates	M	1.4	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	1.4	2.6	-	-	1.7	-	0.9	-	2.7	-	-	0.9

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	1.9	-	0.8	0.9	-	0.8	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	0.9	-	1.8	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	1.9	0.9	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	4.3	-	-	-	-	-	1.9	-	-	1.1	-	-
Arthropoda	Odonata	Gomphidae	Arigomphus	I	2.9	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	0.9	-	2.5	-	-	-	-	-	-	1.7	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	0.8	-	2.1	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	2.9	-	-	-	17.1	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	0.9	5.3	6.6	0.9	1.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	10.2	7.6	20.7	-	7.6	22.1
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	2.9	1.7	-	1.6	0.9	4.7	1.9	5.9	2.7	-	10.1	4.4
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	4.3	-	-	1.7	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	4.3	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	5.0	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	2.7	-	-	3.8	-	-	-	-	-	1.8
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	0.8	-	0.9	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	4.3	-	0.9	-	0.9	-	-	-	2.7	-	0.8	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	5.1	-	-	0.9	0.9	-	-	-	13.7	-	-
Arthropoda	Trichoptera	Brachycentridae	Brachycentrus	I	1.4	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Calamoceratidae	Anisocentropus		-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	6.6	-	-	1.9	-	0.9	-	1.7	0.9
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.4	-	2.7	0.8	-	1.9	1.9	-	-	-	5.0	5.3

					1995	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	0.8	0.9	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	2.8	2.8	-	1.8	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	1.8	-	1.7	-	-	-	0.9	1.1	-	0.9
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	1.9	2.8	-	5.4	-	0.8	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	0.9	-	-	3.6	-	-	2.7
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	0.9	-	-	1.7	-	1.1	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	0.9	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	1.4	-	-	0.8	-	-	0.9	-	0.9	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	0.9	-	-	1.7	-	-	-	-
Arthropoda	Trichoptera	Sericostomatidae	Agarodes	I	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	7.2	-	0.9	-	-	-	3.7	1.7	1.8	1.1	0.8	1.8
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	-	-	-	3.2	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	0.8	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	Phagocata	T	-	1.7	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	1995 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	2.5	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	3.5	-	-	-	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	0.8	-	1.8	-	-	0.9	-	-
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	-	1.7	-	-	1.8	-	0.8	-	4.2	0.9
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	0.8	9.6	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporous	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	0.8	-	-	0.8	-	0.8	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Microcylloepus	M	-	-	-	-	-	-	-	3.5	7.6	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	2.6	0.8	4.8	-	4.8	1.7	1.8	0.8	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	0.8	0.9
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrochidae	Hydrochus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Helochares		-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	0.8	-	-	1.6	4.4	5.6	1.7	1.8	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	0.8	-	1.8	-	1.7	0.9	0.8	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	0.8	-	-	-	-	0.9	2.5	0.9
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Culicoides	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	0.8	-	-	-	26.7
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	0.8	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	1.8	-	0.9
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	4.3
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Diplocladius	M	0.8	0.9	-	-	-	-	0.8	-	2.5	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	-	6.8	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	2.4	-	-	2.5	-	-	-
Arthropoda	Diptera	Chironomidae	Labrundinia	M	-	-	-	-	-	-	-	-	-	1.7

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.9	4.9	14.4	0.9	1.6	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.9	0.8	-	0.9	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Monodiamesa	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	0.8	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	2.6	-	2.4	-	1.6	-	-	23.7	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	1.6	3.2	-	4.0	0.8	0.9	-	18.1
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	0.8	-	5.6	2.5	31.9	4.2	9.5
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Procladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.9	0.8	2.4	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	1.6	-	-	-	-	0.9	2.5	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	0.8	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	0.8	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	2.5	-	-	-	-	0.9	-	3.4
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	0.9	-	-	-	-	-	-	-	2.6
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	1.7	0.8	1.6	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	1.6	0.8	-	-	-	-	0.8	5.2
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	1.6	0.9	-	-	3.5	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Dixidae	Dixella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Simuliidae	Prosimulium	I	72.6	52.6	13.9	6.4	4.4	-	6.6	0.9	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	0.8	0.8	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	2.4	-	0.9	4.2	0.9
Arthropoda	Diptera	Simuliidae	Stegopterna	I	16.9	2.6	-	-	1.8	1.6	1.7	0.9	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	0.9	-	0.8	0.9	1.6	0.8	2.7	0.8	0.9
Arthropoda	Diptera	Tipulidae	Pilaria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.8	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	0.9	-	-	-	-	1.7	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	5.2	31.1	1.6	2.6	4.8	18.2	7.1	2.5	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	6.0	5.7	14.4	10.5	27.4	30.6	2.7	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	-	1.6	7.0	3.2	1.7	8.8	-	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	0.9	-	1.6	1.8	1.6	1.7	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Siphlonuridae	Siphlonurus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Gerridae	Trepobates	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.9	-	0.8	0.9	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	0.8	-	-	-	0.9
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Arigomphus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	0.8	-	-	-	-	1.7	0.9
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	0.8	0.9	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	0.9	-	-	0.9	-	-	-	-	0.9
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	4.4	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	2.4	4.1	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	6.0	10.7	5.6	-	7.3	-	16.8	8.5	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	1.7	17.2	9.6	-	4.0	3.3	-	0.8	0.9
Arthropoda	Plecoptera	Nemouridae	na	I	0.8	-	-	-	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	0.8	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	0.9	-	-	0.9	-	4.1	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Brachycentridae	Brachycentrus	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Calamoceratidae	Anisocentropus		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	-	-	0.8	1.8	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	4.0	8.8	4.8	-	1.8	4.2	0.9
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	0.9	-	-	1.8	3.2	2.5	9.7	3.4	1.7
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	0.8	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	0.9	-	0.9
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	0.8	-	-	-	2.6	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	0.8	3.5	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	7.9	2.4	0.8	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	na	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	1.6	-	-	0.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Sericostomatidae	Agarodes	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.8	-	-	9.6	-	4.0	4.1	-	-	-
Mollusca	Basommatophora	Planorbidae	Menetus	T	-	-	-	-	-	-	-	-	0.8	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	0.9	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	0.8	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	Phagocata	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Swanson Creek (PAXL-294-S)

Site PAXL-294-S is located on Swanson Creek in the Coastal Plain – western shore region of Maryland. It is in the Lower Patuxent River watershed in Charles County. This site was sampled in 1997 and from 2000 to 2020.

Swanson Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	73.36	73.50	73.43	73.46	73.62	73.70	73.36
Urban	10.59	10.59	10.59	10.59	10.59	10.59	10.77
Agriculture	14.28	14.21	14.18	14.21	14.23	14.21	14.12
Other	1.76	1.70	1.79	1.74	1.56	1.50	1.76

Water Chemistry

Water chemistry measurements collected at Swanson Creek (1997, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	**R = 0.483, p = 0.027**	6.85	6.70	6.94	6.83	6.46	6.69	6.75	7.11	7.01	6.89	7.09	6.96	6.965
Specific Conductance (µS/cm)	**R = 0.491, p = 0.024**	80.6	81.4	91.6	98.0	100.0	90.98	101.4	117.1	102.5	137.3	128.0	106.2	116.2
Acid Neutralizing Capacity (µeq/L)	**R = 0.569, p = 0.007**	152.5	153.0	166.4	207.6	87.5	132.0	128.9	193.3	165.5	214.6	235.6	158.4	169.1
Dissolved Organic Carbon (mg/L)	R = 0.340, p = 0.132	2.500	3.100	1.900	3.800	2.900	2.800	3.016	2.527	2.353	3.086	2.494	2.670	2.691
Chloride (mg/L)	**R = 0.604, p = 0.005**		7.00	7.36	8.41	11.89	9.91	11.15	15.95	12.58	16.86	15.41	13.74	15.28
Sulfate (mg/L)	R = -0.220, p = 0.339	14.76	14.74	14.80	15.37	17.54	14.00	14.61	15.35	13.86	22.33	17.12	13.75	15.42
Total Nitrogen (mg/L)	R = 0.008, p = 0.972		0.698	0.487	0.362	0.678	0.580	0.783	0.546	0.747	0.409	0.444	0.693	0.727
Nitrate-Nitrogen (mg/L)	R = -0.128, p = 0.579	0.6000	0.3130	0.4240	0.2130	0.5360	0.3520	0.7036	0.4135	0.5593	0.2253	0.2580	0.4966	0.5273
Nitrite-Nitrogen (mg/L)	R = 0.357, p = 0.122		0*	0.0009*	0.0041	0.0004*	0.0017	0.0019*	0.0029	0.0019	0.0019*	0.0025	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.373, p = 0.105		0.0417	0.0142	0.0442	0.0151	0.0516	0.0215	0.0130	0.0161	0.0222	0.0190	0.0114	0.0126
Total Phosphorus (mg/L)	R = -0.116, p = 0.625		0.0430	0.0350	0.0600	0.0450	0.0560	0.0485	0.0449	0.0390	0.0335	0.0476	0.0729	0.0288
Ortho-phosphate (mg/L)	**R = 0.703, p = 0.001**		0.0005*	0.0065	0.0124	0.0075	0.0080	0.0103	0.0152	0.0090	0.0084	0.0129	0.0120	0.0098
Bromide (mg/L)	R = 0.651, p = 0.114													
Magnesium (mg/L)	R = -0.111, p = 0.834											2.511		
Calcium (mg/L)	R = 0.232, p = 0.658											10.646		
Copper (µg/L)	R = -0.692, p = 0.128													
Zinc (µg/L)	R = -0.485, p = 0.330													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.93	6.85	6.77	6.87	7.16	7.30	7.02	6.89	
Specific Conductance (µS/cm)	104.2	102.9	99.7	122.4	107.5	117.6	117.5	93.0	
Acid Neutralizing Capacity (µeq/L)	195.9	188.7	145.7	186.0	204.9	261.7	235.8	212.4	
Dissolved Organic Carbon (mg/L)	2.667	1.898	4.734	3.154	3.888	2.994	3.120	3.574	
Chloride (mg/L)	12.84	13.45	13.41	17.22	14.17	15.22	14.73	10.77	
Sulfate (mg/L)	14.52	16.29	13.94	16.75	13.12	13.50	14.41	12.34	
Total Nitrogen (mg/L)	0.609	0.549	0.604	0.640	0.498	0.392	0.758	0.589	
Nitrate-Nitrogen (mg/L)	0.4401	0.4018	0.3778	0.4582	0.2864	0.2044	0.5678	0.4323	Not sampled due to COVID-19 Pandemic
Nitrite-Nitrogen (mg/L)	0.0017	0.0043	0.0026	0.0011*	0.0009	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0215	0.0166	0.0209	0.0471	0.0077	0.0124	0.0151	0.0155	
Total Phosphorus (mg/L)	0.0356	0.0311	0.0522	0.0378	0.0533	0.0540	0.0305	0.0447	
Ortho-phosphate (mg/L)	0.0099	0.0099	0.0176	0.0118	0.0205	0.0223	0.0126	0.0155	
Bromide (mg/L)		0.0169	0.0136	0.0146	0.0215	0.0201	0.0161	0.0247	
Magnesium (mg/L)			1.992	2.476	1.936	2.225	2.305	1.944	
Calcium (mg/L)			6.683	8.426	7.270	9.447	8.964	6.925	
Copper (µg/L)			0.569	0.381	0.230	0.296	0.251	0.313	
Zinc (µg/L)			11.176	15.725	4.948	3.607	7.583	8.350	

Physical Habitat

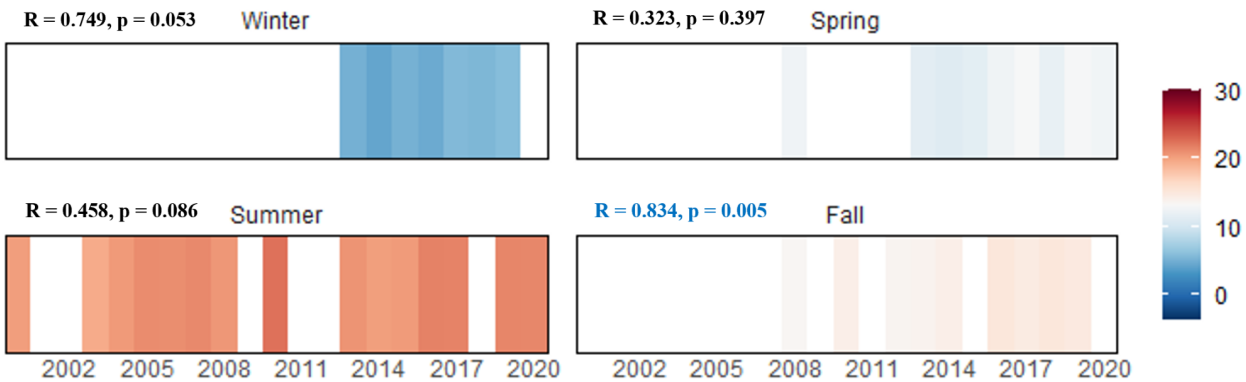
Physical habitat measurements collected at Swanson Creek (1997, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.150, p = 0.505	14	18	15	6	14	12	16	16	16	17	17	15	18	16	13	11	16	15	15	12	12	10
Epifaunal substrate (0-20)	R = -0.085, p = 0.707	13	16	13	4	16	15	13	12	15	14	15	13	15	16	12	10	17	14	14	11	12	9
Velocity/Depth Diversity (0-20)	R = 0.047, p = 0.835	14	15	15	6	17	12	13	12	12	16	16	14	16	14	15	12	14	13	13	16	13	12
Pool Quality (0-20)	R = -0.018, p = 0.936	14	17	15	11	15	12	16	16	15	16	17	15	17	15	17	14	17	16	15	14	11	14
Riffle Quality (0-20)	R = 0.025, p = 0.913	16	14	15	0	16	15	13	16	16	17	17	12	15	17	12	13	16	15	9	16	13	13
Shading (%)	**R = -0.459, p = 0.032**	65	70	92	91	90	90	90	90	89	80	80	90	85	80	70	60	70	60	70	75	85	55
Embeddedness (%)	**R = 0.536, p = 0.010**	20	35	30	50	20	25	35	65	50	75	75	75	40	70	80	80	85	55	80	55	50	35
Discharge (cfs)	R = 0, p = 1	4.21	3.86	7.01	0	14.04	2.62	2.59	2.84	2.53	6.26	6.74	2.83	1.38	4.05	2.53	3.33	3.86	3.45	3.7	12.18	5.49	2.07
Stream Area (m2)	R = 0.172, p = 0.445	266.3	315.0	360.0	47.6	365.6	348.8	301.9	241.9	221.3	346.9	318.8	238.1	283.1	303.8	191.3	277.5	301.9	346.9	243.8	332.3	337.5	346.9

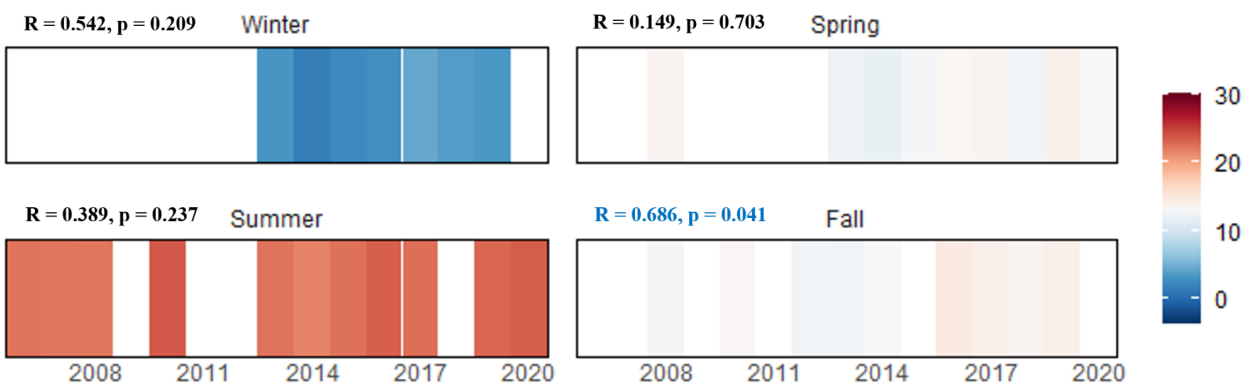
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Swanson Creek (only calculated for summers missing no less than 2 weeks of data).

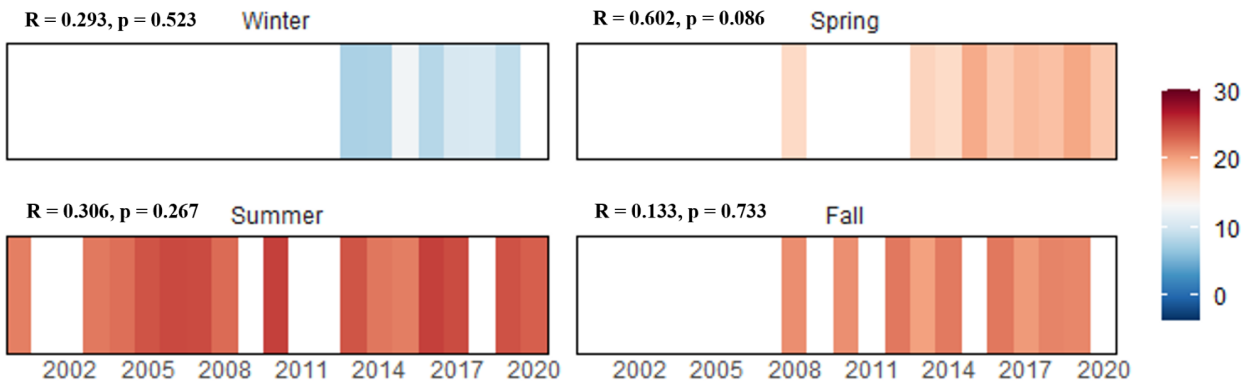
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.496, p = 0.060	56.9	-	-	50.9	64.2	70.5	70.4	73.1	61.5	-	87.7	-	-	63.0	55.6	68.5	70.7	77.6	-	74.4	80.7
% above 24°C	R = 0.251, p = 0.366	1.5	-	-	0.8	0.1	12.1	11.6	10.2	2.3	-	24.4	-	-	5.4	1.1	0	19.1	12.2	-	10.9	6.3



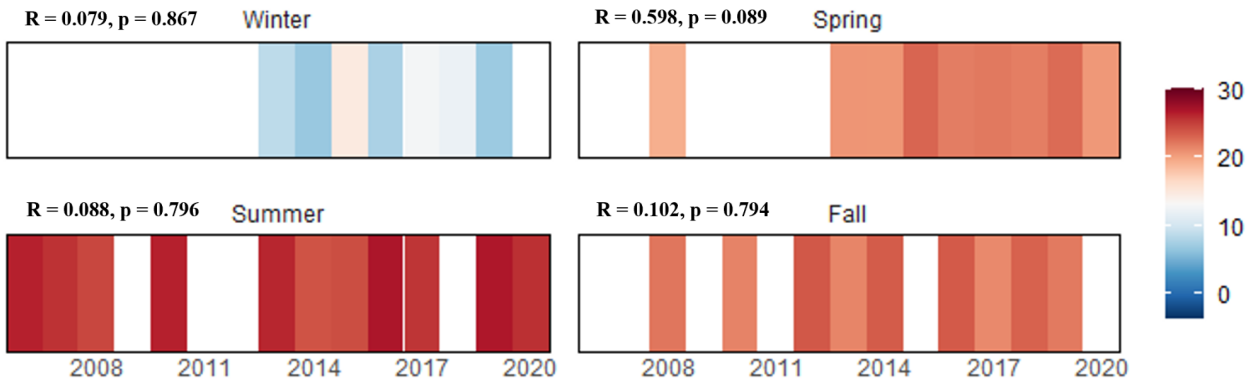
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Swanson Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Swanson Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Swanson Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Swanson Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.163, p = 0.468	4.43	4.14	4.71	4.43	4.43	5.00	4.71	4.71	4.71	4.14	4.14	5.00	5.00	4.14	4.43	4.71	4.71	5.00	4.71	4.71	4.43	4.43
# Taxa	R = 0.394, p = 0.069	24	21	23	20	29	24	23	24	33	25	21	22	36	18	21	34	29	30	27	25	26	34
# Ephemeroptera Taxa	R = -0.268, p = 0.228	3	5	4	3	3	3	4	3	3	1	3	3	4	4	2	3	4	3	3	2	3	3
# EPT Taxa	R = 0.054, p = 0.811	9	11	11	10	14	9	11	9	9	8	8	11	11	11	10	14	14	11	9	10	10	9
# Scraper Taxa	R = 0.199, p = 0.374	2	4	4	3	1	2	4	5	6	2	2	3	6	2	2	7	6	4	3	4	2	4
% Climbers	R = 0.370, p = 0.090	0	0.7	2.2	7.3	2.7	12.3	1.7	2.6	2.6	4.7	0	10.2	15.4	0	2.8	3.8	1.8	10.0	5.3	1.6	4.3	30.6
% Ephemeroptera	**R = -0.538, p = 0.010**	37.8	77.2	67.2	56.5	41.4	16.0	47.1	26.3	30.8	0.9	34.2	35.2	22.2	54.9	46.8	22.9	25.2	35.5	34.9	22.0	5.1	13.4
% Intolerant Urban Taxa	**R = -0.468, p = 0.028**	76.5	44.1	85.1	83.1	76.6	50.9	84.3	78.1	59.0	35.5	53.5	73.2	57.3	94.3	85.3	60.0	56.8	65.5	63.6	35.0	37.6	4.5

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.338, p = 0.123	4.33	3.33	3.33	4.33	2.33	3.67	3.33	4.67	3.67	4.00	4.33	4.67	4.33	3.33	4.67	3.67	4.67	4.33	5.00	3.67	4.00	4.00
Abundance per m2	R = -0.175, p = 0.437	1.19	0.3	0.5	4.39	0.06	0.47	0.24	0.45	0.38	0.31	0.53	0.78	1.45	0.42	1.53	0.65	1.18	0.58	0.82	0.44	0.28	0.37
# Benthic Sp. (Adjusted)	R = 0.402, p = 0.064	1.48	0.37	0.74	1.11	0	1.11	1.11	1.48	1.11	1.11	1.48	1.48	1.48	0.74	1.48	1.48	1.48	1.48	1.11	1.11	1.11	1.48
% Abundance of Dominant Species	R = -0.332, p = 0.131	32.6	43.0	54.2	29.7	73.9	56.7	36.6	31.2	32.9	31.5	33.1	35.1	29.0	35.4	30.8	37.4	39.5	43.6	31.7	33.3	39.6	29.2
% Generalists/ Omnivores/ Invertivores	R = -0.418, p = 0.053	92.1	100	98.3	80.4	100	96.3	84.5	74.3	68.2	95.4	93.5	96.8	96.6	100	97.3	96.7	80.4	76.7	83.4	55.1	85.4	72.3

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Round-bodied Suckers	R = 0.088, p = 0.698	0.6	2.2	1.1	0.5	4.4	2.4	0	4.6	0	5.6	7.1	5.4	1.0	1.6	2.4	0	0.8	5.5	7.0	0	1.0	1.5
% Tolerant	R = -0.389, p = 0.073	51.6	46.2	82.7	69.4	17.4	89.0	73.2	56.0	45.9	50.0	42.0	33.5	43.8	46.5	51.4	57.5	26.6	52.0	42.2	36.1	52.1	36.2

Fish

Cumulative list of fish species (with abundance) collected in Swanson Creek by sampling year.

Species	*Tolerance*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	7	5	-	-	1	3	6	11	9	14	7	4	6	4	9	5	6	1	2	2	2	4
Blacknose Dace	T	103	16	97	62	-	93	26	34	28	34	56	44	119	31	47	67	57	88	63	26	38	38
Bluegill	T	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek Chubsucker	M	2	2	2	1	1	4	-	5	-	6	12	10	4	2	7	-	3	11	14	-	1	2
Eastern Mudminnow	T	10	21	15	3	2	29	10	8	3	6	4	8	15	15	16	7	13	1	4	4	2	3
Fallfish	I	34	3	2	4	-	1	-	1	7	23	41	65	116	16	26	16	34	7	15	8	12	32
Golden Shiner	T	10	-	2	-	1	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Green Sunfish	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	1	1
Largemouth Bass	T	-	-	-	8	-	-	-	3	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Least Brook Lamprey	M	21	-	2	7	-	6	9	2	-	-	2	1	7	-	2	3	16	20	12	49	14	35
Pumpkinseed	T	4	3	3	4	1	7	2	2	-	-	-	-	-	-	-	-	-	2	1	-	-	-
Redbreast Sunfish	M	-	-	-	-	-	1	-	-	-	-	-	-	2	-	-	2	6	-	7	2	3	-
Redfin Pickerel	T	-	-	1	-	-	-	2	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-

Species	*Tolerance*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Rosyside Dace	M	76	40	25	26	17	1	1	5	-	4	26	36	86	45	90	45	141	30	44	17	8	8
Satinfin Shiner	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-
Sea Lamprey	I	4	-	-	26	-	-	-	22	27	5	9	5	7	-	6	3	53	27	21	16	-	1
Tadpole Madtom	M	9	-	-	-	-	2	3	2	3	2	1	2	3	1	2	2	3	1	-	-	3	1
Tessellated Darter	T	33	1	30	35	-	16	11	12	8	14	11	6	35	13	86	27	22	14	13	22	9	5
White Sucker	T	3	1	-	33	-	-	-	1	-	-	-	4	11	-	1	2	1	-	2	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Swanson Creek by sampling year.

Species	*1997*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	N	N	N	N	N	N	N	N	D	N	N	N	N	N	N	N
Faxonius limosus	D	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Lacunicambarus diogenes	N	N	N	N	N	N	N	N	D	N	N	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Swanson Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Swanson Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern cricket frog, Fowler's toad, Gray treefrog, Northern green frog, Northern spring peeper, Pickerel frog, Southern Leopard Frog, Wood frog
Caudata (Salamanders and Newts)	Northern two-lined salamander
Squamata (Snakes and Lizards)	Eastern worm snake, Northern watersnake
Testudines (Turtles)	Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Swanson Creek by sampling year, RA = %Relative Abundance.

					1997	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	1.8	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	0.7	-	-	-	-	-	-	-	-	0.9	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	2.7	-	0.8	-	-	-	1.8	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	3.4	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	0.9	1.9	4.1	0.9	1.9	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	0.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	1.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	0.7	0.7	-	-	-	-	3.5	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.0	-	9.7	3.2	-	-	16.5	17.5	6.7	0.9	3.5	1.9
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	0.8	0.9	1.9	-	-	0.9
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	1.0	0.7	-	-	-	-	1.7	-	1.0	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	1.0	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	1.9	-	0.9	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	0.9	-	-	-	1.0	1.9	-	0.9
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	0.9	-	-	1.0	-	0.9	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	1997 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	20.4	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	1.0	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	2.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.0	-	-	-	-	-	-	-	1.0	0.9	-	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	0.8	-	-	0.8	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	0.7	-	0.9	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Odontomesa	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	0.8	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	1.0	-	-	1.6	-	16.0	-	-	1.0	2.8	8.8	5.6
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	1.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	1.0	1.4	1.5	-	1.8	3.8	-	-	1.0	2.8	2.7	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	0.8	-	-	-	-	1.0	0.9	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	1.0	-	-	-	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	0.7	-	-	10.4	-	0.9	-	-	-	7.4
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	0.8	-	-	-	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	1.0	-	-	-	-	-	-	1.8	2.9	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	3.0	-	-	2.8	0.8	1.8	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	0.9	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-	1.8	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.7	5.6	-	-	-	0.9	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	1.8	4.7	0.8	-	1.9	1.9	-	0.9
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	3.7	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	2.0	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	0.7	-	-	-	-	-	-	0.9	2.7	-
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	0.9	-	0.9
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	1.0	-	-	1.6	-	1.9	-	-	-	-	1.8	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	9.2	-	1.5	-	1.8	0.9	-	6.1	-	9.3	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	9.2	3.4	-	-	0.9	0.9	-	0.9	-	-	-	4.6
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	0.7	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	0.8	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	5.1	-	-	4.0	-	2.8	1.7	2.6	1.0	-	1.8	1.9

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	0.9	-	-	1.0	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	2.0	0.7	-	0.8	1.8	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	42.1	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	18.4	9.0	6.7	12.1	3.6	0.9	33.9	6.1	7.6	-	15.0	10.2
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	0.9	-	-	-	-	-	3.5	3.7
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Dannella	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	18.4	24.8	57.5	43.5	36.9	14.2	11.6	18.4	24.8	0.9	10.6	20.4
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-	4.4	0.9
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	0.7	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	1.0	0.7	2.2	0.8	-	-	-	1.8	1.9	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	2.8	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	0.9	-	-	0.9	1.9	0.9	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	0.7	0.8	-	-	0.8	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	0.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	-	-	-	-	-	-	-	-	-	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	2.8	5.2	-	1.8	12.3	9.1	-	9.5	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	15.3	-	-	12.9	-	-	4.1	11.4	-	-	11.5	23.1
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	2.0	0.7	-	-	0.9	0.9	-	-	2.9	0.9	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	3.1	0.7	-	-	0.9	2.8	2.5	3.5	6.7	-	1.8	7.4
Arthropoda	Plecoptera	Nemouridae	na	I	1.0	-	-	-	-	-	-	-	-	12.1	0.9	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	0.7	-	4.5	-	-	4.4	-	13.1	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	1.0	-	-	-	-	2.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	0.7	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	1.4	0.7	0.8	0.9	3.8	0.8	-	1.0	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Cultus	I	1.0	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	0.7	-	2.4	20.7	-	-	5.3	-	7.5	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	0.7	1.6	-	-	-	2.6	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	0.9	-	-	-	-	27.1	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	1.5	4.0	-	-	-	2.6	4.8	-	1.8	0.9
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	1.5	-	-	-	0.8	-	1.9	-	0.9	0.9
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	0.8	-	-	-	0.9	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-	-	-	-	1.9
Arthropoda	Trichoptera	Limnephilidae	na	M	-	0.7	-	-	-	0.9	-	-	-	1.9	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	1997 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	-	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	0.8	0.9	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	0.7	0.8	3.6	7.5	2.5	2.6	-	0.9	-	0.9
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	0.9	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	0.6
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	0.9	-	0.9	-	0.9	-	-	-	0.9	-
Arthropoda	Amphipoda	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	0.9	0.9	-	-	9.4	0.6
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	1.0	-	-	-	-	-	1.3
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	0.9	-	-	1.0	4.5	-	-	0.8	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.6	0.8	1.8	1.9	2.7	0.9	0.8	2.4	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	0.9	-	-	-	-	-	-	0.8	-	0.6
Arthropoda	Coleoptera	Gyrinidae	Dineutus	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	2.6	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Ablabesmyia	T	1.7	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	0.9	-	-	-	2.5
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	0.9	0.8	-	-	1.9
Arthropoda	Diptera	Chironomidae	Corynoneura	M	0.9	-	-	-	2.7	0.9	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	3.2
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.9	0.8	0.9	1.9	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	1.0	-	1.8	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	12.0	-	0.9	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	1.7	-	-	1.9	1.8	2.7	0.8	1.6	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Odontomesa	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	5.1	5.1
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	0.8	1.8	5.7	-	1.8	7.6	2.4	28.2	6.4

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	2.6	-	-	1.0	-	6.4	4.5	-	-	5.1
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.9	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	0.9	-	-	7.3	1.5	1.6	1.7	23.6
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	2.6	-	-	1.9	0.9	-	4.5	0.8	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.7	-	-	1.0	2.7	-	-	35.8	-	10.8
Arthropoda	Diptera	Chironomidae	Stempellinella	M	1.7	-	-	-	-	-	1.5	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.9	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	0.8	-	1.3
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	0.9	1.5	-	0.9	7.0
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	1.3
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	1.7	-	-	-	-	-	0.8	0.8	0.9	0.6
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	1.0	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	2.9	-	0.9	0.8	-	-	1.9
Arthropoda	Diptera	Chironomidae	Xylotopus	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	1.7	-	-	-	-	-	-	-	0.9	0.6
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	0.9	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Dolichopodidae	na	T	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	1.8	-	1.5	0.8	0.9	1.3
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	1.6	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	13.9	17.4	19.0	9.9	-	2.3	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	1.7	-	-	3.8	-	-	2.3	-	0.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	na	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.8	1.0	5.4	0.9	3.0	-	-	0.6
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.9	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	14.5	11.5	11.9	5.7	9.0	5.5	12.1	10.6	0.9	-
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	5.7
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	2.6	7.0
Arthropoda	Ephemeroptera	Ephemerellidae	Dannella	I	-	-	-	-	-	-	-	-	-	0.6
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	6.0	41.0	34.9	15.2	13.5	24.5	22.0	11.4	1.7	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	0.9	0.8	-	1.9	1.8	5.5	0.8	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.9	-	-	1.0	-	-	-	-	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Gomphus	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	8.5	-	-	-	2.7	-	6.8	1.6	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	6.6	8.3	1.0	-	11.8	3.8	-	9.4	0.6
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.6	-	-	-	1.8	-	-	1.7	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	2.9	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	4.9	4.6	-	-	7.3	4.5	0.8	15.4	0.6
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	1.8	4.8	6.3	-	3.8	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	1.0	0.9	-	-	0.8	-	0.6
Arthropoda	Plecoptera	Perlidae	Perlesta	I	-	0.8	-	-	-	-	-	-	6.8	-
Arthropoda	Plecoptera	Perlidae	na	I	4.3	2.5	-	-	-	-	-	-	-	0.6
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Cultus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	2.6	5.7	1.8	5.7	3.6	1.8	6.1	3.3	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.8	-	1.0	-	-	1.5	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	3.4	1.6	0.9	2.9	3.6	-	1.5	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	7.7	1.6	3.7	2.9	12.6	4.5	-	11.4	2.6	1.3
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	1.0	-	0.9	-	4.1	-	0.6
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Oecetis	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Phryganeidae	Ptilostomis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	0.9	-	0.8	-	-	0.6
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	4.3	-	1.8	1.0	3.6	2.7	-	1.6	-	-
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	1.9	0.9	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Zekiah Swamp Run (ZEKI-012-S)

Site ZEKI-012-S is located on an unnamed tributary to Zekiah Swamp Run in the Coastal Plain – western shore region of Maryland. It is in the Zekiah Swamp watershed in Charles County. This site was sampled from 2000 to 2008 and 2010 to 2013. Access to the site in 2009, the summer of 2013, and 2014 to present was not obtained.

Unnamed tributary to Zekiah Swamp Run in spring 2013.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	93.34	92.90	92.90	92.84	92.84	93.01	93.34
Urban	3.52	3.52	3.52	3.52	3.52	3.52	3.52
Agriculture	3.13	3.13	3.13	3.13	3.13	3.13	3.13
Other	0.00	0.45	0.45	0.50	0.50	0.34	0.00

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Zekiah Swamp Run (2000 to 2013). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014- 2020*
pH	R = -0.165, p = 0.609	6.52	6.66	6.81	6.44	6.32	6.47	6.79	6.56	6.49			6.59	6.38	6.60	
Specific Conductance (µS/cm)	R = -0.110, p = 0.733	45.1	53.3	64.5	50.0	52.9	48.7	61.5	50.4	71.0			49.3	47.2	48.0	
Acid Neutralizing Capacity (µeq/L)	R = -0.045, p = 0.890	93.3	128.1	211.6	68.4	77.9	71.0	134.4	91.7	128.6			126.6	106.8	110.4	
Dissolved Organic Carbon (mg/L)	R = 0.221, p = 0.489	2.600	1.700	4.100	2.100	2.800	2.634	2.355	2.093	6.558			3.674	2.381	2.991	
Chloride (mg/L)	R = 0.052, p = 0.872	3.55	4.01	4.04	4.75	4.65	4.00	7.41	4.68	5.85	Not sampled	Data not available	4.87	3.61	3.63	Not Sampled
Sulfate (mg/L)	R = 0.209, p = 0.514	7.88	7.36	8.74	10.23	8.55	8.59	7.46	7.97	13.33			7.84	8.38	9.68	
Total Nitrogen (mg/L)	R = -0.067, p = 0.837	0.394	0.226	0.217	0.222	0.248	0.254	0.332	0.243	0.403			0.298	0.267	0.204	
Nitrate-Nitrogen (mg/L)	R = -0.246, p = 0.440	0.0790	0.2140	0.0960	0.1070	0.1500	0.1829	0.1866	0.1281	0.0987			0.0990	0.1396	0.0776	
Nitrite-Nitrogen (mg/L)	R = 0.288, p = 0.365	0*	0.0012*	0.0037	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0023			0.0013	0.0010*	0.0031	
Ammonia-Nitrogen (mg/L)	R = -0.568, p = 0.054	0.0161*	0.0168	0.0160	0.0030*	0.0150	0.0071	0.0083	0.0074	0.0071			0.0082	0.0092	0.0069	
Total Phosphorus (mg/L)	R = -0.291, p = 0.359	0.0280	0.0320	0.0540	0.0210	0.0420	0.0284	0.0388	0.0353	0.0335			0.0341	0.0266	0.0232	
Ortho-phosphate (mg/L)	R = 0.159, p = 0.621	0.0037*	0.0148	0.0164	0.0114	0.0097	0.0108	0.0158	0.0132	0.0105			0.0179	0.0085	0.0116	
Bromide (mg/L)	-														0.0088	
Magnesium (mg/L)	-															
Calcium (mg/L)	-															
Copper (µg/L)	-															
Zinc (µg/L)	-															

Physical Habitat

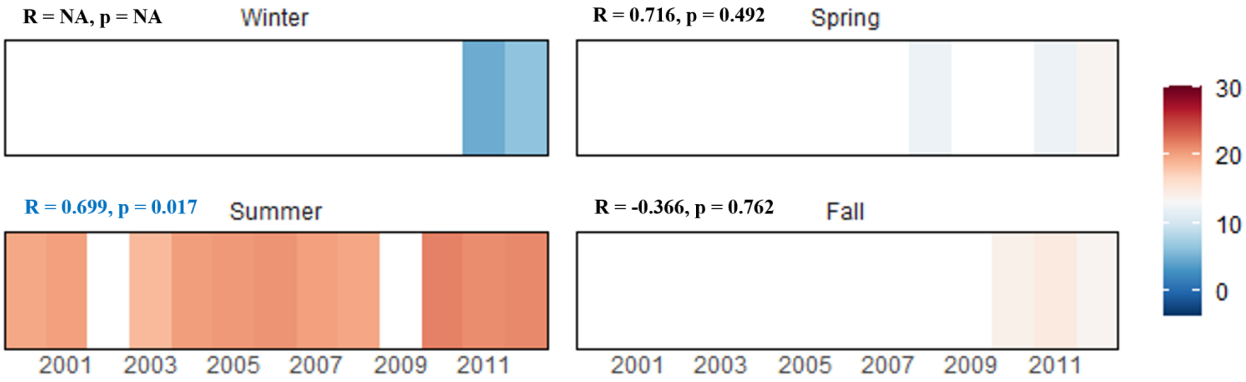
Physical habitat measurements collected at the unnamed tributary to Zekiah Swamp Run (2000 to 2012). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.084, p = 0.796	15	17	4	15	13	12	12	15	12		8	16	12								
Epifaunal substrate (0-20)	R = 0.331, p = 0.293	11	17	1	12	14	12	12	14	11		13	16	14								
Velocity/Depth Diversity (0-20)	R = -0.074, p = 0.820	10	10	2	8	11	9	6	9	7		5	10	8								
Pool Quality (0-20)	R = 0.232, p = 0.468	10	10	5	8	7	8	8	10	10		5	10	12								
Riffle Quality (0-20)	R = 0.404, p = 0.193	6	14	0	13	12	14	9	12	10	Not sampled	10	15	13				Not Sampled				
Shading (%)	**R = -0.608, p = 0.036**	95	94	95	94	94	92	95	94	80		80	90	90								
Embeddedness (%)	R = -0.399, p = 0.199	45	16	100	40	15	40	45	40	40		15	25	20								
Discharge (cfs)	R = -0.384, p = 0.196	0.33	0.69	0	1.11	0.30	0.56	0.15	0.22	0.58		0.20	0.20	0.35								
Stream Area (m2)	R = 0.231, p = 0.470	142.5	136.9	23.3	168.8	142.5	135.0	91.9	153.8	129.4		127.5	163.1	136.9								

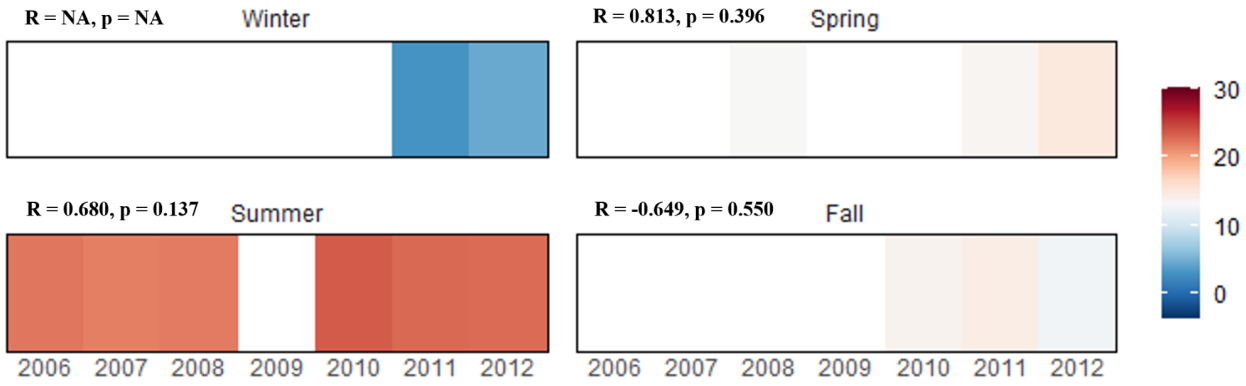
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Zekiah Swamp Run (only calculated for summers missing no less than 2 weeks of data).

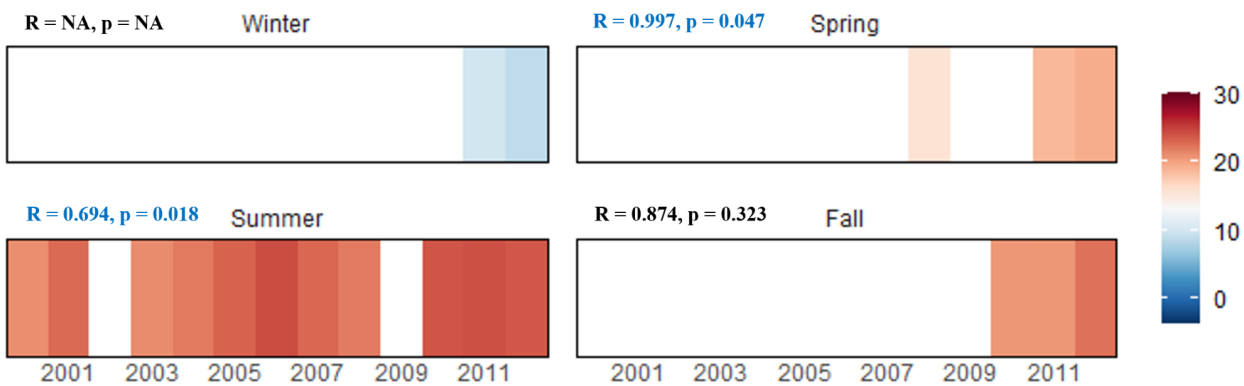
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*
% above 20°C	**R = 0.677, p = 0.022**	43.3	55.3	-	33.0	57.9	64.7	64.5	55.5	44.0	-	80.1	70.0	73.3
% above 24°C	**R = 0.717, p = 0.013**	0.03	1.9	-	0	0.08	3.6	9.3	0.7	0.2	-	11.9	9.1	9.8



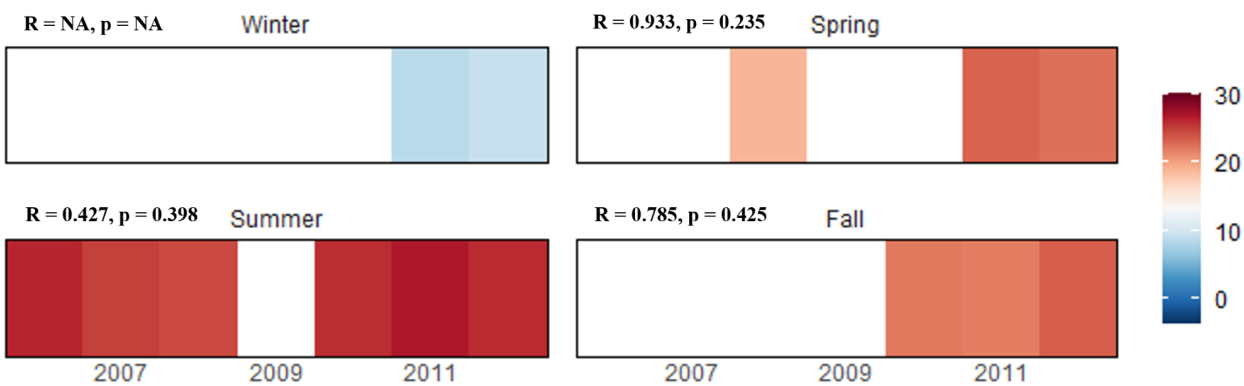
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Zekiah Swamp Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Zekiah Swamp Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Zekiah Swamp Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Zekiah Swamp Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.273, p = 0.367	4.71	4.71	4.43	3.57	4.71	4.43	4.71	4.71	5.00	4.43	4.71	4.71	4.71							
# Taxa	R = 0.459, p = 0.115	31	24	22	13	29	19	23	28	37	30	35	37	24							
# Ephemeroptera Taxa	R = -0.083, p = 0.787	4	4	3	1	2	3	3	3	3	3	3	4	2							
# EPT Taxa	**R = 0.557, p = 0.048**	7	11	9	6	12	9	12	8	17	10	11	17	12							
# Scraper Taxa	R = -0.005, p = 0.988	3	4	4	4	1	2	4	4	4	3	4	3	3			Not Sampled				
% Climbers	R = 0.213, p = 0.485	6.7	2.3	0.9	1.7	15.5	3.8	1.7	3.5	10.5	7.1	16.7	3.5	2.6							
% Ephemeroptera	R = -0.123, p = 0.688	14.2	22.1	31.9	0.9	21.1	58.1	27.6	21.2	16.7	9.8	6.1	20.9	24.6							
% Intolerant Urban Taxa	R = -0.315, p = 0.294	63.3	79.4	81.0	87.0	83.7	87.6	80.2	54.9	59.7	71.4	61.4	61.7	83.3							

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.005, p = 0.987	3.67	4.33	3.67	1.33	3.33	3.67	3.67	3.33	3.33	3.33	3.00	4.00								
Abundance per m2	R = -0.153, p = 0.635	0.64	0.91	3.83	0.12	2.06	0.59	0.66	0.47	0.32	1.86	0.58	1.18								
# Benthic Sp. (Adjusted)	R = -0.060, p = 0.854	0.94	0.94	1.88	0	0.94	1.88	1.88	0.94	0.94	0.94	0.94	0.94								
% Abundance of Dominant Species	R = 0.393, p = 0.206	47.3	39.5	64.0	55.0	79.9	39.2	45.9	47.2	63.4	77.6	81.1	50.3				Not Sampled				
% Generalists/ Omnivores/ Invertivores	R = -0.045, p = 0.890	41.8	63.7	74.2	100	88.7	77.2	47.5	55.6	34.2	79.8	82.1	54.7								
% Round-bodied Suckers	-	0	0	0	0	0	0	0	0	0	0	0	0								

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Tolerant	R = -0.102, p = 0.752	52.8	62.1	74.2	100	91.1	89.9	54.1	75.0	34.2	78.1	82.1	55.3								

Fish

Cumulative list of fish species (with abundance) collected at the unnamed tributary to Zekiah Swamp Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	-	2	-	-	-	-	-	1	1		5	1	1								
Blacknose Dace	T	23	21	-	11	20	31	12	34	12		184	77	81								
Eastern Mudminnow	T	15	49	57	9	234	29	15	5	1		-	-	6								
Fallfish	I	-	-	2	-	-	-	-	-	-		-	-	-								
Least Brook Lamprey	M	43	45	21	-	26	8	28	17	26	Not Sampled	47	16	71				Not Sampled				
Pirate Perch	T	-	7	5	-	5	-	-	-	-		-	-	-								
Pumpkinseed	T	-	-	-	-	1	-	-	-	-		-	-	-								
Redfin Pickerel	T	10	-	2	-	7	10	4	15	1		1	1	2								
Tessellated Darter	T	-	-	2	-	-	1	2	-	-		-	-	-								

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Zekiah Swamp Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	Not Sampled	N	D	D	D	Not Sampled						
Lacunicambarus diogenes	N	D	D		D	N	N	N							

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Zekiah Swamp Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected at or near the unnamed tributary to Zekiah Swamp Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Gray tree frog, Northern green frog, Pickerel frog, Southern leopard frog, Wood frog
Caudata (Salamanders and Newts)	Northern dusky salamander, Northern red salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern watersnake
Testudines (Turtles)	Eastern box turtle, Spotted turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected at the unnamed tributary to Zekiah Swamp Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2010*	*2011*	*2012*	*2013*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	5.8	-	-	-	-	-	-	-	-	1.8	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	0.9	-	0.8	1.0	-	-	1.8	0.9	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	0.9	-	0.9	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	0.9	1.8	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	0.9	-	-	0.9	-	-
Arthropoda	Coleoptera	Dytiscidae	Hydroporus	M	1.7	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	0.8	-	-	-	0.9	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	3.5	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	5.8	2.3	8.6	4.3	-	-	7.8	1.8	-	-	1.8	-	0.9
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	34.2	2.3	16.4	6.1	-	2.9	4.3	0.9	-	-	-	-	2.6
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	0.9	-	-	-	-	0.9	0.9	0.9	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	0.8	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	0.9	-	-	-	0.9	2.7	-	0.9	-	-	2.6
Arthropoda	Collembola	na	na	M	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Decapoda	Cambaridae	na	I	-	-	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	4.4	0.9	0.9	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	0.8	-	-	-	-	-	-	0.9	0.9	0.9	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	0.8	-	-	-	-	-	-	0.9	1.8	-	2.6	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	0.8	5.2	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Stilobezzia	M	-	-	-	-	-	-	-	-	-	2.7	-	-	-
Arthropoda	Diptera	Chironomidae	Apsectrotanypus	M	-	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	1.0	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2010	2011	2012	2013
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	0.8	-	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	1.7	-	-	-	-	1.0	-	0.9	2.6	-	0.9	0.9	0.9
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	4.2	6.9	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cryptochironomus	T	-	-	-	-	0.8	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	-	-	7.0	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.7	-	-	0.9	-	1.0	0.9	12.4	0.9	-	-	3.5	1.8
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	1.9	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.8	0.9	-	-	1.0	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Odontomesa	M	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	0.8	-	-	-	-	-	-	-	-	0.9	2.6	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	0.9	-	0.9	7.0	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paralauterborniella	M	-	-	-	-	-	1.0	-	-	-	2.7	-	-	-
Arthropoda	Diptera	Chironomidae	Paramerina	M	-	-	-	-	-	-	-	-	-	0.9	0.9	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	3.3	3.8	0.9	-	1.6	3.8	-	1.8	1.8	-	2.6	0.9	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	1.8	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	2.5	-	-	-	0.8	-	-	-	-	0.9	2.6	0.9	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	1.7	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	1.0	3.4	1.8	-	-	6.1	0.9	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	0.9	1.8	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	1.8	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2010	2011	2012	2013
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	0.9	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.8	-	-	-	1.6	-	-	-	0.9	1.8	8.8	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.8	-	-	-	-	-	-	-	0.9	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	2.6	-	0.9	1.7	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	0.9	-	0.8	-	-	-	2.6	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	42.7	3.4	67.0	-	-	21.6	1.8	22.8	-	-	5.2	3.5
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	2.6	-	-	-	0.9	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	2.5	-	0.9	-	0.8	1.0	-	1.8	-	6.3	-	1.7	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.8	5.3	0.9	9.6	-	-	3.4	-	1.8	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Tabanidae	Tabanus	I	-	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.8	-	-	-	-	-	0.9	-	-	5.4	2.6	-	5.3
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.8	-	-	-	0.8	-	-	-	-	1.8	-	0.9	0.9
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	-	-	0.9	0.9	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	0.8	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	6.9	14.7	-	1.6	22.9	-	8.8	9.6	3.6	1.8	4.3	6.1
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	1.7	-	-	-	1.8	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	11.7	13.7	15.5	0.9	19.5	34.3	25.0	9.7	4.4	5.4	1.8	14.8	18.4
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	1.8	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2010	2011	2012	2013
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	na	I	0.8	0.8	-	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	0.9	0.9	-	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	1.7	-	-	1.0	-	2.7	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.8	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Hemiptera	Veliidae	Microvelia	M	-	-	-	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	0.8	-	-	-	-	1.8	1.8	0.9	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	0.8	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	0.8	-	-	-	1.6	-	0.9	0.9	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	1.6	-	-	-	0.9	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	0.8	-	-	-	0.8	-	-	-	-	1.8	-	0.9	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	0.9	-	-	0.9	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	5.8	2.3	-	-	3.3	6.7	-	2.7	1.8	-	6.1	16.5	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	19.8	-	-	3.8	0.9	3.5	-	16.1	-	-	13.2
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	16.3	1.9	-	-	-	-	11.4	1.7	1.8
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	3.3	0.8	0.9	0.9	10.6	8.6	10.3	25.7	0.9	24.1	19.3	5.2	15.8
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	0.9	-	-	3.4	-	4.4	-	-	1.7	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	4.3	-	-	0.9	-	3.5	-	-	0.9	5.3
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	1.7	-	8.9	-	1.7	-	0.9	-	-	0.9	1.8
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	1.9	1.7	-	0.9	2.7	-	-	1.8
Arthropoda	Plecoptera	Perlodidae	na	I	0.8	-	-	-	0.8	-	0.9	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	0.8	2.6	-	-	-	-	0.9	0.9	0.9	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	1.5	-	0.9	5.7	-	1.7	0.9	0.9	-	2.6	2.6	2.6
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	1.5	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	8.1	1.9	0.9	-	-	4.5	0.9	0.9	0.9
Arthropoda	Trichoptera	Leptoceridae	na	M	-	-	-	-	-	-	-	-	0.9	-	0.9	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	0.9	-	-	0.9	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2010	2011	2012	2013
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Limnephilidae	na	M	-	0.8	-	1.7	0.8	-	-	0.9	6.1	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	1.0	-	-	-	-	-	0.9	1.8
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	0.9	-	-	-	2.6	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	1.6	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	1.8	-	-	0.9	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	0.8	0.9	0.9	4.1	-	-	-	3.5	4.5	3.5	1.7	8.8
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	0.9	-	-	0.9	-	-
Mollusca	Veneroida	Pisidiidae	Sphaerium	M	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	-	-	-	0.9

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Appendix C
Sentinel Sites in the Eastern Piedmont Region

Baisman Run (LOCH-120-S)
Unnamed Tributary to Dipping Pond Run (JONE-109-S)
North Branch Jones Falls (JONE-315-S)
Unnamed Tributary to the Patuxent River (RKGR-119-S)
Unnamed Tributary to Principio Creek (FURN-101-S)
Timber Run (LIBE-102-S)

Baisman Run (LOCH-120-S)

Site LOCH-120-S is located on Baisman Run in the Eastern Piedmont region of Maryland. It is in the Loch Raven Reservoir watershed in Baltimore County. This site was sampled from 2000 to 2020.

Baisman Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	73.99	74.01	73.99	73.99	73.99	74.06	74.01
Urban	24.60	24.60	24.60	24.60	24.60	24.60	24.60
Agriculture	1.24	1.21	1.21	1.21	1.14	1.17	1.21
Other	0.17	0.17	0.20	0.20	0.27	0.17	0.17

Water Chemistry

Water chemistry measurements collected at Baisman Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = -0.048, p = 0.841	7.01	7.14	7.32	7.01	7.04	7.20	7.05	7.02	6.91	7.06	7.11	7.11
Specific Conductance (µS/cm)	**R = 0.611, p = 0.004**	93.0	130.1	130.4	140.0	123.5	95.2	145.2	132.4	152.9	186.4	145.6	151.2
Acid Neutralizing Capacity (µeq/L)	**R = 0.503, p = 0.024**	178.1	199.0	231.7	191.9	182.4	165.3	209.6	193.5	218.5	237.5	195.1	219.9
Dissolved Organic Carbon (mg/L)	R = 0.073, p = 0.759	1.000	0.800	1.100	1.000	0.700	0.688	0.715	0.668	0.740	0.619	0.450	1.388
Chloride (mg/L)	**R = 0.610, p = 0.004**	15.20	23.35	24.80	26.90	23.67	19.83	27.57	24.37	29.82	37.66	26.71	32.80
Sulfate (mg/L)	R = -0.151, p = 0.526	4.92	2.89	2.20	6.46	3.32	4.80	2.96	4.30	3.13	2.77	4.20	3.64
Total Nitrogen (mg/L)	R = 0.351, p = 0.129	1.265	1.977	1.627	1.657	1.879	1.135	1.943	1.605	1.595	2.167	1.846	1.636
Nitrate-Nitrogen (mg/L)	**R = 0.496, p = 0.026**	1.0750	1.6580	1.5940	1.6550	1.7180	1.2432	1.8349	1.5761	1.5122	2.0878	1.6892	1.4693
Nitrite-Nitrogen (mg/L)	**R = 0.567, p = 0.009**	0*	0.0013*	0.0015	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	**R = 0.498, p = 0.025**	0*	0.0052*	0.0032	0.0020*	0.0032	0.0043	0.0058	0.0027	0.0045	0.0042	0.0023	0.0050
Total Phosphorus (mg/L)	**R = 0.502, p = 0.024**	0.004	0.0040*	0.0040*	0.0050*	0.0060*	0.0079	0.0046	0.0078*	0.0037*	0.0081	0.0056	0.0078*
Ortho-phosphate (mg/L)	**R = 0.761, p < 0.001**	0.0002*	0.0007*	0.0025	0.0007*	0.0007*	0.0019	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	R = -0.514, p = 0.238												
Magnesium (mg/L)	R = 0.227, p = 0.666										4.710		
Calcium (mg/L)	R = -0.140, p = 0.791										7.237		
Copper (µg/L)	R = -0.680, p = 0.137												
Zinc (µg/L)	R = -0.529, p = 0.280												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.20	7.13	6.60	7.14	7.22	7.18	6.97	7.16	Not sampled due to COVID-19 Pandemic
Specific Conductance (µS/cm)	147.1	141.8	283.9	308.9	167.9	199.1	194.8	153.9	
Acid Neutralizing Capacity (µeq/L)	212.8	209.7	216.8	239.5	217.2	227.9	209.2	211.3	
Dissolved Organic Carbon (mg/L)	0.607	0.240	0.861	1.120	0.992	1.241	1.015	0.713	
Chloride (mg/L)	29.21	27.53	69.59	79.39	36.64	43.34	41.81	33.54	
Sulfate (mg/L)	3.30	3.46	3.91	3.85	4.07	3.13	3.11	3.99	
Total Nitrogen (mg/L)	1.866	1.894	2.253	1.952	1.587	1.687	1.978	1.775	
Nitrate-Nitrogen (mg/L)	1.8227	1.8657	2.1589	1.9162	1.5869	1.6765	1.8718	1.7613	
Nitrite-Nitrogen (mg/L)	0.0030	0.0033	0.0050	0.0011*	0.0004*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0031	0.0028	0.0070	0.0051	0.0042	0.0063	0.0026*	0.0084*	
Total Phosphorus (mg/L)	0.0107	0.0080*	0.0078*	0.0062	0.0049	0.0051	0.0070	0.0102*	
Ortho-phosphate (mg/L)	0.0028	0.0013	0.0039	0.0030*	0.0032	0.0031*	0.0031*	0.0032*	
Bromide (mg/L)		0.0226	0.0235	0.0196	0.0218	0.0215	0.0218	0.0201	
Magnesium (mg/L)			4.414	4.214	4.050	4.665	5.232	4.064	
Calcium (mg/L)			6.893	7.198	6.232	7.999	7.225	6.161	
Copper (µg/L)			0.406	0.355	0.208	0.430	0.221	0.135	
Zinc (µg/L)			1.506	2.743	0.976	1.995	0.499	1.049	

Physical Habitat

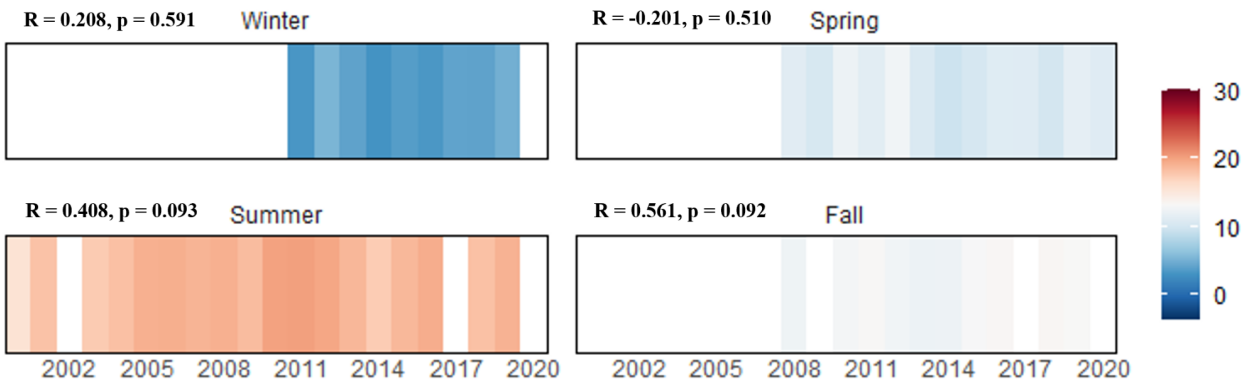
Physical habitat measurements collected at Baisman Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.516, p = 0.017**	16	16	16	18	18	16	16	16	17	17	15	14	17	15	16	17	13	17	12	15	14
Epifaunal substrate (0-20)	**R = -0.480, p = 0.028**	16	17	17	19	18	15	17	18	16	18	14	16	16	17	17	17	15	16	13	16	15
Velocity/Depth Diversity (0-20)	R = -0.049, p = 0.833	8	10	9	10	10	13	10	11	9	12	10	8	9	12	13	10	10	9	9	8	10
Pool Quality (0-20)	R = -0.226, p = 0.324	9	10	9	10	10	13	10	11	10	14	9	9	10	12	11	10	10	8	8	8	10
Riffle Quality (0-20)	**R = -0.560, p = 0.008**	17	15	15	16	15	15	16	15	15	18	17	15	13	16	14	16	15	14	12	13	13
Shading (%)	**R = -0.755, p < 0.001**	95	95	98	96	95	94	90	90	90	90	90	90	75	85	55	75	80	92	75	75	60
Embeddedness (%)	R = 0.374, p = 0.095	20	20	35	16	25	35	40	25	40	40	60	15	45	25	70	35	30	45	40	65	15
Discharge (cfs)	R = -0.084, p = 0.718	1.29	0.80	0.37	5.91	1.15	2.16	0.86	0.96	0.75	1.49	1.13	1.01	0.78	1.93	1.79	1.43	0.80	0.45	2.32	1.35	1.81
Stream Area (m2)	R = 0.256, p = 0.263	204.4	225.0	185.6	341.3	328.1	279.4	215.6	255.0	225.0	232.5	260.6	270.0	241.9	271.9	251.3	204.4	270.0	303.8	232.5	303.8	301.9

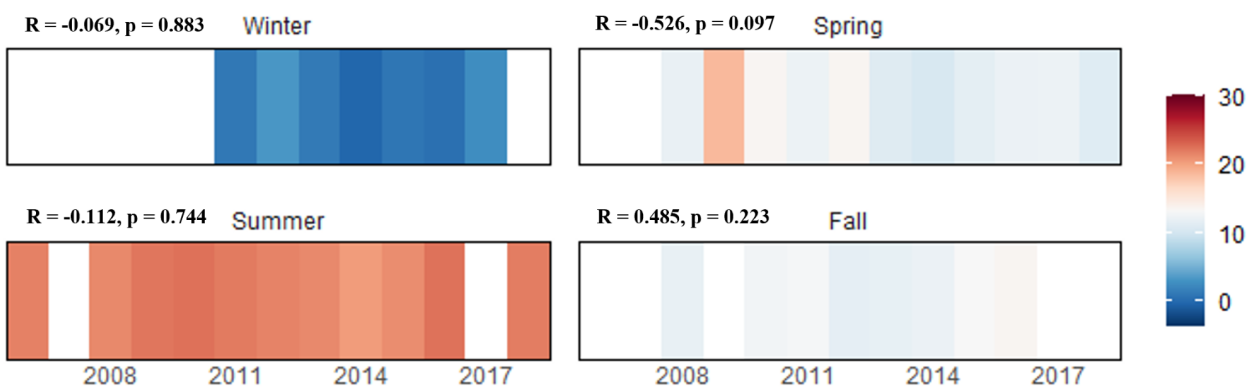
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Baisman Run (only calculated for summers missing no less than 2 weeks of data).

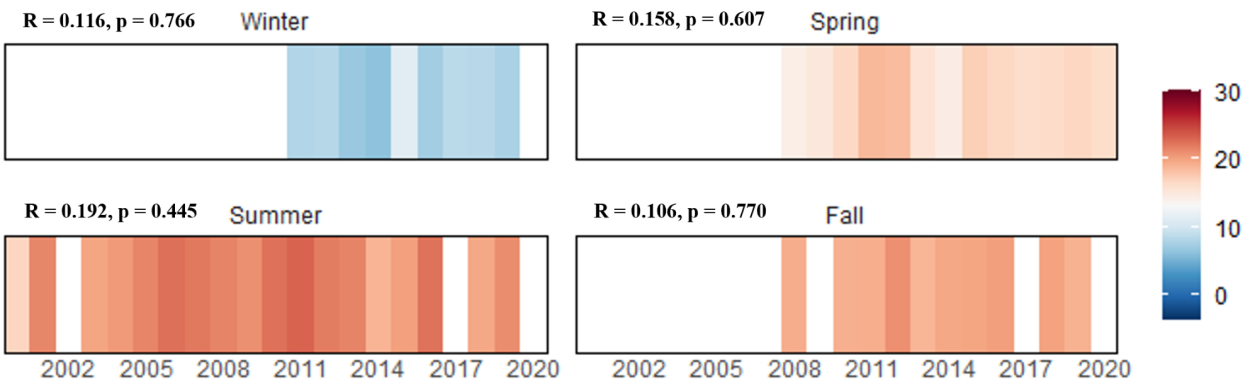
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.227, p = 0.365	0	11.1	-	7.0	13.5	33.6	40.1	29.6	30.2	22.0	53.9	53.3	50.9	21.5	1.3	17.2	40.4	-	5.4	32.0	-
% above 24°C	R = 0.004, p = 0.987	0	0	-	0	0	0	0.8	0.4	0	0	0.6	1.6	0	0	0	0	0.2	-	0	0	-



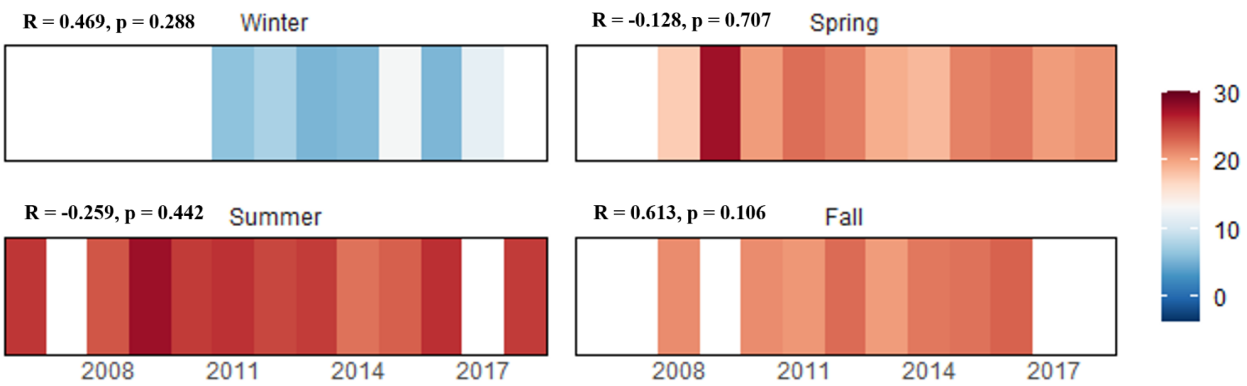
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Baisman Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Baisman Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Baisman Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Baisman Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	**R = 0.460, p = 0.036**	4.33	5.00	4.33	4.00	4.33	4.67	4.67	4.00	4.33	5.00	4.67	4.67	4.33	5.00	4.67	5.00	5.00	5.00	4.67	4.67	4.67
# Taxa	**R = 0.537, p = 0.012**	16	27	21	16	17	28	19	24	23	30	30	31	29	30	27	31	29	30	24	23	26
# Ephemeroptera Taxa	R = 0.143, p = 0.537	4	6	4	2	3	2	4	3	2	4	3	3	4	5	4	4	4	5	4	4	3
# EPT	**R = 0.502, p = 0.020**	9	13	10	7	11	14	13	10	12	15	18	11	13	16	14	19	14	18	15	11	12
% Chironomidae	**R = 0.557, p = 0.009**	1.6	8.8	5.4	9.2	3.2	6.5	7.3	19.6	4.9	14.6	13.3	21.2	25.0	13.8	24.3	22.2	20.8	11.8	9.5	19.7	9.0
% Clingers	**R = -0.451, p = 0.040**	95.2	87.2	90.1	81.6	93.7	89.5	90.2	74.5	91.2	74.6	74.2	76.9	72.1	81.2	74.8	74.1	75.0	86.0	83.6	77.9	89.7
% Intolerant Urban Taxa	**R = -0.527, p = 0.014**	89.5	79.2	85.6	79.4	87.3	79.8	78.1	75.5	79.4	63.6	66.7	59.6	66.4	79.0	64.5	69.4	60.0	75.7	75.0	70.5	80.7

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.286, p = 0.209	2.67	2.67	2.33	2.33	2.00	1.67	2.67	1.67	2.00	2.00	3.00	2.33	2.67	2.67	3.00	3.00	2.67	2.33	2.33	3.33	2.00
Abundance per m2	R = -0.084, p = 0.718	0.66	0.9	1.13	0.11	0.21	0.3	0.71	0.21	1.12	0.99	1.04	0.83	0.68	0.56	0.52	0.63	0.39	0.43	1.06	0.51	0.3
Biomass per m2	R = 0.365, p = 0.104	4.05	5.19	4.63	1.25	1.38	3.91	3.32	2.85	3.77	4.69	5.76	3.59	5.59	6.02	6.01	6.38	2.91	3.25	5.27	6.28	3.53
# Benthic Sp. (Adjusted)	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Generalists/ Omnivores/ Invertivores	**R = -0.493, p = 0.023**	99.3	100.0	100.0	97.4	98.6	100.0	98.7	100	100	100	99.6	99.6	98.8	92.8	96.2	96.1	99.1	97.7	98.8	76.3	94.6
% Tolerant	R = -0.299, p = 0.187	64.2	68.0	69.9	63.2	80.0	82.1	60.4	73.6	69.6	75.7	62.0	72.8	67.7	62.5	57.3	57.4	51.9	64.4	76.8	51.3	75.0
% Lithophilic Spawners	R = -0.396, p = 0.075	51.5	61.6	66.0	68.4	64.3	60.7	68.8	62.3	64.0	60.4	66.4	66.1	61.0	59.9	61.8	65.1	65.1	52.3	35.8	66.0	42.4

Fish

Cumulative list of fish species (with abundance) collected in Baisman Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	45	58	51	11	22	28	43	17	81	87	86	72	56	50	43	41	31	55	141	45	47
Bluegill	T	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	1
Brook Trout	I	19	31	18	2	5	4	33	11	10	10	17	18	8	9	6	7	12	13	12	14	9
Brown Trout	M	1	-	-	1	1	-	2	-	-	-	1	1	2	10	5	5	1	3	3	37	5
Creek Chub	T	41	80	95	13	34	41	50	22	94	87	82	91	55	44	32	33	24	30	48	35	21
Largemouth Bass	T	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Longnose Dace	M	20	20	20	1	3	5	5	3	9	4	5	4	8	10	7	4	6	8	17	8	5
River Chub	I	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	-	1	-	-	-	-
Rosyside Dace	M	8	14	25	10	5	6	21	-	58	42	80	38	35	28	35	39	31	23	25	17	4

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Baisman Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Faxonius Virilis	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Baisman Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Baisman Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Northern green frog, Pickerel frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Long-tailed salamander, Northern dusky salamander, Northern red salamander, Northern two-lined salamander, Spotted salamander
Squamata (Snakes and Lizards)	Eastern garter snake, Northern ring-necked snake, Northern watersnake
Testudines (Turtles)	Eastern Snapping Turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Baisman Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.7	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	2.4	-	1.8	-	-	-	-	-	1.0	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	1.6	-	2.0	1.0	0.9	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	3.2	3.2	3.6	-	-	4.0	-	-	1.0	0.9	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	0.8	-	4.5	-	-	5.6	-	1.0	-	0.9	1.7
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	-	-	-	-	-	-	-	6.4	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	na	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	0.8	-	-	-	0.8	-	1.0	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	0.8	-	1.0	-	-	0.8
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	0.8	0.8	-	1.4	0.8	-	-	2.9	-	1.8	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.8	1.6	0.9	-	-	0.8	5.7	-	-	6.4	8.3
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	0.9	-	-	-	-	5.9	-	0.9	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	0.7	-	0.8	-	1.0	-	-	0.8
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	1.8	0.7	1.6	2.4	0.8	2.9	2.0	0.9	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	0.9	-	-	-	-	2.0	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	0.8	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	3.2	-	1.4	-	0.8	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	1.0	-	1.7
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	0.8	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	0.8	0.9	5.0	-	0.8	0.8	2.9	2.0	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	0.8	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	1.6	-	-	0.9	2.5
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	18.5	13.6	6.3	62.4	40.5	5.6	34.1	37.3	43.1	32.7	27.5
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	1.8	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	0.8	-	2.1	-	-	-	-	1.0	-	0.8
Arthropoda	Diptera	Tipulidae	Antocha	T	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.8	1.6	-	0.7	0.8	-	-	4.9	1.0	2.7	7.5
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	1.6	1.8	7.8	2.4	-	1.6	-	-	8.2	0.8
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	55.6	28.0	54.1	5.0	31.7	38.7	13.8	18.6	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	11.8	1.8	9.2
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	1.6	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	1.6	0.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	8.1	13.6	0.9	-	-	4.0	17.9	1.0	8.8	4.5	0.8
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	1.8	-	-	1.6	0.8	1.0	2.0	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.8	1.6	-	-	1.6	-	-	2.0	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Plecoptera	na	na	I	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	0.8	-	5.7	-	-	0.8	-	-	-	0.8
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-	2.5
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	1.6	6.5	-	1.0	1.0	0.9	1.7
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	1.8	-	0.8	3.2	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	8.0	-	-	3.2	-	1.6	1.0	-	-	1.7
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	4.3	3.2	0.8	8.9	-	4.9	2.7	2.5
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	0.8	1.6	0.9	-	-	0.8	2.4	1.0	3.9	2.7	4.2
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	5.6	-	-	-	-	1.6	1.0	1.0	0.9	1.7
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	3.6	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	3.2	-	1.8	-	2.4	1.6	-	-	-	0.9	3.3
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	2.4	3.6	-	1.6	3.2	0.8	1.0	2.0	-	2.5
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	0.8	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	0.8	-	-	-	1.0	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	1.6	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	0.9	-	-	0.8	-	-	-	0.9	0.8
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	1.8	-	-	0.8	0.8	1.0	2.0	3.6	1.7
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	4.0	1.6	2.9	1.0	4.5	3.3
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	0.8	-	-	2.4	4.0	1.6	-	2.0	2.7	0.8
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	0.7	3.2	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	0.8	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	1.6	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	0.7	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	-	-	-	-	-	-	1.0	1.0	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	0.7	-	0.8	0.8	-	2.0	1.8	2.5
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	0.9	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	0.7
Annelida	Haplotaxida	Naididae	na	T	-	-	1.4	-	-	0.8	-	-	-	2.1
Annelida	Lumbriculida	Lumbriculidae	na	M	1.0	-	-	-	-	-	-	-	-	0.7
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Coleoptera	Dytiscidae	Neoporus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	1.5	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	3.8	1.0	-	-	-	-	0.7	0.9	-	1.4
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.0	1.9	-	-	-	5.8	8.8	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	0.7	-	0.9	-	-	-	-	0.7
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	0.7	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	0.8	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	1.0	-	-	0.9	-	-	0.7	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	na	na	M	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	0.9	1.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	4.8	1.9	2.9	-	-	2.5	0.7	4.3	-	2.8
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	1.9	-	0.9	-	0.8	-	-	3.3	0.7
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	0.7	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	7.7	2.9	1.4	12.1	4.6	1.7	6.6	1.7	1.6	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	1.4	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	6.5	7.5	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	0.9	0.9	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	0.9	3.7	-	0.7	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	2.9	2.2	0.9	1.9	3.3	0.7	-	3.3	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	2.9	1.9	2.2	0.9	1.9	-	0.7	0.9	1.6	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	1.0	1.0	-	-	-	-	-	-	1.6	2.1

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	1.0	0.7	1.9	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	1.0	1.0	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	1.0	-	-	2.8	-	-	-	-	3.3	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	1.0	-	-	1.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	1.4
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	1.0	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	1.0	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	0.7	-	-	2.5	0.7	0.9	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	1.0	9.6	-	-	-	0.8	-	0.9	0.8	0.7
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	1.4	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	1.9	1.0	2.9	-	-	-	0.7	-	-	1.4
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	20.2	8.7	1.4	37.4	6.5	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	1.0	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	1.9	-	-	-	0.9	0.8	-	-	0.8	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	0.9	1.9	-	-	-	0.8	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.0	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	1.0	-	-	-	-	1.7	0.7	1.7	2.5	0.7
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	1.9	4.3	0.9	3.7	-	0.7	5.2	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	2.1
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	2.8
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	3.7	5.0	-	-	3.3	0.7
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	1.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	1.9	24.0	43.5	2.8	4.6	13.3	24.3	38.8	40.2	11.7
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	2.9	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	1.9	4.8	5.8	12.1	13.0	4.2	10.3	9.5	1.6	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	1.0	-	0.7	-	-	0.8	1.5	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	1.0	-	-	-	-	-	0.7	1.7	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	1.0	0.7	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	2.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	1.5	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	1.9	2.5	-	3.4	-	1.4
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.9	-	-	-	-	-	0.9	-	4.1
Arthropoda	Plecoptera	Leuctridae	na	I	-	1.0	1.4	-	1.9	-	2.9	2.6	4.9	2.1
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	1.7	2.9	0.9	-	7.6

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Nemouridae	na	I	12.5	1.0	-	1.9	-	-	1.5	2.6	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	3.7	3.7	4.2	-	4.3	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	1.0	1.9	-	2.8	1.9	-	-	-	0.8	1.4
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	1.9	-	3.6	-	10.2	1.7	4.4	-	-	2.1
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	5.8	7.2	0.9	0.9	16.7	1.5	6.0	19.7	3.4
Arthropoda	Plecoptera	Perlodidae	na	I	-	4.8	2.9	-	-	2.5	4.4	-	-	2.8
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	0.7	0.9	-	-	1.5	0.9	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	1.0	0.7	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	1.0	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	0.7	-	0.9	0.8	-	-	-	0.7
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	2.9	-	1.4	0.9	1.9	-	0.7	3.4	0.8	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	5.8	6.7	-	-	1.9	1.7	2.2	0.9	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	1.9	1.0	-	3.7	2.8	8.3	6.6	4.3	1.6	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	1.0	-	-	-	2.5	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	0.9	-	0.7	-	-	0.7
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	1.7	-	-	0.8	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	2.9	-	0.7	0.9	1.9	-	-	-	0.8	38.6

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	0.9	-	-	-	0.8	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	0.7	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	1.0	2.2	0.9	7.4	-	0.7	0.9	-	0.7
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	6.7	-	1.4	0.9	1.9	-	2.2	0.9	-	-
Mollusca	Veneroida	Pisidiidae	Musculium	M	-	1.0	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Dipping Pond Run (JONE-109-S)

Site JONE-109-S is located on an unnamed tributary to Dipping Pond Run in the Eastern Piedmont region of Maryland. It is in the Jones Falls watershed in Baltimore County. This site was sampled from 2000 to 2020.

Unnamed tributary to Dipping Pond Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	61.51	61.51	61.51	61.51	61.51	61.51	61.51
Urban	38.36	38.36	38.36	38.36	38.36	38.36	38.36
Agriculture	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Dipping Pond Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	**R = -0.456, p = 0.043**	6.41	6.67	6.41	6.34	6.68	6.75	6.63	6.36	6.27	6.16	6.46	6.40
Specific Conductance (µS/cm)	**R = 0.544, p = 0.013**	133.1	159.7	161.7	150.0	191.0	164.5	181.7	194.7	208.4	205.8	269.7	220.4
Acid Neutralizing Capacity (µeq/L)	**R = 0.543, p = 0.013**	255.5	238.9	254.0	222.5	283.6	256.8	234.4	250.5	223.8	230.0	318.1	265.7
Dissolved Organic Carbon (mg/L)	R = -0.121, p = 0.610	0.800	1.100	0.900	1.000	0.300	0.291	0.655	0.435	0.509	0.449	0.484	0.992
Chloride (mg/L)	**R = 0.514, p = 0.020**	24.03	29.22	26.91	29.40	34.44	30.83	32.66	37.40	41.18	39.36	53.35	48.12
Sulfate (mg/L)	R = 0.098, p = 0.682	2.66	1.14	1.25	3.82	2.54	2.82	1.32	2.00	1.45	1.08	3.40	1.77
Total Nitrogen (mg/L)	**R = 0.823, p < 0.001**	2.613	3.023	3.142	2.690	2.951	2.799	3.553	4.024	4.235	4.332	4.600	4.858
Nitrate-Nitrogen (mg/L)	**R = 0.850, p < 0.001**	2.3860	2.9210	3.1690	2.6490	2.7560	3.2553	3.4517	4.0381	3.9586	4.3127	4.3569	4.2670
Nitrite-Nitrogen (mg/L)	**R = 0.548, p = 0.012**	0*	0.0011*	0.0014	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.110, p = 0.643	0*	0.0186	0.0096	0.0046	0.0062	0.0067	0.0060	0.0053	0.0055	0.0055	0.0047	0.0076
Total Phosphorus (mg/L)	R = 0.039, p = 0.869	0.0060	0.0090	0.0100	0.0070	0.0120	0.0102	0.0074	0.0086	0.0037*	0.0092	0.0055	0.0078*
Ortho-phosphate (mg/L)	**R = 0.617, p = 0.004**	0.0018*	0.0007*	0.0037	0.0007*	0.0007*	0.0024	0.0007*	0.0011*	0.0012	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	R = -0.521, p = 0.231												
Magnesium (mg/L)	R = -0.646, p = 0.166										5.460		
Calcium (mg/L)	R = 0.537, p = 0.272										8.457		
Copper (µg/L)	R = -0.548, p = 0.260												
Zinc (µg/L)	R = -0.448, p = 0.373												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.46	6.47	6.26	6.35	6.25	6.34	6.19	6.49	
Specific Conductance (µS/cm)	228.5	221.7	568.6	686.2	236.3	229.7	258.2	312.6	
Acid Neutralizing Capacity (µeq/L)	261.8	258.9	259.0	323.2	300.5	287.8	238.6	375.5	
Dissolved Organic Carbon (mg/L)	0.229	0.192*	0.563	0.891	0.670	0.996	0.676	0.603	
Chloride (mg/L)	46.29	45.94	158.48	191.09	48.52	47.24	54.34	74.27	
Sulfate (mg/L)	1.78	1.65	2.33	2.90	2.30	1.49	1.29	4.22	Not sampled due to COVID-19 Pandemic
Total Nitrogen (mg/L)	4.741	4.848	4.871	4.439	4.5164	4.268	4.717	4.212	
Nitrate-Nitrogen (mg/L)	4.5795	4.7492	4.9175	4.5000	4.4207	4.0974	4.6185	4.2139	
Nitrite-Nitrogen (mg/L)	0.0010*	0.0011*	0.0036	0.0011*	0.0005	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0051	0.0047	0.0044	0.0058	0.0059	0.0109	0.0035	0.0084*	
Total Phosphorus (mg/L)	0.0078*	0.0080*	0.0078*	0.0189	0.0065	0.0056	0.0065	0.0102*	
Ortho-phosphate (mg/L)	0.0027	0.0024	0.0036	0.0030*	0.0058	0.0046	0.0031*	0.0032*	
Bromide (mg/L)		0.0365	0.0333	0.0303	0.0342	0.0356	0.0324	0.0295	
Magnesium (mg/L)			7.550	7.243	6.995	7.162	7.230	7.053	
Calcium (mg/L)			11.030	11.670	11.430	12.410	11.080	12.450	
Copper (µg/L)			0.310	0.357	0.180	0.313	0.205	0.230	
Zinc (µg/L)			2.292	3.007	2.592	1.621	1.272	2.448	

Physical Habitat

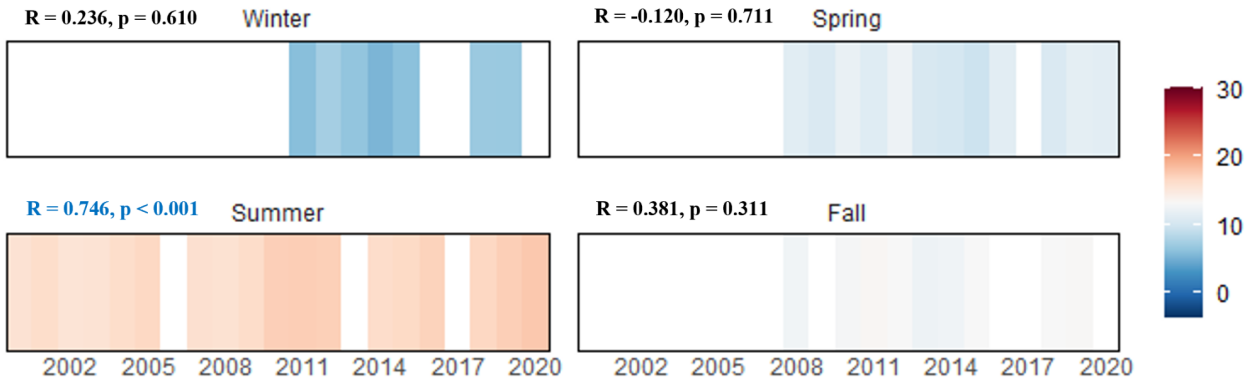
Physical habitat measurements collected at the unnamed tributary to Dipping Pond Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.213, p = 0.354	12	11	16	16	15	8	13	12	13	15	15	9	12	14	15	16	11	17	6	9	11
Epifaunal substrate (0-20)	R = -0.125, p = 0.590	11	13	16	18	17	9	13	12	12	15	14	12	15	14	16	17	13	17	8	11	12
Velocity/Depth Diversity (0-20)	R = -0.210, p = 0.360	8	7	11	11	9	7	7	9	7	8	11	6	9	9	9	9	9	5	6	8	9
Pool Quality (0-20)	R = -0.215, p = 0.350	6	7	11	11	8	6	6	8	6	10	11	7	7	9	9	9	6	4	6	7	8
Riffle Quality (0-20)	R = -0.178 , p = 0.439	9	11	10	14	11	11	12	8	9	9	10	9	8	10	10	15	10	10	7	10	10
Shading (%)	**R = -0.760, p < 0.001**	90	95	95	97	95	90	95	90	95	85	90	85	70	75	65	65	80	90	70	80	65
Embeddedness (%)	R = 0.208, p = 0.365	25	40	35	15	23	40	40	30	40	50	40	30	35	35	25	25	35	60	50	25	30
Discharge (cfs)	R= 0.132, p = 0.569	0.12	0.08	0.06	0.26	0.1	0.16	0.13	0.04	0.09	0.1	0.41	0.09	0.06	0.15	0.2	0.34	0.13	0.11	0.1	0.14	0.13
Stream Area (m2)	R = 0.258, p = 0.259	82.5	103.1	86.3	101.3	101.3	88.1	88.1	93.8	75.0	91.9	101.3	86.3	88.1	101.3	99.4	97.5	112.5	101.3	120.0	78.8	91.9

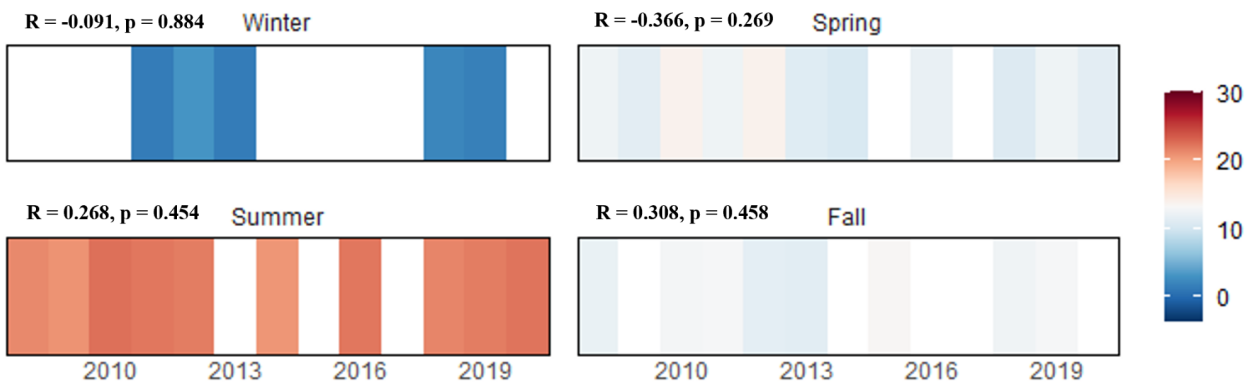
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Dipping Pond Run (only calculated for summers missing no less than 2 weeks of data).

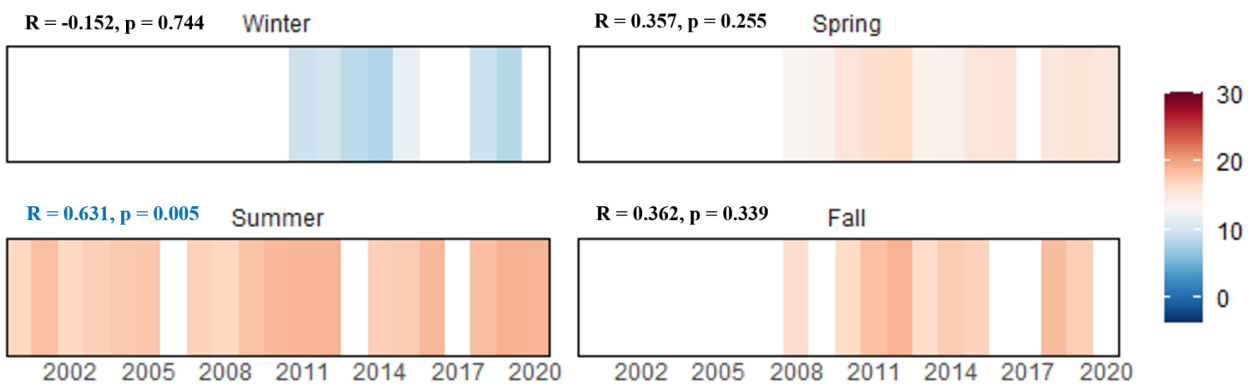
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.604, p = 0.008**	0.03	0.6	0.1	0.1	0.3	0.1	-	0.3	0.2	0.5	0.9	2.1	2.1	-	0.1	0.7	1.2	-	0.3	2.2	2.0
% above 24°C	R = 0.052, p = 0.837	0	0	0	0	0	0	-	0	0	0	0	0.02	0	-	0	0	0	-	0	0	0



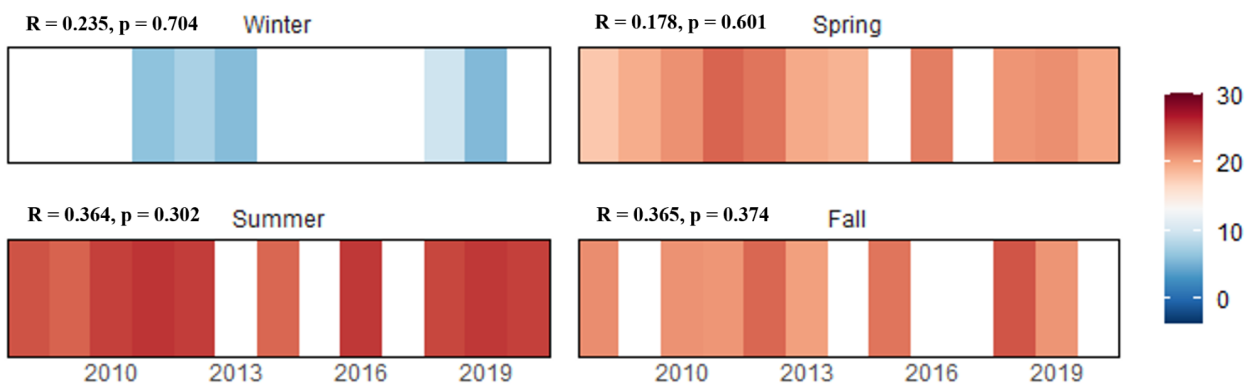
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Dipping Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Dipping Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Dipping Pond Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Dipping Pond Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	**R = -0.598, p = 0.004**	4.67	5.00	4.00	4.33	3.67	4.67	3.67	3.67	3.67	4.00	4.33	4.00	4.67	3.33	3.67	3.67	3.00	4.00	3.67	3.33	3.67
# Taxa	R = -0.099, p = 0.669	22	26	24	31	32	21	26	30	27	28	31	32	32	30	31	33	27	19	32	23	14
# Ephemeroptera Taxa	**R = -0.766, p < 0.001**	6	4	3	4	3	4	3	2	3	4	4	2	3	2	2	2	1	1	2	2	2
# EPT	R = -0.260, p = 0.254	13	12	13	13	13	12	8	9	10	9	14	12	12	10	15	12	10	12	10	11	9
% Chironomidae	R = 0.278, p = 0.222	12.6	14.2	3.7	24.6	31.4	6.0	23.3	33.3	28.8	35.3	37.3	33.6	20.8	38.9	27.9	36.8	40.0	4.9	35.4	38.5	1.6
% Clingers	R = -0.022, p = 0.925	75.6	79.5	70.9	63.9	62.8	88.0	63.2	67.5	66.1	59.6	53.7	61.8	75.3	58.7	72.1	53.4	65.6	93.5	54.6	60.7	94.3
% Intolerant Urban Taxa	R = -0.317, p = 0.161	78.2	70.9	71.6	66.4	47.1	76.1	47.4	53.5	61.0	54.4	51.5	58.0	67.5	35.7	45.9	42.1	36.0	87.0	52.3	25.4	82.8

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	**R = 0.530, p = 0.013**	1.33	1.33	1.33	1.33	1.67	1.33	1.67	1.67	1.33	1.67	1.67	1.67	1.67	1.67	1.67	1.67	1.33	1.33	1.67	1.67	2.00
Abundance per m2	R = 0.291, p = 0.201	0.5	0.9	0.57	0.28	0.53	0.73	0.5	0.65	0.79	0.86	0.45	1.39	1.1	0.7	1.1	0.94	0.48	1.07	0.69	0.79	0.49
Biomass per m2	R = 0.223, p = 0.330	1.66	2.52	1.44	0.86	1.61	1.94	1.61	2.1	1.93	2.24	1.67	3.08	2.18	1.93	2.65	1.98	1.42	2.66	1.17	2.73	1.58
# Benthic Sp. (Adjusted)	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Generalists/Omnivores/ Invertivores	**R = -0.471, p = 0.031**	100	100	100	100	96.3	100	95.5	98.4	100	98.7	95.7	100	99.0	94.4	99.1	92.4	100	100	97.6	95.2	73.3

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Tolerant	**R = -0.471, p = 0.031**	100	100	100	100	96.3	100	95.5	98.4	100	98.7	95.7	100	99.0	94.4	99.1	92.4	100	100	97.6	95.2	73.3
% Lithophilic Spawners	**R = 0.471, p = 0.031**	0	0	0	0	3.7	0	4.6	1.6	0	1.3	4.4	0	1.0	5.6	0.9	7.6	0	0	2.4	4.8	26.7

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Dipping Pond Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	41	93	49	28	52	64	42	60	59	78	44	120	96	67	108	85	54	108	81	59	33
Brown Trout	M	-	-	-	-	2	-	2	1	-	1	2	-	1	4	1	7	-	-	2	3	12

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Dipping Pond Run by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	N	D	N	D	D	D	D	N	N	N	N	D
Faxonius Virilis	N	N	D	D	N	D	N	D	N	N	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Dipping Pond Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the unnamed tributary to Dipping Pond Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray treefrog, Eastern American toad, Gray treefrog, Northern green frog, Northern spring peeper, Pickerel frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Northern dusky salamander, Northern red salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Northern watersnake
Testudines (Turtles)	Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to Dipping Pond Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.8	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	5.9	5.5	20.1	-	-	-	5.3	1.8	1.7	1.5	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	1.0	-	-	-	-	-	3.0
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	3.9	-	-	-	1.7	1.5	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.7	2.4	-	-	-	2.6	7.5	0.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	0.7	-	-	-	-	-	1.7	-	-
Arthropoda	Collembola	na	na	M	0.8	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	0.7	-	-	-	0.8	0.9	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	4.1	-	0.9	1.5	-	-	0.7	0.7
Arthropoda	Diptera	Ceratopogonidae	na	M	-	1.6	-	-	-	-	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	1.0	-	-	0.9	-	-	0.7
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	0.8	-	-	2.2	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	1.5	0.8	1.0	-	-	3.5	1.7	7.4	9.0
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	9.2	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	-	-	-	-	-	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.7	-	-	8.2	2.0	-	9.8	6.1	-	5.1	3.7
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	2.5	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	3.1	-	-	2.9	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	0.8	0.7	2.2
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	0.9	0.8	2.2	0.7
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	3.1	1.5	2.5	6.9	4.3	6.8	9.6	6.8	9.6	8.2
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	1.7	1.6	-	-	2.0	-	0.8	4.4	-	2.2	0.7

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	1.5	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	2.6	-	0.7	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	9.8	-	-	-	0.9	11.0	1.5	2.2
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	2.0	0.9	-	-	2.5	-	3.7
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	1.0	-	0.8	-	-	0.7	2.2
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	1.0	-	-	-	0.8	0.7	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	1.6	0.7	-	5.9	-	1.5	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	2.4	-	0.8	5.9	-	-	0.9	1.7	2.2	2.2
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	0.8	-	-	-	0.7
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	2.2	0.7
Arthropoda	Diptera	Empididae	Chelifera	T	-	0.8	0.7	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	1.7	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	3.3	2.9	-	8.3	0.9	1.7	0.7	1.5
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	1.0	-	-	0.9	-	2.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	0.8	-	-	-	0.9	1.7	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	0.8	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	0.8	0.7	-	3.9	-	-	0.9	-	-	1.5
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	0.8	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	1.6	-	1.7	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	0.8	-	1.5	-	-	0.9	2.3	-	1.7	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.8	-	-	0.8	2.9	0.9	3.8	3.5	-	1.5	1.5
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	0.8	-	-	-	1.5
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	5.0	-	-	-	1.0	1.7	-	-	-	0.7	1.5
Arthropoda	Ephemeroptera	Baetidae	na	I	0.8	-	1.5	0.8	-	-	0.8	-	-	0.7	0.7
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	1.6	-	-	5.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	23.5	27.6	18.7	16.4	-	11.1	1.5	4.4	17.8	0.7	0.7
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	2.3	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	0.8	-	-	0.8	-	-	-	-	2.5	0.7	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	0.8	-	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	4.2	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.8	2.4	0.7	6.6	2.9	8.5	9.8	0.9	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	1.7	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.8	0.8	-	0.8	-	-	1.5	2.6	-	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	0.8	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	-	0.7	0.8	-	-	-	1.8	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Plecoptera	na	na	I	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	3.0	3.3	1.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	5.0	3.1	6.7	-	2.0	8.5	-	1.8	6.8	16.2	27.6

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	22.7	17.3	11.9	1.6	5.9	17.9	8.3	15.8	12.7	27.9	2.2
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	1.7	6.8	1.8	0.8	-	-
Arthropoda	Plecoptera	Nemouridae	Soyedina	I	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Peltoperla	I	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	0.8	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	1.6	1.0	0.9	-	0.9	0.8	-	0.7
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	1.6	2.0	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	2.5	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	2.0	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	5.9	3.1	6.0	2.5	4.9	3.4	-	-	-	-	3.0
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	0.7	-	1.0	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	0.8	1.0	5.1	0.8	2.6	0.8	0.7	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	5.0	9.4	7.5	16.4	14.7	23.9	12.0	21.9	12.7	5.1	9.0
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	0.9	-	-	-	-	0.7
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	1.6	-	-	2.9	-	-	-	-	0.7	0.7
Arthropoda	Trichoptera	Molannidae	Molanna	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.8	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Philopotamidae	na	I	-	0.8	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	6.0	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	0.8	1.5	1.6	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.8	1.6	3.7	3.3	3.9	-	-	-	0.8	-	1.5
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	0.8	-	-
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	-	1.6	1.0	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	0.8	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	0.8	0.8	10.5	-	-	10.0	0.8	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	0.8
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	0.6	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	0.6	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.5	1.3	1.6	-	-	0.8	4.9	0.8	-	1.6
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Hydrophilidae	Tropisternus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	0.8	0.6	-	-	0.8	0.8	-	0.8	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Collembola	na	na	M	-	-	-	-	0.8	-	-	1.5	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	0.8	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	0.8	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	0.6	-	-	2.3	6.4	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	1.5	-	0.8	-	2.3	1.6	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	4.6	3.9	7.9	0.8	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.6	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	14.5	5.2	12.7	16.4	5.3	7.2	-	3.8	12.3	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	0.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	1.3	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	0.8	-	-	-	1.5	1.6	-	3.8	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	1.6	-	-	0.8	-	2.3	5.7	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	1.5	-	2.4	-	-	-	-	3.1	0.8	-
Arthropoda	Diptera	Chironomidae	Paracladopelma	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	1.5	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	4.6	0.6	7.1	-	3.0	3.2	-	4.6	9.0	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.6	-	1.6	0.8	11.2	1.6	0.8	1.6	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	1.5	-	-	2.3	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	0.8	1.6	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	0.8	1.3	0.8	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.8	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.8	3.3	1.5	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	1.5	4.5	0.8	-	-	2.4	-	6.2	0.8	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.8	-	-	0.8	0.8	-	0.8	1.5	0.8	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	0.8	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	1.5	1.3	0.8	1.6	16.5	5.6	-	0.8	6.6	0.8
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	0.8	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	0.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	1.5	-	3.2	0.8	0.8	-	-	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ephydridae	na		-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	3.1	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	1.9	1.6	-	0.8	2.4	-	-	5.7	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	0.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	0.8	0.6	0.8	1.6	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	1.3	2.4	1.6	-	2.4	1.6	0.8	1.6	3.3
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	1.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	0.8	1.5	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	2.6	10.3	5.7	2.3	10.4	1.6	1.5	23.0	9.0
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	-	-	-	1.5	-	-	-	0.8	2.5
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	1.5	0.6	-	0.8	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Odonata	Cordulegastridae	Cordulegaster	I	-	-	-	0.8	-	0.8	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	2.3	-	5.6	-	-	-	16.3	-	0.8	31.1

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Leuctridae	na	I	8.4	38.3	-	3.3	16.5	-	-	28.5	12.3	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	25.2	5.8	18.3	7.4	14.3	8.8	30.1	2.3	4.1	28.7
Arthropoda	Plecoptera	Nemouridae	na	I	-	0.6	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	1.5	-	4.0	4.9	-	1.6	-	-	0.8	-
Arthropoda	Plecoptera	Nemouridae	Soyedina	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Peltoperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	0.8	0.6	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	0.8	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	3.1	0.6	-	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	0.8	1.5	1.6	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	1.9	0.8	4.9	2.3	1.6	0.8	-	0.8	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	8.4	8.4	5.6	12.3	3.0	16.0	13.8	6.9	1.6	6.6
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	0.8	0.6	-	1.6	1.5	3.2	0.8	-	3.3	2.5
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	2.4	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Limnephilus	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	0.8	-	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Molannidae	Molanna	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	0.6	-	0.8	0.8	-	-	1.5	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	0.8	2.5	-	-	16.3	0.8	1.6	8.2

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Philopotamidae	na	I	-	6.5	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	-	-	-	-	-	0.8	0.8	0.8	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	1.3	3.2	16.4	1.5	4.0	1.6	3.8	2.5	3.3
Mollusca	Basommatophora	Physidae	Physa	T	-	-	-	-	-	-	-	1.5	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		1.5	-	-	-	0.8	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

North Branch of Jones Falls (JONE-315-S)

Site JONE-315-S is located on the North Branch of Jones Falls in the Eastern Piedmont region of Maryland. It is in the Jones Falls watershed in Baltimore County. This site was sampled in 1996 and from 2000 to 2020.

North Branch of Jones Falls in spring 2019.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	57.79	57.69	57.40	57.26	56.99	57.11	57.25
Urban	23.62	23.62	24.45	24.45	24.59	24.59	24.63
Agriculture	17.81	17.79	17.26	17.24	17.18	17.21	17.17
Other	0.78	0.89	0.89	1.05	1.24	1.09	0.95

Water Chemistry

Water chemistry measurements collected at the North Branch of Jones Falls (1996, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.142, p = 0.541	7.60	7.52	8.20	8.05	7.50	7.59	7.66	7.92	7.74	7.89	7.91	7.63	7.82
Specific Conductance (µS/cm)	R = 0.101, p = 0.662	445.9	168.7	242.4	253.4	190.0	219.2	191.8	242.1	260.6	274.7	279.7	237.5	237.1
Acid Neutralizing Capacity (µeq/L)	R = 0.344, p = 0.127	795.0	958.1	1194.0	1477.0	781.3	948.6	928.7	1151.0	1164.7	1424.3	1512.7	984.3	1196.6
Dissolved Organic Carbon (mg/L)	R = -0.197, p = 0.393	2.600	2.000	1.100	1.800	2.200	1.000	1.129	0.842	1.078	0.965	0.566	1.164	2.238
Chloride (mg/L)	**R = 0.766, p < 0.001**		17.42	23.97	22.85	26.23	26.87	24.56	28.72	36.28	32.44	33.56	30.82	33.38
Sulfate (mg/L)	**R = -0.480, p = 0.028**	7.36	6.17	4.30	5.60	7.77	4.88	5.95	4.19	5.20	5.23	4.03	5.91	5.96
Total Nitrogen (mg/L)	R = 0.438, p = 0.054		1.34	1.56	1.06	1.33	1.79	1.39	1.75	1.53	1.36	1.73	1.59	1.49
Nitrate-Nitrogen (mg/L)	**R = 0.432, p = 0.050**	1.3200	1.0660	1.5220	0.9600	1.1670	1.5030	1.4687	1.5722	1.4034	1.2707	1.7070	1.3804	1.2407
Nitrite-Nitrogen (mg/L)	R = 0.293, p = 0.209		0*	0.0028	0.0023	0.0017	0.0023	0.0021	0.0047	0.0017	0.0022	0.0053	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = 0.269, p = 0.252		0*	0.0051*	0.0033	0.0090	0.0067	0.0049	0.0031	0.0046	0.0044	0.0046	0.0028	0.0040
Total Phosphorus (mg/L)	R = -0.404, p = 0.077		0.0090	0.0090	0.0150	0.0250	0.0140	0.0127	0.0058	0.0111	0.0048	0.0086	0.0116	0.0171
Ortho-phosphate (mg/L)	R = 0.085, p = 0.723		0.0033*	0.0007*	0.0007*	0.0112	0.0007*	0.0037	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0031
Bromide (mg/L)	R = 0.051, p = 0.913													
Magnesium (mg/L)	R = 0.144, p = 0.785											6.189		
Calcium (mg/L)	R = 0.214, p = 0.683											28.559		
Copper (µg/L)	R = -0.295, p = 0.570													
Zinc (µg/L)	R = -0.317, p = 0.540													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.76	8.00	7.96	7.56	7.82	8.02	7.89	7.58	
Specific Conductance (µS/cm)	248.0	252.0	341.1	296.7	273.6	311.0	317.5	233.8	
Acid Neutralizing Capacity (µeq/L)	1195.0	1244.2	1147.3	872.7	1185.0	1331.8	1544.9	1010.9	
Dissolved Organic Carbon (mg/L)	0.450	0.330	1.073	3.115	1.141	1.701	1.138	1.493	
Chloride (mg/L)	32.55	32.80	61.29	59.14	41.40	46.17	41.30	38.37	
Sulfate (mg/L)	4.66	4.48	5.01	4.60	4.82	5.06	4.92	5.12	
Total Nitrogen (mg/L)	1.942	1.840	1.877	1.352	1.666	1.340	1.987	1.650	
Nitrate-Nitrogen (mg/L)	1.7611	1.8006	1.7884	1.1275	1.6098	1.2716	1.6229	1.6167	Not sampled due to COVID-19 Pandemic
Nitrite-Nitrogen (mg/L)	0.0026	0.0047	0.0037	0.0011*	0.0023*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0040	0.0038	0.0031	0.0113	0.0051	0.0045	0.0044	0.0084*	
Total Phosphorus (mg/L)	0.0096	0.0089	0.0078*	0.0030*	0.0077	0.0070	0.0086	0.0102*	
Ortho-phosphate (mg/L)	0.0025	0.0017	0.0026	0.0066	0.0033	0.0031*	0.0031*	0.0032*	
Bromide (mg/L)		0.0317	0.0323	0.0162	0.0307	0.0291	0.0301	0.0301	
Magnesium (mg/L)			7.699	5.145	7.249	9.209	8.237	6.233	
Calcium (mg/L)			23.500	17.640	21.010	28.310	28.260	19.300	
Copper (µg/L)			0.380	1.945	0.259	1.309	0.269	0.399	
Zinc (µg/L)			0.775	3.967	1.423	2.985	0.300*	0.965	

Physical Habitat

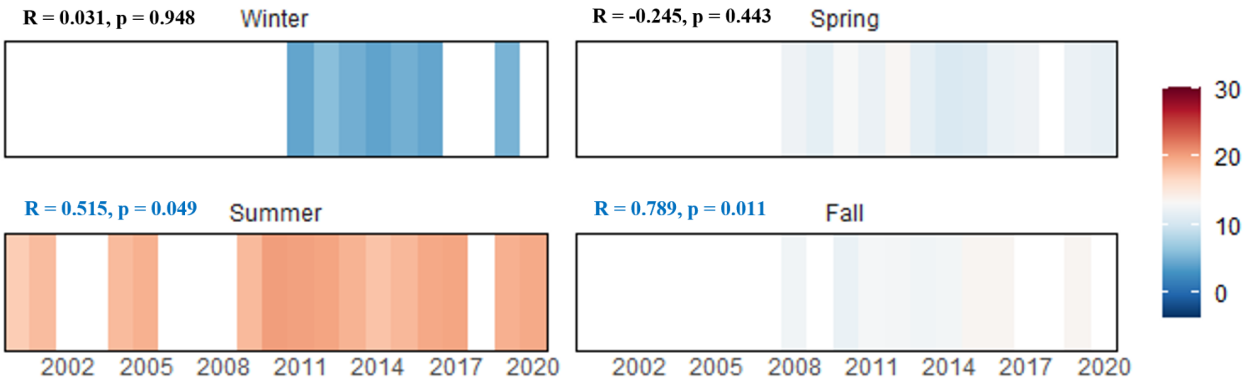
Physical habitat measurements collected at the North Branch of Jones Falls (1996, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.565, p = 0.006**	19	17	17	19	19	18	17	18	17	17	17	17	17	17	14	15	18	16	16	17	18	15
Epifaunal substrate (0-20)	R = -0.325, p = 0.140	18	17	18	19	18	16	17	17	16	14	17	17	17	15	13	14	18	17	17	16	17	17
Velocity/Depth Diversity (0-20)	R = -0.378, p = 0.083	18	15	15	15	17	16	15	16	14	13	13	13	15	12	12	8	14	14	15	17	14	15
Pool Quality (0-20)	**R = -0.565, p = 0.006**	17	16	16	19	17	17	17	17	16	17	15	16	16	12	13	16	14	15	14	14	17	15
Riffle Quality (0-20)	R = -0.377, p = 0.084	16	17	17	17	17	17	16	16	13	13	17	16	16	15	14	14	15	15	16	16	15	16
Shading (%)	**R = -0.671, p = 0.001**	87	95	83	96	98	80	90	90	85	80	80	85	65	40	70	60	40	60	75	75	55	75
Embeddedness (%)	R = 0.354, p = 0.106	20	15	20	16	20	15	30	35	20	25	20	30	30	65	20	20	40	25	30	65	20	15
Discharge (cfs)	R = -0.037, p = 0.872	6.85	2.77	3.05	0.59	8.44	4.73	1.25	2.62	0.99	2.59	3.06	4.74	3.28	4.84	1.77	3.72	5.14	4.15	na	5.44	3.42	2.74
Stream Area (m2)	**R = 0.656, p = 0.001**	573.8	384.4	485.6	298.1	513.8	403.1	390.0	476.3	525.0	571.9	459.4	536.3	476.3	511.9	483.8	598.1	641.3	671.3	641.3	594.8	628.5	585.0

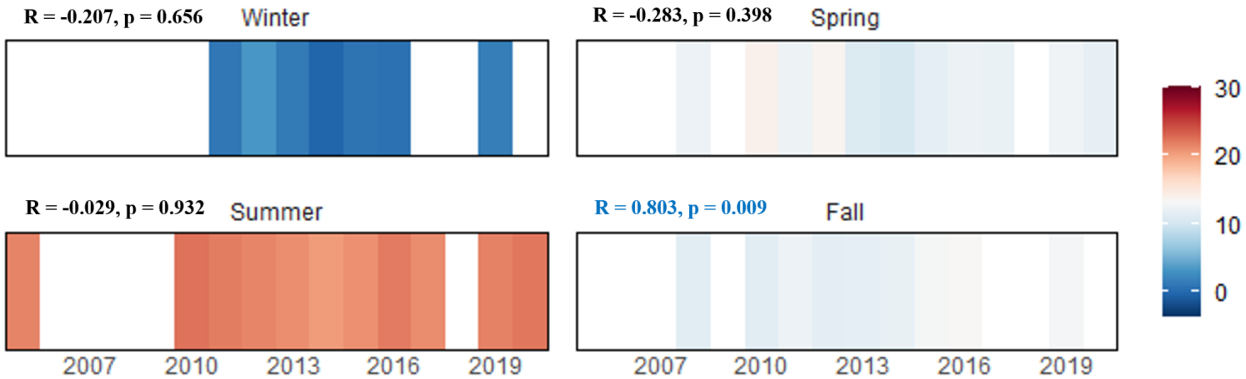
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at the North Branch of Jone Falls (only calculated for summers missing no less than 2 weeks of data).

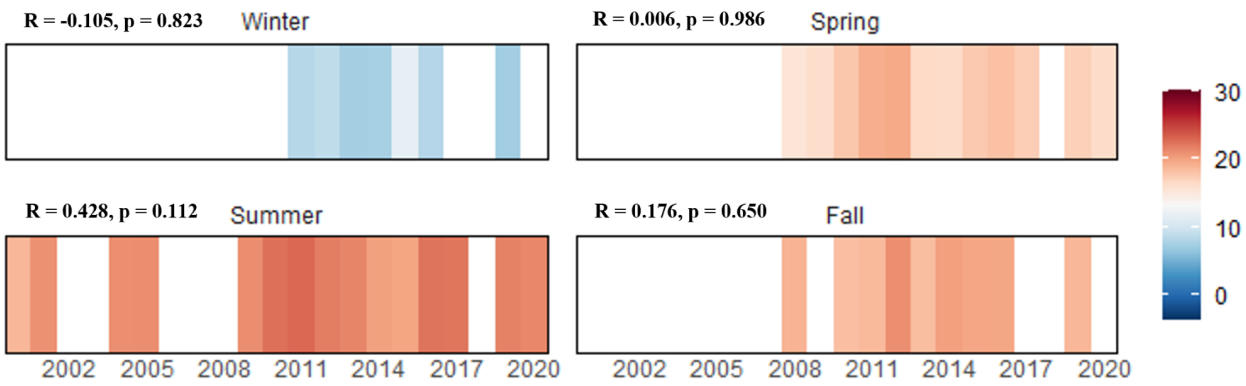
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.533, p = 0.041**	0	12.0	-	-	16.3	33.7	-	-	-	20.1	55.5	51.7	52.4	27.7	8.3	15.4	41.3	50.4	-	35.5	47.9
% above 24°C	R = 0.081, p = 0.773	0	0	-	-	0	0	-	-	-	0	0.7	1.3	0	0	0	0	0.1	0.5	-	0	0



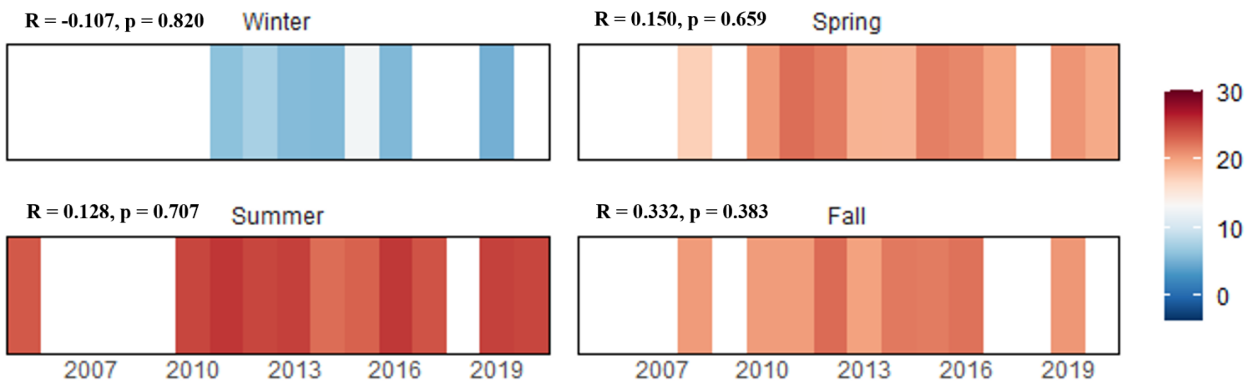
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the North Branch of Jones Falls (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the North Branch of Jones Falls (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the North Branch of Jones Falls (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the North Branch of Jones Falls (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	**R = -0.436, p = 0.043**	4.67	5.00	4.00	4.67	4.67	4.00	5.00	4.00	3.33	3.33	2.33	2.67	3.33	3.67	3.00	3.00	3.67	4.00	3.67	3.33	3.67	4.67
# Taxa	**R = 0.479, p = 0.024**	23	26	16	20	21	22	28	24	28	29	23	24	22	29	26	20	21	27	29	26	27	33
# Ephemeroptera Taxa	R = -0.197, p = 0.380	6	7	3	5	5	2	6	2	2	2	1	4	1	5	2	3	4	4	5	3	4	5
# EPT	R = -0.088, p = 0.698	11	15	9	12	11	11	14	10	9	9	7	9	8	13	9	9	13	13	8	9	10	15
% Chironomidae	**R = 0.538, p = 0.010**	9.5	16.3	14.3	1.7	17.2	12.3	10.1	19.5	34.6	29.2	59.3	63.0	20.4	62.8	26.3	50.0	49.2	26.7	26.4	46.7	38.9	21.9
% Clingers	**R = -0.482, p = 0.023**	87.4	79.7	85.7	98.3	81.0	80.7	89.0	79.7	61.5	69.9	38.9	29.0	77.0	41.6	72.8	48.1	50.8	69.0	73.6	59.8	58.4	79.8
% Intolerant Urban Taxa	**R = -0.683, p < 0.001**	56.8	75.6	74.1	84.8	75.9	42.1	61.5	62.5	25.0	15.9	9.3	8.0	29.2	9.7	11.4	12.5	23.0	22.4	36.0	26.2	12.4	40.3

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	**R = -0.422, p = 0.050**	4.33	4.00	4.00	4.33	3.33	3.67	4.33	4.00	4.00	3.33	3.33	4.33	3.00	3.00	3.33	3.67	3.67	3.67	3.33	3.00	4.00	4.00
Abundance per m2	R = -0.359, p = 0.100	0.32	1.37	0.89	0.85	0.35	1.16	1.46	0.75	0.7	0.53	0.68	0.48	0.56	1.08	0.87	0.68	0.35	0.44	0.57	0.72	0.46	0.39
Biomass per m2	**R = -0.446, p = 0.038**	9.44	23.05	11.36	15.43	7.61	27.59	24.62	14.98	13.35	11.58	7.38	9.2	6.79	9.74	13.15	12.52	5.83	7.48	6.21	8.17	13.46	9.21
# Benthic Sp. (Adjusted)	R = 0.352, p = 0.108	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47	0.47
% Generalists/ Omnivores/ Invertivores	R = -0.002, p = 0.991	75.3	82.2	72.8	66.4	86.7	87.6	75.9	61.6	75.7	81.2	82.8	76.9	94.0	91.9	89.1	85.2	73.9	68.6	84.9	89.6	70.7	57.4
% Tolerant	R = 0.214, p = 0.338	52.7	51.7	45.0	37.2	56.4	63.7	63.2	54.9	57.9	69.6	65.5	55.0	83.2	79.8	72.6	64.6	51.4	47.1	62.9	70.1	51.2	45.2

Metric	*Pearson's Correlation Coefficients*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Lithophilic Spawners	R = 0.084, p = 0.710	61.3	38.3	41.8	54.9	44.8	34.1	36.3	51.0	43.4	32.7	48.2	61.5	33.3	29.4	41.4	37.9	42.8	48.1	50.6	43.6	57.5	59.6

Fish

Cumulative list of fish species (with abundance) collected in the North Branch of Jones Falls by sampling year.

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-
Blacknose Dace	T	41	162	105	35	39	101	57	39	69	87	73	43	67	152	96	111	53	75	67	98	41	34
Bluegill	T	2	-	5	4	6	4	77	43	8	34	13	22	44	103	27	21	3	-	15	27	4	5
Brown Trout	M	45	94	111	81	24	57	131	134	86	55	48	60	16	36	40	59	56	92	55	36	82	95
Creek Chub	T	20	26	23	9	13	32	21	5	12	29	29	27	20	64	52	41	21	16	59	75	12	8
Cutlip Minnow	M	8	13	7	6	11	27	18	7	10	1	27	34	8	18	10	13	4	11	23	17	20	13
Golden Shiner	T	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Green Sunfish	T	3	16	9	2	8	108	162	63	58	26	6	11	40	55	23	14	5	5	4	6	33	24
Largemouth Bass	T	-	-	7	4	-	1	4	-	3	2	6	-	-	9	6	1	2	-	-	9	2	3
Lepomis Hybrid	M	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Longnose Dace	M	23	128	109	62	34	81	52	17	57	36	31	23	16	57	65	69	48	52	57	76	36	18
Northern Hogsucker	I	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Pumpkinseed	T	-	-	-	-	-	-	-	4	5	-	-	-	-	-	-	-	-	-	1	-	-	2
Redbreast Sunfish	M	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-
Rock Bass	M	-	5	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Rosyside Dace	M	11	15	11	9	10	4	5	-	1	-	1	-	-	1	-	-	-	-	-	-	1	-
Smallmouth Bass	M	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sunfish (Unknown)	M	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tessellated Darter	T	2	20	17	7	13	12	8	6	7	19	32	1	8	15	29	33	16	20	36	27	5	7
White Sucker	T	30	49	29	33	23	39	30	37	50	14	46	39	42	44	72	40	14	22	47	60	50	21

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to North Branch of Jones Falls by sampling year.

Species	*1996*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	N	D	N	D	D	N	N	D	N	D
Faxonius Sp.	N	N	N	N	N	N	N	N	N	N	N	D	N	N	N	N
Faxonius Virilis	D	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the North Branch of Jones Falls by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the North Branch of Jones Falls.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Eastern American toad, Gray treefrog, Northern green frog, Pickerel frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Long-tailed salamander, Northern dusky salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Northern watersnake, Queen snake
Testudines (Turtles)	Eastern box turtle, Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the North Branch of Jones Falls by sampling year, RA = %Relative Abundance.

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-	-	1.0
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	0.9	-	-	-	-	0.9	-	1.0
Annelida	Lumbriculida	Lumbriculidae	na	M	1.1	-	-	-	-	0.9	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	0.9	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	6.3	-	-	0.8	0.9	-	0.9	3.1	-	-	0.9	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	0.9	0.8	-	-	5.5	3.9	2.9	0.9	-	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	0.9	-	-	1.6	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	0.8	-	-	-	0.8	1.9	-	-	-

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	1.1	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	1.7	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	2.1	8.1	9.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	0.9	-	-	-	-	-	3.8	0.9	2.8	6.0
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.1	1.6	1.8	0.8	-	-	-	0.8	-	0.9	-	1.0
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	3.7	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	1.0	0.9	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	1.1	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	2.8	0.8	-	0.9	5.6	3.0
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	1.6	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	1.1	-	-	-	9.5	1.8	1.8	14.1	16.3	6.2	38.9	37.0
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-	2.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	2.1	1.6	1.8	0.8	-	2.6	2.8	1.6	6.7	6.2	4.6	2.0
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	1.8	-	1.9	1.8	0.9	-

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	1.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	2.7	-	1.0
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Sublettea	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	1.6	-	-	5.2	-	-	0.8	1.9	2.7	-	6.0
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	0.8	-	-	-	-	-	-	-	1.8	0.9	1.0
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	1.8	-	-	1.0	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	4.4	-	1.6	1.0	0.9	0.9	4.0
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	1.1	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Empididae	Clinocera	T	-	1.6	-	-	-	-	3.7	1.6	5.8	-	8.3	3.0
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	1.1	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Psychodidae	Psychoda	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	24.2	12.2	33.0	26.3	61.2	10.5	3.7	29.7	8.7	3.5	0.9	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	0.8	-	0.8	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	1.8	-	-	1.0	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	3.7	0.8	1.0	-	-	2.0
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	2.6	-	0.8	1.9	2.7	-	-

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	1.1	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	0.8	-	-	-	3.5	1.8	-	3.8	-	0.9	1.0
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	3.3	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	0.8	0.9	0.8	-	-	1.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	5.3	-	-	-	-	21.9	5.5	-	-	-	-	1.0
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	0.8	-	2.5	-	-	0.9	1.6	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	16.8	39.0	34.8	44.9	6.9	16.7	34.9	18.8	4.8	2.7	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	1.1	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	4.2	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	0.9	-	0.9	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	3.7	1.0
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	2.1	1.6	1.8	2.5	0.9	-	4.6	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	5.3	0.8	-	-	0.9	-	0.9	-	-	-	-	1.0
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	3.4	0.9	0.9	0.9	-	1.0	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	0.9	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	-	-	-	-

					1996	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Leuctridae	na	I	-	1.6	1.8	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	2.4	-	-	-	-	4.6	-	1.0	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	2.3	-	0.9	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	15.8	-	4.5	-	1.7	4.4	-	1.6	-	0.9	0.9	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	1.6	-	-	-	-	-	-	-	0.9	1.9	-
Arthropoda	Plecoptera	Perlidae	na	I	2.1	-	-	-	-	-	-	0.8	1.0	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	1.1	4.9	1.8	0.8	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	0.9	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	2.7	-	0.9	5.3	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-	-	4.0
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	2.4	-	5.1	-	2.6	2.8	2.3	3.8	16.8	7.4	11.0
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	6.5	-	1.7	1.7	1.8	0.9	0.8	-	1.8	2.8	3.0
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	1.1	-	-	2.5	0.9	3.5	-	3.9	14.4	8.0	7.4	4.0
Arthropoda	Trichoptera	Hydroptilidae	Hydroptila	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	0.9	-	-	-	-	1.0
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	3.5	0.9	3.9	8.7	25.7	1.9	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	0.8	0.9	0.9	-	-	1.0	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Psychomyia	M	-	-	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	2.1	0.8	-	1.7	-	6.1	2.8	-	-	0.9	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	-	-	0.9	-	0.8	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	1996 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	-	-	-	-	-	-	-	-	-
Nematoda	na	na	na		-	-	-	-	-	-	-	-	-	-	-	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	1.8	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	0.9	1.0	-	-	1.6	-	6.2	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	Limnodrilus	T	-	-	-	-	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	0.8	0.9	-
Arthropoda	Amphipoda	Crangonyctidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	0.8	-	0.8
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	0.9	-	0.9	-	-	0.9	2.4	-	-	1.7
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	-	-	-	-	4.0	2.5	2.7	0.8
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	2.5
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	0.8	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Decapoda	Cambaridae	Orconectes	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Chironomus	M	-	-	-	-	-	-	-	3.3	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	0.9	-	1.0	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	5.3	1.8	-	3.2	2.6	-	0.8	6.2	0.8
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	0.9	-	0.8	-	-	-	2.7	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	4.4	0.9	-	-	-	12.8	-	1.8	0.8
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	1.0	0.8	1.7	-	5.7	0.9	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	0.9	-	4.8	0.8	0.9	-	2.5	0.9	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae A	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	2.7	25.7	11.4	23.1	27.8	7.8	2.4	10.7	14.2	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	1.7
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	10.6	8.0	3.5	3.8	2.4	-	2.4	0.8	-	9.2
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	4.4	-	1.0	-	-	3.2	0.8	0.9	3.4

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.8	1.8	0.9	1.0	-	-	-	8.2	3.5	1.7
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Sublettea	T	-	-	-	-	-	-	-	8.2	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	2.7	0.9	0.9	8.7	13.5	12.1	-	-	4.4	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	2.4	-	-	0.8
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.9	6.2	-	-	-	-	1.6	2.5	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	0.8	-	0.8
Arthropoda	Diptera	Chironomidae	Tribelos	T	-	-	-	-	-	-	-	1.6	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	1.8	3.5	4.4	5.8	-	0.9	0.8	-	1.8	0.8
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	0.9	0.9	8.8	-	-	-	1.6	-	3.5	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Psychodidae	Psychoda	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	1.8	1.8	7.0	-	1.6	0.9	2.4	-	-	0.8
Arthropoda	Diptera	Simuliidae	Simulium	M	-	3.5	0.9	-	-	0.9	0.8	-	1.8	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	0.9	1.8	1.0	1.6	3.4	2.4	3.3	5.3	1.7
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	0.9	1.6	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	2.7	-	0.9	2.9	-	-	0.8	-	-	3.4
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	0.9	-	-	-	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	0.8	-	-	2.5
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	0.9	9.6	2.9	5.6	24.1	-	0.8	11.5	2.5
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	0.9	-	-	-	-	4.0	0.8	0.9	0.8
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	1.9	1.6	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	0.9	2.9	7.9	4.3	15.2	15.6	2.7	4.2
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	6.2	1.8	-	3.8	1.6	5.2	6.4	-	0.9	0.8
Arthropoda	Megaloptera	Corydalidae	Chauliodes	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	1.8	-	-	-	-	-	0.8	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	0.9	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	1.8	2.5
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	-	-	-	-	4.2
Arthropoda	Plecoptera	Nemouridae	na	I	15.9	-	-	-	0.8	0.9	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	23.9	7.1	8.8	-	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	1.8	-	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.9	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	0.9	-	-	-	1.7
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	4.4	1.8	14.0	2.9	6.3	4.3	8.8	11.5	8.8	1.7
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	0.9	0.9	0.9	1.0	0.8	0.9	-	0.8	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	6.2	8.8	13.2	11.5	10.3	10.3	4.8	12.3	7.1	9.2
Arthropoda	Trichoptera	Hydroptilidae	Hydroptila	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	8.8	2.7	2.6	16.3	4.0	6.0	12.0	-	2.7	11.8
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	0.9	-	-	0.8	-	-	-	-	20.2
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	0.9	-	0.8	-	-
Arthropoda	Trichoptera	Psychomyiidae	Psychomyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	0.9	1.0	2.4	0.9	-	0.8	-	0.8
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	0.9	1.0	1.6	4.3	-	-	2.7	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	-	-	0.9	-	-	-	-
Nematoda	na	na	na		-	-	-	-	-	-	-	0.8	0.9	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	0.8	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	0.9	0.8	0.8	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to the Patuxent River (RKGR-119-S)

Site RKGR-119-S is located on an unnamed tributary to the Patuxent River in the Eastern Piedmont region of Maryland. It is in the Rocky Gorge Dam watershed in Howard County. This site was sampled in 1997 and from 2000 to 2020.

Unnamed tributary to the Patuxent River in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	55.80	55.80	55.01	55.01	54.94	55.87	56.06
Urban	10.55	10.55	10.55	10.55	11.14	11.14	11.14
Agriculture	33.22	32.86	33.39	32.53	31.25	31.41	31.61
Other	0.43	0.79	1.05	1.91	2.67	1.58	1.19

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to the Patuxent River (1997, 2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	**R = 0.447, p = 0.042**	7.69	7.49	6.81	7.88	7.56	7.73	7.71	7.87	7.89	7.69	7.74	7.785	7.70
Specific Conductance (µS/cm)	**R = 0.831, p = < 0.001**	132.7	147.3	181.9	187.4	150.0	173.8	143.5	184.9	181.7	202.4	221.4	196.5	176.3
Acid Neutralizing Capacity (µeq/L)	**R = 0.551, p = 0.010**	796.7	867.3	1005.0	1095.0	877.9	855.3	768.7	998.5	971.7	1088.3	1310.1	997.3	922.8
Dissolved Organic Carbon (mg/L)	R = 0.041, p = 0.861	1.500	1.600	1.100	1.400	1.300	1.000	1.195	1.035	0.756	0.913	1.122	1.105	1.913
Chloride (mg/L)	**R = 0.981, p = < 0.001**		11.18	12.80	13.07	12.99	13.92	11.93	15.93	15.72	17.96	18.47	18.41	19.41
Sulfate (mg/L)	R = -0.268, p = 0.240	7.17	7.59	5.92	5.78	7.68	6.47	7.36	5.54	5.48	6.07	5.27	5.91	6.92
Total Nitrogen (mg/L)	**R = 0.672, p = 0.001**		1.455	1.913	1.644	1.495	2.034	1.629	1.995	2.017	2.057	1.995	2.018	2.137
Nitrate-Nitrogen (mg/L)	**R = 0.735, p < 0.001**	1.3600	1.2050	1.6480	1.5990	1.4560	1.8880	1.7032	1.7973	1.9216	2.0407	1.9610	1.8876	1.8350
Nitrite-Nitrogen (mg/L)	R = 0.358, p = 0.122		0*	0.0017*	0.0033	0.0025	0.0030	0.0029	0.0037	0.0026	0.0020	0.0039	0.0021	0.0035
Ammonia-Nitrogen (mg/L)	R = 0.348, p = 0.133		0.0002*	0.0046*	0.0071	0.0070	0.0054	0.0059	0.0067	0.0045	0.0091	0.0089	0.0039	0.0107
Total Phosphorus (mg/L)	R = -0.144, p = 0.544		0.0100	0.0120	0.0100	0.0130	0.0110	0.0196	0.0093	0.0078*	0.0041	0.0078*	0.0124	0.0148
Ortho-phosphate (mg/L)	R = -0.105, p = 0.660		0.0051	0.0032*	0.0044	0.0029	0.0036	0.0054	0.0058	0.0020	0.0050	0.0047	0.0011*	0.0061
Bromide (mg/L)	R = 0.748, p = 0.053													
Magnesium (mg/L)	R = 0.743, p = 0.090											4.046		
Calcium (mg/L)	R = 0.401, p = 0.431											27.985		
Copper (µg/L)	R = -0.733, p = 0.097													
Zinc (µg/L)	R = -0.754, p = 0.083													

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.94	7.86	7.71	7.93	7.78	7.87	7.93	7.63	Not sampled due to COVID-19 Pandemic
Specific Conductance (µS/cm)	198.5	189.4	197.1	210.1	216.5	230.5	249.7	219.0	
Acid Neutralizing Capacity (µeq/L)	1156.5	1040.9	928.2	1071.6	1038.4	1112.7	1210.1	1058.7	
Dissolved Organic Carbon (mg/L)	0.960	0.789	1.391	1.646	1.035	1.369	1.084	1.752	
Chloride (mg/L)	20.75	21.07	21.44	22.92	24.02	25.41	26.81	25.06	
Sulfate (mg/L)	5.56	6.14	6.40	6.21	6.40	6.03	5.86	7.06	
Total Nitrogen (mg/L)	2.144	2.046	1.831	1.893	2.121	2.022	2.226	2.114	
Nitrate-Nitrogen (mg/L)	2.0525	2.0066	1.7329	1.6862	2.0004	1.9375	2.1930	1.9573	
Nitrite-Nitrogen (mg/L)	0.0019	0.0038	0.0021	0.0037	0.0015*	0.0027	0.0022*	0.0057	
Ammonia-Nitrogen (mg/L)	0.0043	0.0063	0.0073	0.0162	0.0046	0.0081	0.0039	0.0084*	
Total Phosphorus (mg/L)	0.0093	0.0087	0.0116	0.0122	0.0114	0.0096	0.0085	0.0102*	
Ortho-phosphate (mg/L)	0.0014	0.0029	0.0058	0.0053	0.0047	0.0031*	0.0031*	0.0032*	
Bromide (mg/L)		0.0223	0.0236	0.0203	0.0274	0.0247	0.0253	0.0308	
Magnesium (mg/L)			3.896	4.223	4.312	4.672	4.848	4.386	
Calcium (mg/L)			20.140	23.250	25.00	28.320	28.160	21.600	
Copper (µg/L)			1.109	0.443	0.204	0.257	0.251	0.262	
Zinc (µg/L)			2.017	1.484	0.428	0.384	0.300*	0.757	

Physical Habitat

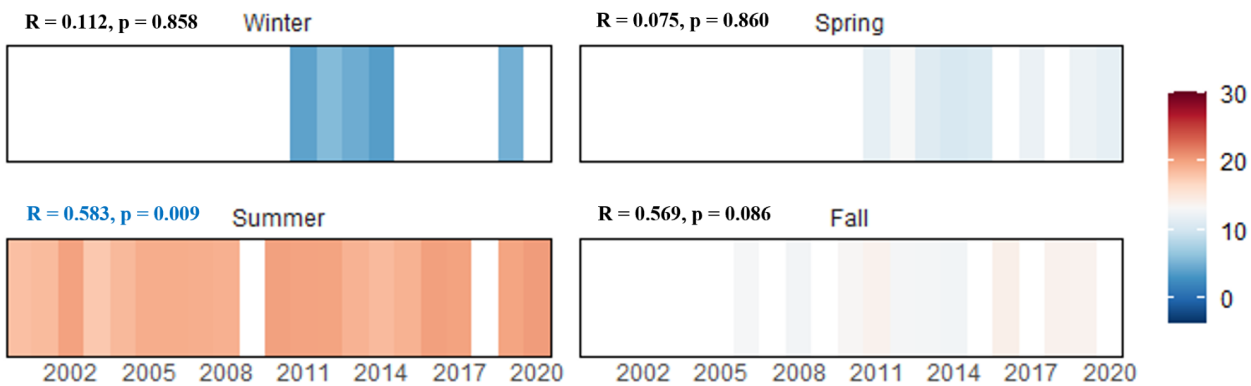
Physical habitat measurements collected at the unnamed tributary to the Patuxent River (1997, 2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.618, p = 0.002**	14	16	16	16	18	18	16	15	17	15	13	16	17	13	15	14	11	11	15	15	12	10
Epifaunal substrate (0-20)	**R = -0.703, p < 0.001**	16	17	17	16	18	19	13	16	17	16	15	17	16	15	12	15	12	13	14	15	12	8
Velocity/Depth Diversity (0-20)	R = -0.371, p = 0.089	14	14	14	13	14	14	14	12	14	11	13	12	14	11	14	11	16	8	13	12	12	13
Pool Quality (0-20)	R = -0.041, p = 0.857	12	12	11	13	14	14	15	14	13	13	13	12	16	16	16	13	11	11	14	12	13	11
Riffle Quality (0-20)	**R = -0.552, p = 0.008**	14	16	14	12	16	14	15	16	15	14	12	14	13	11	13	14	11	12	13	12	14	12
Shading (%)	**R = -0.666, p = 0.001**	90	90	95	95	93	95	96	95	95	90	90	80	95	90	70	75	90	90	85	80	70	75
Embeddedness (%)	**R = 0.454, p = 0.034**	30	35	25	18	10	15	35	35	35	20	20	30	25	15	55	35	45	35	50	40	35	30
Discharge (cfs)	R = 0.270, p = 0.225	0.62	1.35	0.97	0.17	1.58	0.85	0.54	0.62	0.23	0.44	0.65	1.06	0.55	0.6	0.8	0.8	0.65	0.22	0.63	1.59	3.27	1.03
Stream Area (m2)	**R = 0.532, p = 0.011**	232.5	219.4	228.8	165.0	249.4	232.5	206.3	151.9	142.5	247.5	215.6	234.4	163.1	215.6	271.9	316.9	313.1	247.5	363.8	247.5	426.0	226.9

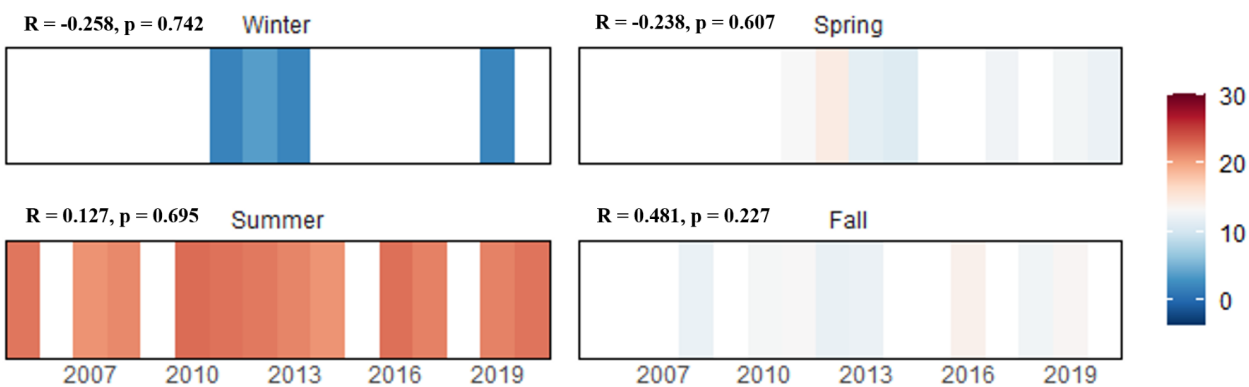
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at the unnamed tributary to the Patuxent River (only calculated for summers missing no less than 2 weeks of data).

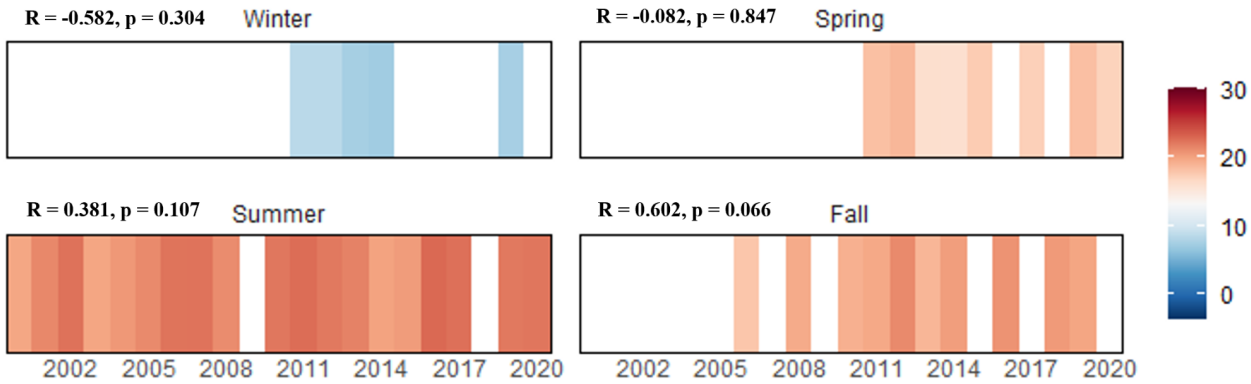
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.535, p = 0.018**	8.8	20.2	52.7	4.5	19.8	39.5	40.8	36.5	29.8	-	56.1	48.1	56.0	24.8	11.2	24.7	54.6	54.0	-	52.4	64.7
% above 24°C	R = 0.299, p = 0.213	0	0	0.05	0	0	0	0.6	0.3	0	-	0.2	0.4	0.3	0	0	0	0.6	0.5	-	0.3	0



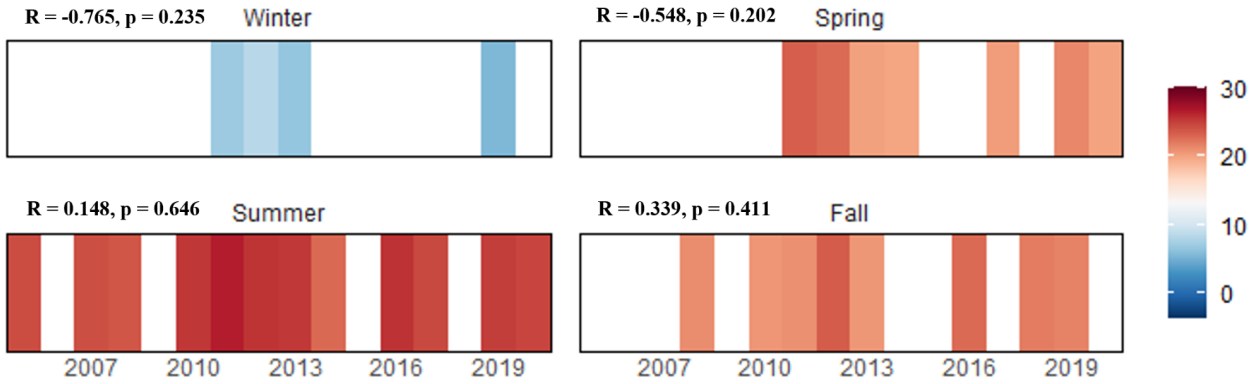
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to the Patuxent River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to the Patuxent River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to the Patuxent River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to the Patuxent River (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.111, p = 0.623	4.33	4.33	5.00	4.00	4.33	4.67	4.67	4.00	3.67	5.00	4.33	4.67	5.00	5.00	4.00	4.00	4.67	4.33	5.00	4.33	4.33	4.67
# Taxa	R = 0.273, p = 0.219	22	16	27	26	25	31	28	27	22	26	21	32	32	25	18	25	26	19	28	30	32	28
# Ephemeroptera Taxa	R = -0.029, p = 0.897	3	4	4	1	2	3	3	3	1	4	2	3	5	4	2	1	3	3	5	3	2	2
# EPT	R = 0.104, p = 0.646	13	9	14	8	8	14	12	12	9	12	11	11	17	12	9	10	12	11	12	12	13	11
% Chironomidae	R = 0.279, p = 0.209	9.1	3.6	10.4	22.9	5.5	16.5	11.7	34.1	20.9	10.2	11.6	18.6	17.1	15.6	6.3	15.0	10.3	2.4	20.2	22.4	26.5	21.8
% Clingers	R = -0.033, p = 0.884	85.2	92.7	87.5	78.1	89.0	79.1	83.5	66.7	78.2	86.7	86.6	75.2	81.3	85.2	93.7	93.3	92.1	96.0	77.5	78.4	75.5	80.9
% Intolerant Urban Taxa	**R = -0.545, p = 0.009**	76.1	90.9	81.3	73.3	84.3	67.0	77.7	57.1	70.9	82.8	82.1	72.6	64.2	61.7	86.5	59.2	73.0	85.6	65.9	45.6	57.1	51.8

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.321, p = 0.145	3.67	4.00	4.67	4.33	3.67	4.00	4.67	4.67	4.33	3.33	4.00	4.00	4.33	4.33	4.67	3.67	3.33	3.33	3.33	3.67	4.00	4.00
Abundance per m2	**R = -0.524, p = 0.012**	0.34	1.18	1.63	3.07	1.24	1.14	1.32	1.27	0.94	1.01	1.08	0.82	1.39	0.84	1.27	0.56	0.65	0.71	0.38	0.46	0.47	0.5
Biomass per m2	R = -0.411, p = 0.058	2.54	5.97	7.66	8.56	4.08	5.4	4.06	4.75	4.73	3.26	3.71	3.4	7.85	5.55	6.48	2.65	3.15	3.74	2.16	2.87	3.36	3.6
# Benthic Sp. (Adjusted)	R = 0.101, p = 0.654	1.7	1.7	1.7	0.85	0.85	0.85	1.7	1.7	1.7	1.7	1.7	0.85	1.7	1.7	1.7	0.85	1.7	1.7	0.85	1.7	1.7	1.7
% Generalists/ Omnivores/ Invertivores	R = 0.052, p = 0.819	68.0	56.6	24.3	54.0	71.6	54.1	28.7	20.2	50.0	56.2	37.8	33.3	54.2	36.8	23.2	49.4	68.3	50.6	37.4	57.0	55.5	68.1
% Tolerant	R = 0.196, p = 0.382	28.2	43.8	20.3	46.4	57.7	41.7	21.3	10.9	35.1	54.6	33.9	29.2	47.6	36.3	37.7	47.8	63.4	58.5	52.5	41.2	30.5	22.1

Metric	*Pearson's Correlation Coefficients*	*1997*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Lithophilic Spawners	R = -0.045, p = 0.842	42.3	58.9	79.1	63.0	44.8	55.3	84.9	86.0	63.4	46.6	67.8	71.9	62.6	67.0	64.4	65.7	54.0	51.7	41.7	52.6	64.0	71.7

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to the Patuxent River by sampling year.

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-
Blacknose Dace	T	41	162	105	35	39	101	57	39	69	87	73	43	67	152	96	111	53	75	67	98	41	34
Bluegill	T	2	-	5	4	6	4	77	43	8	34	13	22	44	103	27	21	3	-	15	27	4	5
Brown Trout	M	45	94	111	81	24	57	131	134	86	55	48	60	16	36	40	59	56	92	55	36	82	95
Creek Chub	T	20	26	23	9	13	32	21	5	12	29	29	27	20	64	52	41	21	16	59	75	12	8
Cutlip Minnow	M	8	13	7	6	11	27	18	7	10	1	27	34	8	18	10	13	4	11	23	17	20	13
Golden Shiner	T	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Green Sunfish	T	3	16	9	2	8	108	162	63	58	26	6	11	40	55	23	14	5	5	4	6	33	24
Largemouth Bass	T	-	-	7	4	-	1	4	-	3	2	6	-	-	9	6	1	2	-	-	9	2	3
Lepomis Hybrid	M	-	-	-	-	-	-	-	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Longnose Dace	M	23	128	109	62	34	81	52	17	57	36	31	23	16	57	65	69	48	52	57	76	36	18
Northern Hogsucker	I	-	-	-	-	-	-	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-
Pumpkinseed	T	-	-	-	-	-	-	-	4	5	-	-	-	-	-	-	-	-	-	1	-	-	2
Redbreast Sunfish	M	-	-	-	-	-	-	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-
Rock Bass	M	-	5	-	1	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Species	*Tolerance*	*1996*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Rosyside Dace	M	11	15	11	9	10	4	5	-	1	-	1	-	-	1	-	-	-	-	-	-	1	-
Smallmouth Bass	M	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tessellated Darter	T	2	20	17	7	13	12	8	6	7	19	32	1	8	15	29	33	16	20	36	27	5	7
White Sucker	T	30	49	29	33	23	39	30	37	50	14	46	39	42	44	72	40	14	22	47	60	50	21
Sunfish (Unknown)	M	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to the Patuxent River by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D
Faxonius Virilis	D	D	D	D	D	D	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to the Patuxent River by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna collected in or near the unnamed tributary to the Patuxent River.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Cope's gray tree frog, Eastern American toad, Fowler's toad, Gray tree frog, Northern green frog, Pickerel frog, Southern leopard frog, Wood frog

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Northern red salamander, Northern two-lined salamander, Northern dusky salamander, Spotted salamander
Testudines (Turtles)	Eastern box turtle, Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to the Patuxent River by sampling year, RA = %Relative Abundance.

					1997	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	-	-	-	1.0	2.4	-	-	-	-	-	0.9	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	1.6	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	1.1	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	1.6	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	-	-	-	-	1.9	2.4	1.8	1.6	-	0.9
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	0.7	-	-	1.1	-	-	-	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cardiocladius	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	0.9	1.4	7.6	-	-	1.0	-	-	-	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	5.7	-	0.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	1.0	0.8	1.1	1.9	0.8	0.9	-	-	0.9
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	1.8	-	1.0	0.8	2.2	-	-	-	0.8	-	1.8
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	1.0	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	0.7	2.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	1.9	-	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	0.7	1.0	0.8	-	-	8.7	9.1	0.8	4.5	3.5
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	2.3	-	2.1	2.9	0.8	3.3	1.0	13.5	1.8	1.6	1.8	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	1.1	-	-	4.5	0.8	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	1.9	-	-	-	6.3	-	-	-	2.7
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	0.8	1.1	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	0.7	-	-	3.3	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	0.8	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Synorthocladius	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	0.8	-	2.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	1.1	-	-	-	-	-	-	-	1.8	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	0.9	-	1.0	-	1.1	-	2.4	-	3.1	-	1.8
Arthropoda	Diptera	Chironomidae	Thienemannimyia	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	1.1	1.0	-	-	1.6	-	5.3
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	1.1	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	3.5	1.0	-	1.1	1.0	1.6	-	0.8	2.7	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Empididae	Chelifera	T	2.3	-	-	-	0.8	1.1	1.0	0.8	-	-	-	0.9
Arthropoda	Diptera	Empididae	Clinocera	T	1.1	0.9	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	0.9	-	0.9	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	2.3	7.3	34.0	21.9	41.7	27.5	1.0	4.0	1.8	10.9	31.3	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	1.6	-	-	-	2.7	0.8	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	2.3	3.6	-	-	0.8	-	2.9	2.4	1.8	1.6	-	1.8
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-	1.8	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	1.0	0.8	1.1	1.0	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	1.6	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	1.1	1.0	3.2	-	1.6	-	0.9

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	0.8	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Tipula	M	1.1	-	1.4	-	-	2.2	-	-	0.9	-	-	0.9
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	3.4	2.7	0.7	-	-	-	-	-	-	1.6	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	2.3	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	1.8	0.7	-	-	2.2	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	52.3	59.1	31.3	28.6	26.0	15.4	50.5	36.5	31.8	38.3	-	6.2
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	-	-	40.2	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	0.8	-	0.9
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	2.7	3.5	-	-	-	-	0.8	-	0.8	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	0.8	-	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	0.8	1.1	2.9	1.6	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	0.8	2.2	2.9	0.8	0.9	-	-	0.9
Arthropoda	Odonata	Gomphidae	na	I	-	0.9	0.7	1.0	-	-	1.9	-	-	0.8	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	0.9	-	-	-

					1997	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	1.1	-	-	-	-	-	-	-	4.5	-	-	8.0
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	1.1	1.0	-	-	0.8	0.9	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	6.8	12.7	3.5	11.4	4.7	2.2	7.8	1.6	20.9	14.1	1.8	33.6
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	1.4	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	2.3	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	1.1	-	-	-	-	3.3	1.0	1.6	-	0.8	0.9	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	1.4	-	-	-	-	-	-	3.1	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	2.3	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.8	-	1.0	-	3.3	2.9	0.8	3.6	6.3	-	0.9
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	2.3	-	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-	0.9	0.9
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	-	-	-	-	-	0.8	-	0.8	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	2.3	0.9	4.2	1.0	1.6	3.3	1.0	0.8	-	-	1.8	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.1	0.9	0.7	-	0.8	2.2	-	0.8	0.9	-	0.9	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	0.7	1.0	-	5.5	1.0	0.8	0.9	-	0.9	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	2.3	-	-	-	-	2.2	-	-	-	0.8	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	0.7	1.9	-	2.2	-	-	-	-	-	9.7
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	1.8	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	1.1	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	2.9	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	0.7	-	-	-	-	-	-	-	1.8	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	0.7	3.8	0.8	-	1.0	0.8	1.8	-	-	0.9

PHYLUM	ORDER	FAMILY	TAXON	TOL	1997 RA	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	1.1	0.9	2.1	1.9	7.1	2.2	1.0	0.8	-	0.8	2.7	2.7
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	-	-	-	-	0.9
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	1.0	0.8	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	0.8	-	-	-	0.9	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Naididae	na	T	-	0.8	-	-	-	-	3.1	-	0.7	0.9
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	1.6	-	-	-	0.8	1.6	0.8	1.4	2.7
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.6	-	2.7	0.8	3.2	-	4.7	3.2	4.1	4.5
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	-	0.8	-	-	0.8	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cardiocladius	T	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	0.7	0.9

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	1.6	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	1.6	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	-	-	1.6	-	-	-	10.9	0.9
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Dicrotendipes	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.8	-	1.8	-	3.2	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	0.8	0.9	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	2.3	-	-	-	-	1.6	5.6	2.7	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	7.0	2.7	0.8	-	0.8	9.3	0.8	2.0	1.8
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	8.1	-	-	1.7	0.8	0.8	-	5.6	2.0	5.5
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratendipes	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	1.6	-	3.3	0.8	0.8	1.6	1.6	1.4	8.2
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	0.7	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.6	-	0.9	1.7	1.6	-	-	2.4	4.1	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	0.8	-	-	-	-	-	1.6	0.8	-	-
Arthropoda	Diptera	Chironomidae	Synorthocladius	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	0.8	-	-	-	-	0.7	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	0.8	-	3.3	-	-	2.3	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	1.6	-	-	-	-	-	-	1.6	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	0.8	-	-	1.6	-	2.3	0.8	-	0.9
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	1.6	-	0.9
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	1.6	-	-	-	-	-	-	1.6	2.0	-
Arthropoda	Diptera	Empididae	na	T	-	1.6	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	-	-	-	-	-	0.8	1.4	1.8
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	0.8	-	-	-	0.7	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	16.3	3.1	27.9	10.8	11.1	36.0	7.0	9.6	-	-
Arthropoda	Diptera	Simuliidae	na	M	0.8	1.6	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	14.1	0.9	17.5	5.6	-	0.8	0.8	3.4	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	0.8	1.6	-	1.6	-	0.7	0.9

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	0.8	-	0.9
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	0.8	-	0.8	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	3.3	0.8	-	-	-	0.8	1.6	0.8	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Anafroptilum	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	18.8	31.5	20.8	42.1	36.0	28.7	12.8	10.2	6.4
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	14.6	10.2	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	0.8	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	0.8	0.8	1.8	-	1.6	1.6	1.6	3.2	1.4	1.8
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Lepidoptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.8	3.9	-	-	0.8	-	0.8	-	1.4	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	1.6	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	0.8	-	-	-	0.7	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	0.8	-	-	0.8	-	-	0.8	4.8	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	0.8	4.0	-	1.6	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	1.6	15.6	11.7	11.7	3.2	-	7.0	0.8	27.9	29.1
Arthropoda	Plecoptera	Nemouridae	na	I	4.9	-	0.9	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	8.1	-	2.7	-	-	5.6	-	2.4	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	0.8	0.9	-	-	1.6	2.3	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	3.3	-	-	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	2.3	-	-	-	0.8	-	-	1.4	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	0.9	-	-	-	1.6	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	5.0	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	1.6	-	-	2.4	-	-
Arthropoda	Trichoptera	Glossosomatidae	na	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	3.3	-	1.8	0.8	4.8	0.8	3.9	20.0	2.0	5.5
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	0.8	0.8	-	0.8	1.6	-	-	2.4	0.7	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	0.8	2.3	-	5.0	3.2	3.2	-	3.2	2.0	10.0
Arthropoda	Trichoptera	Limnephilidae	na	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	0.9	-	-	0.8	1.6	1.6	2.0	0.9
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	3.1	-	-	-	-	-	-	2.0	3.6
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	4.2	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.8	-	-	-	0.8	-	-	-	0.7	0.9
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	0.8	-	-	-	0.8	-	-	-	0.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	12.2	-	7.2	3.3	0.8	6.4	7.0	8.8	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	0.9

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Principio Creek (FURN-101-S)

Site FURN-101-S is located on an unnamed tributary to Principio Creek in the Eastern Piedmont region of Maryland. It is in the Furnace Bay watershed in Cecil County. This site was sampled from 2000 to 2020.

Unnamed tributary to Principio Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	77.98	77.61	75.88	75.29	73.05	69.02	60.74
Urban	5.55	5.55	6.67	6.67	6.82	6.82	6.82
Agriculture	9.33	9.33	9.33	9.33	9.33	9.27	9.27
Other	7.13	7.50	8.12	8.71	10.79	14.88	23.16

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Principio Creek (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.430, p = 0.058	6.66	6.78	6.91	6.65	6.79	6.69	6.88	6.73	6.91	6.78	6.76	6.85
Specific Conductance (µS/cm)	**R = 0.445, p = 0.050**	53.4	93.1	75.0	70.0	70.6	58.6	67.1	66.8	79.2	78.6	74.2	70.7
Acid Neutralizing Capacity (µeq/L)	**R = 0.573, p = 0.008**	120.8	133.0	162.8	107.4	145.8	102.0	141.6	135.2	156.8	200.8	138.7	137.8
Dissolved Organic Carbon (mg/L)	R = -0.091, p = 0.702	2.200	3.100	2.500	3.300	2.300	2.594	1.408	2.302	1.722	1.569	0.424	2.405
Chloride (mg/L)	**R = 0.455, p = 0.044**	7.02	16.84	10.13	12.96	10.00	7.83	10.19	10.52	13.72	12.38	11.51	11.19
Sulfate (mg/L)	R = -0.358, p = 0.121	4.06	4.88	4.62	5.61	3.52	5.18	3.68	4.03	3.96	3.08	4.32	3.93
Total Nitrogen (mg/L)	**R = 0.501, p = 0.025**	0.654	0.767	0.722	0.611	0.808	0.744	0.879	0.671	0.845	0.758	0.976	0.792
Nitrate-Nitrogen (mg/L)	R = 0.290, p = 0.215	0.5090	0.6220	0.6560	0.5160	0.7750	0.7152	0.7912	0.5143	0.7490	0.6632	0.8241	0.6399
Nitrite-Nitrogen (mg/L)	R = -0.114, p = 0.631	0.0065	0.0022*	0.0033	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.162, p = 0.496	0.0232*	0.0032*	0.0067	0.0037	0.0038	0.0033	0.0034	0.0054	0.0037	0.0052	0.0020*	0.0042
Total Phosphorus (mg/L)	R = 0.063, p = 0.792	0.0080	0.0080	0.0060	0.0090	0.0090	0.0051*	0.0043	0.0078*	0.0037*	0.0067*	0.0076	0.0078*
Ortho-phosphate (mg/L)	**R = 0.884, p < 0.001**	0*	0.0011*	0.0007*	0.0007*	0.0007*	0.0007*	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	R = 0.089, p = 0.849												
Magnesium (mg/L)	**R = 0.877, p = 0.022**										2.042		
Calcium (mg/L)	**R = 0.849, p = 0.033**										2.859		
Copper (µg/L)	R = -0.783, p = 0.065												
Zinc (µg/L)	R = -0.754, p = 0.084												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.90	6.97	6.88	6.67	6.98	6.84	6.86	6.84	
Specific Conductance (µS/cm)	65.0	68.1	86.8	92.3	80.0	81.7	89.3	76.4	
Acid Neutralizing Capacity (µeq/L)	158.6	199.1	140.6	135.3	183.9	184.6	173.2	170.5	
Dissolved Organic Carbon (mg/L)	1.856	2.539	1.865	3.255	2.716	1.529	2.907	2.224	
Chloride (mg/L)	10.18	9.82	15.91	17.88	13.54	14.00	16.34	12.21	
Sulfate (mg/L)	3.38	3.21	4.11	4.77	3.38	4.119	4.05	4.01	
Total Nitrogen (mg/L)	0.912	0.692	0.916	0.825	0.837	0.691	0.846	0.999	
Nitrate-Nitrogen (mg/L)	0.8336	0.5238	0.8042	0.7160	0.6000	0.5031	0.7143	0.9433	Not sampled due to COVID-19 Pandemic
Nitrite-Nitrogen (mg/L)	0.0010*	0.0011*	0.0022	0.0011*	0.0004*	0.0022*	0.0022*	0.0052*	
Ammonia-Nitrogen (mg/L)	0.0027	0.0068	0.0031	0.0058	0.0047	0.0055	0.0087	0.0084*	
Total Phosphorus (mg/L)	0.0105	0.0080*	0.0078*	0.0086	0.0065	0.0064	0.0044*	0.0102*	
Ortho-phosphate (mg/L)	0.0011*	0.0014	0.0031	0.0030*	0.0030*	0.0031*	0.0038	0.0032*	
Bromide (mg/L)		0.0142	0.0159	0.0143	0.0160	0.0093	0.0144	0.0179*	
Magnesium (mg/L)			1.866	1.965	1.907	2.015	2.015	2.042	
Calcium (mg/L)			2.613	2.718	2.685	2.767	2.974	2.852	
Copper (µg/L)			2.378	0.738	1.449	0.858	0.564	0.484	
Zinc (µg/L)			7.58	7.504	4.263	3.408	2.793	4.814	

Physical Habitat

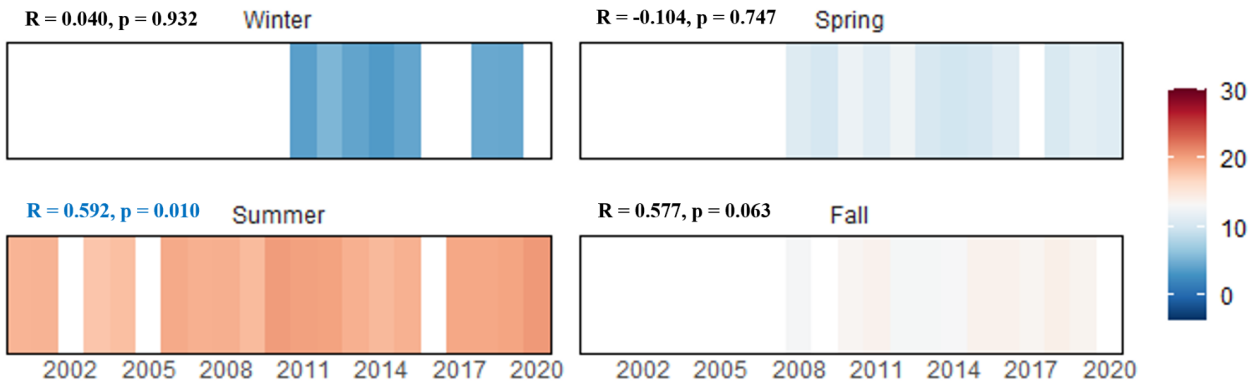
Physical habitat measurements collected at the unnamed tributary to Principio Creek (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.669, p = 0.001**	16	16	16	15	16	14	16	16	16	16	14	17	15	14	13	15	10	13	12	7	14
Epifaunal substrate (0-20)	**R = -0.610, p = 0.003**	16	16	16	16	16	14	16	17	17	17	17	15	15	16	12	14	11	14	11	9	16
Velocity/Depth Diversity (0-20)	**R = -0.496, p = 0.022**	14	13	14	13	13	12	13	12	11	13	12	12	12	13	11	13	12	13	11	11	13
Pool Quality (0-20)	**R = -0.540, p = 0.011**	14	12	15	14	14	14	10	12	12	13	12	14	11	13	12	13	11	12	11	12	11
Riffle Quality (0-20)	**R = -0.563, p = 0.008**	15	14	14	15	15	11	15	13	12	13	13	13	14	14	12	15	10	12	13	7	12
Shading (%)	**R = -0.649, p = 0.001**	92	95	96	95	90	93	90	90	95	90	85	80	80	80	60	70	97	70	75	85	80
Embeddedness (%)	**R = 0.498, p = 0.022**	10	25	10	15	5	30	35	15	15	10	20	15	25	15	50	80	60	35	50	15	25
Discharge (cfs)	R = -0.030, p = 0.897	0.84	0.47	0.12	0.77	2.28	0.38	0.81	0.4	0.93	0.91	1.51	1.04	0.57	1.93	0.9	1.19	0.22	0.54	0.36	0.7	0.80
Stream Area (m2)	R = -0.245, p = 0.284	271.9	309.4	226.9	251.3	196.9	150.0	181.9	153.8	204.4	245.6	240.0	260.6	241.9	260.6	273.8	249.4	163.1	200.6	171.0	208.5	202.5

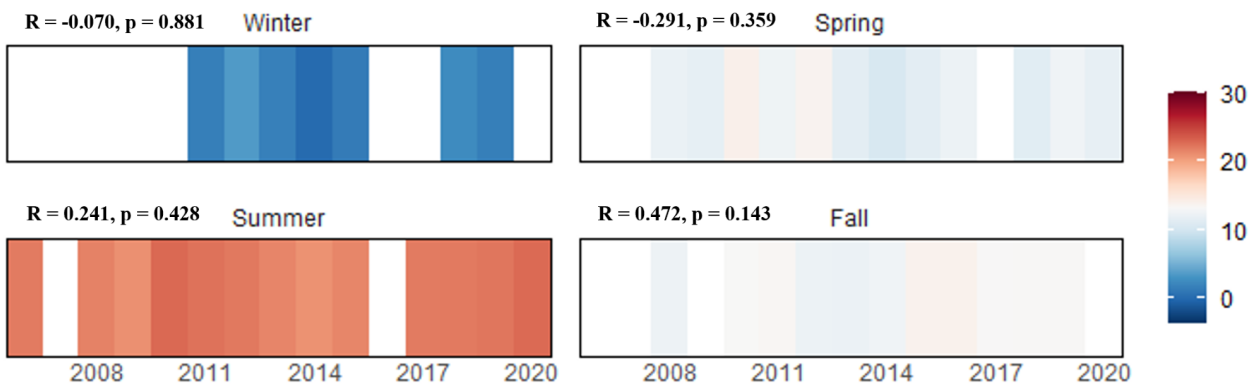
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Principio Creek (only calculated for summers missing no less than 2 weeks of data).

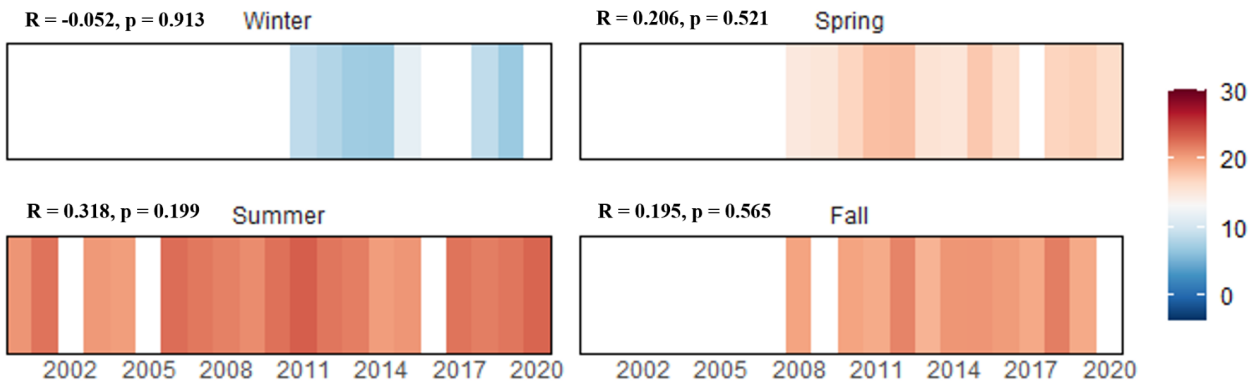
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	**R = 0.571, p = 0.013**	23.7	32.7	-	15.7	11.5	-	46.8	35.4	31.2	28.0	60.6	51.0	57.7	33.0	16.2	25.2	-	50.8	50.5	53.4	66.0
% above 24°C	R = 0.208, p = 0.409	0	0.7	-	0	0	-	0.7	0.3	0	0	0.6	2.4	0.3	0	0	0	-	0	0	0.3	2.2



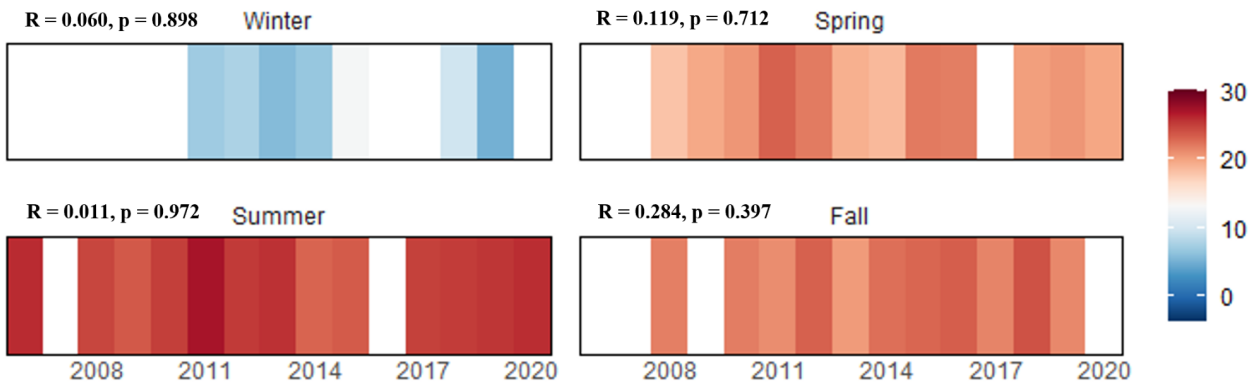
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Principio Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Principio Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Principio Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Principio Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.244, p = 0.287	5.00	4.67	5.00	4.33	4.00	5.00	3.67	4.33	4.00	4.67	5.00	4.67	4.00	4.33	4.33	5.00	5.00	5.00	5.00	5.00	4.67
# Taxa	R = 0.385, p = 0.084	29	23	28	26	16	25	14	30	15	22	32	25	20	28	21	29	28	28	34	27	34
# Ephemeroptera Taxa	R = 0.105, p = 0.649	5	6	5	4	3	5	3	3	3	5	5	4	2	2	3	4	5	6	4	6	6
# EPT	R = 0.178, p = 0.439	14	13	13	10	10	14	7	11	8	12	17	8	7	10	11	14	14	13	14	12	15
% Chironomidae	R = 0.215, p = 0.349	16.8	5.0	9.6	10.2	4.8	6.9	2.6	36.0	0.9	2.6	18.3	8.5	5.9	13.9	6.6	11.5	6.5	8.7	22.8	9.7	26.6
% Clingers	R = 0.002, p = 0.992	76.8	94.1	86.8	73.4	88.8	91.1	95.6	82.4	96.5	93.9	84.1	89.0	90.4	92.6	95.1	87.7	91.1	89.8	79.7	88.7	75.2
% Intolerant Urban Taxa	R = -0.383, p = 0.086	64.8	89.9	85.3	78.9	93.6	86.1	89.5	67.7	89.4	91.2	76.2	83.9	89.0	73.8	86.1	71.3	79.8	82.7	73.2	71.0	58.7

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.022, p = 0.925	4.00	4.00	4.67	3.33	4.00	4.00	4.33	4.67	4.00	3.67	4.67	4.33	4.67	4.00	3.67	4.00	4.00	4.00	4.33	4.33	3.67
Abundance per m2	R = -0.371, p = 0.098	1.14	1.25	1.68	0.76	2.38	3.36	2.59	1.63	0.8	0.59	1.47	1.47	1.46	0.99	0.62	1.1	0.8	1.2	1.53	1.32	0.46
Biomass per m2	R = -0.326, p = 0.149	8.34	6.11	8.81	4.58	19.44	11.96	8.58	10.33	4.19	3.77	10.07	5.51	9.29	5.75	3.28	4.53	6	5.9	11.62	7.76	1.94
# Benthic Sp. (Adjusted)	R = 0.383, p = 0.087	1.65	2.48	2.48	1.65	1.65	2.48	2.48	2.48	1.65	1.65	2.48	2.48	2.48	2.48	1.65	2.48	2.48	2.48	2.48	2.48	2.48
% Generalists/ Omnivores/ Invertivores	R = -0.178, p = 0.439	87.1	81.1	87.1	99.0	99.4	96.8	93.2	86.4	87.7	90.4	88.1	91.9	88.7	90.7	89.4	90.2	99.2	83.8	88.1	86.6	83.9
% Tolerant	**R = -0.577, p = 0.006**	43.0	42.0	35.4	45.8	47.6	67.3	37.2	38.4	43.6	40.4	42.9	41.7	36.8	28.4	23.5	24.5	28.2	33.6	38.7	37.3	26.9

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Lithophilic Spawners	R = 0.183, p = 0.427	64.7	67.4	72.7	60.5	58.4	35.9	72.0	65.2	68.7	63.0	67.3	75.8	66.9	68.1	69.4	69.3	71.0	66.0	60.9	63.8	66.7

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Principio Creek by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
American Eel	M	22	25	26	16	33	13	18	21	13	9	19	11	17	12	11	10	7	10	14	8	2
Blacknose Dace	T	83	99	71	58	159	302	106	62	36	44	88	71	85	53	31	58	13	57	75	67	14
Blue Ridge Sculpin	I	40	73	49	2	3	16	32	34	20	14	42	31	40	24	18	27	1	39	31	37	15
Common Shiner	I	-	-	-	-	4	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-
Creek Chub	T	49	60	56	29	58	26	56	32	29	15	57	67	37	16	9	8	19	20	24	31	9
Cutlip Minnow	M	3	-	-	4	7	9	5	2	3	1	13	4	4	5	4	3	7	2	1	3	-
Margined Madtom	I	4	1	3	1	-	2	2	2	-	1	3	5	10	14	10	15	15	13	12	23	14
Rosyside Dace	M	107	125	168	80	199	125	239	95	56	62	124	173	151	129	87	152	63	96	102	102	37
Tessellated Darter	T	-	1	4	-	3	6	6	2	2	-	5	6	5	3	-	1	3	2	1	2	1
White Sucker	T	1	2	4	-	3	5	7	-	4	-	1	16	3	1	-	-	2	2	1	3	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Principio Creek by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	D	N	N	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Principio Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the unnamed tributary to Principio Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Eastern American toad, Fowler's toad, Gray treefrog, Northern green frog, Pickerel frog, Southern leopard frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Northern dusky salamander, Northern red salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Northern watersnake
Testudines (Turtles)	Common snapping turtle, Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the Unnamed Tributary to Principio Creek by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	0.7	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	4.0	-	-	-	-	-	-	0.7	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	2.3	1.6	-	-	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	3.0	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	1.6	-	0.7	-	-	-	-	-	1.8	1.8	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	5.9	1.5	-	-	3.0	0.9	1.5	1.8	9.6	2.4
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	0.8	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	3.2	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	3.2	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Constempellina	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	0.9	-	-	-	1.6
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	5.6	-	0.7	-	-	-	0.9	-	-	-	4.8
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Lopescladius	M	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.8	2.9	-	-	-	-	9.6	0.9	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	14.0	-	-	0.8
Arthropoda	Diptera	Chironomidae	Nanocladius	T	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	2.0	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	0.7	3.9	-	-	0.9	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	0.7	0.8	2.4	1.0	-	0.7	-	-	0.8
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	3.0	-	-	-	0.9	0.8
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	2.4	-	-	-	-	-	-	2.9	-	-	0.8
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	0.8	0.7	-	-	-	-	5.1	-	-	0.8
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.8	-	1.5	2.3	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	0.8	-	1.5	1.6	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	0.9	3.2
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	2.4	1.0	-	0.7	-	-	2.4
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	0.8	-	-	-	-	-	0.7	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	0.8	-	-	-	-	-	-	-	-	1.6
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	3.2	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	4.0	31.1	18.4	25.0	25.6	9.9	70.2	8.8	73.5	9.6	39.7
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	0.8	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	5.6	-	0.7	3.1	-	1.0	-	1.5	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	1.0	0.9	-	-	0.9	0.8
Arthropoda	Diptera	Tipulidae	Antocha	T	0.8	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.8	0.8	0.7	2.3	1.6	1.0	-	-	0.9	0.9	0.8
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	0.7	-	2.4	-	1.8	-	0.9	2.6	1.6
Arthropoda	Diptera	Tipulidae	Tipula	M	-	0.8	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	7.8	0.8	-	-	-	-	-	0.8
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	2.0	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	2.2	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	35.2	34.5	29.4	9.4	13.6	27.7	7.0	16.9	-	39.5	7.9
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	-	2.7	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	0.8	4.2	0.7	-	-	-	0.9	-	0.9	3.5	0.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	0.8	1.7	5.1	0.8	9.6	7.9	5.3	1.5	3.5	12.3	4.0
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	0.8	0.7	-	-	-	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	0.8

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.8	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	0.8	4.4	0.8	-	2.0	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	6.6	-	-	-	-	-	-	0.9	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	3.0	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	1.6	-	2.2	-	-	-	-	1.5	0.9	0.9	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	1.6
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	0.8	1.0	-	0.7	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	9.6	0.8	-	10.2	26.4	7.9	0.9	17.6	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	0.7	8.6	-	-	-	-	-	0.9	6.3
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	2.4	0.8	2.9	7.0	1.6	7.9	-	2.2	-	4.4	1.6
Arthropoda	Plecoptera	Nemouridae	na	I	-	2.5	1.5	2.3	-	-	-	-	-	1.8	3.2
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	2.9	-	-	-	6.1	-	7.1	-	2.4
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	0.8	1.0	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	0.8	-	-	1.6	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	1.7	0.7	-	-	-	-	-	2.7	-	0.8
Arthropoda	Plecoptera	Perlodidae	Cultus	I	-	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	4.0	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Perlodidae	na	I	-	4.2	2.2	1.6	8.0	5.0	1.8	-	0.9	1.8	-
Arthropoda	Trichoptera	Brachycentridae	na	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	0.8	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	0.8	-	-	-	-	-	-	0.9	-	0.8
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	0.8	-	1.0	-	-	-	-	0.8
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	0.8	-	-	-	-	2.0	-	1.5	-	-	2.4
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	2.4	-	-	-	0.8	-	-	1.5	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	1.0	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.8	-	-	-	-	-	-	2.9	0.9	1.8	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	0.7	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	2.9	-	-	2.0	-	-	-	1.8	0.8
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	0.8	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	0.8	-	-	0.8	-	-	-	-	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	1.0	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	0.8	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	0.8	-	-	-	1.6	-	-	-	-	0.9
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	0.8	-	-	0.9
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	3.2	-	-	-	-
Annelida	Tubificida	Tubificidae	na	T	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Macronychus	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	1.7	-	-	0.8	-	-	1.6	0.8	2.4	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	0.8	1.5	1.6	1.6	-	4.0	12.6	-	4.8	1.8
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	2.5	-	0.8	-	0.8	4.0	-	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	0.8	-	-	-	0.8	-	-	2.8
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Constempellina	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	4.1	0.8	3.7
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	0.8	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.7	-	-	0.8	-	0.8	0.8	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Lopescladius	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	-	-	-	-	-	0.8	1.8

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	1.6	0.8	-	-	-	-	4.6
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Natarsia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nilotanypus	M	-	-	-	-	-	0.8	-	-	-	2.8
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	0.8	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	0.7	0.8	1.6	1.6	-	2.4	0.8	-	0.9
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	0.8	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	-	-	-	0.8	0.8	1.6	2.4	0.8	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Phaenopsectra	T	-	-	-	0.8	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.8	-	1.6	-	-	0.8	0.8	2.4	-	1.8
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	0.8	-	1.6	-	-	1.6	0.8	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	0.8	-	-	-	-	0.8	-	0.8	3.2	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	0.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	0.8	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.8	-	6.6	0.8	4.1	0.8	1.6	0.8	0.8	2.8
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	2.5	0.7	-	-	-	0.8	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.8	0.7	0.8	1.6	-	-	0.8	2.4	0.8	3.7
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	0.8	-	0.8	-	-	0.8	-	0.9
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	1.5	-	-	-	-	-	2.4	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	53.4	53.7	9.8	39.3	32.0	5.6	5.5	17.1	12.9	-
Arthropoda	Diptera	Simuliidae	na	M	-	-	0.8	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	0.8	0.7	6.6	-	-	6.5	1.6	-	16.1	8.3
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	1.6	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	1.7	1.5	-	1.6	-	-	0.8	4.1	4.0	0.9
Arthropoda	Diptera	Tipulidae	Erioptera	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.7	0.7	1.6	-	3.3	1.6	-	0.8	1.6	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	0.8	-	-	0.9
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.8	-	-	-	-	-	-	-	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	0.8	0.8	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	0.8	-	-	-	0.8	-	0.8	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	15.4	26.2	21.3	-	33.9	40.2	21.1	13.7	11.0
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	12.7	-	-	-	4.1	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	0.8	-	-	-	-	-	-	-	-	1.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	-	0.7	-	12.3	5.7	7.3	2.4	8.1	1.6	0.9
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	1.6	-	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	0.8	2.4	0.8	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	2.5	-	-	4.9	4.9	-	-	-	0.8	1.8

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	0.8	-	0.8	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	0.8	-	0.8	0.8	0.8	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	0.7	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	1.5	-	-	-	1.6	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	-	-	-	1.6	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.5	12.3	-	-	2.4	0.8	7.3	12.1	6.4
Arthropoda	Plecoptera	Leuctridae	na	I	-	8.1	-	-	2.5	-	-	-	-	9.2
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	2.9	6.6	-	-	12.1	10.2	4.1	9.7	5.5
Arthropoda	Plecoptera	Nemouridae	na	I	2.5	-	-	-	7.4	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	0.8	3.7	-	4.9	11.5	-	-	1.6	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	1.6	-	1.6	0.8	-	-	0.8	0.9
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	0.8	0.8	2.5	-	-	2.4	-	0.9
Arthropoda	Plecoptera	Perlodidae	Cultus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	0.8	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.8	-	0.8	0.8	-	0.8	0.8	0.8	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	0.8	0.7	-	-	2.5	-	0.8	-	-	0.9
Arthropoda	Trichoptera	Brachycentridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	0.8	-	-	-	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	0.8	0.8	-	0.8	-	0.8	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	0.8	-	-	-	-	-	0.9

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	-	-	0.8	0.8	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	3.3	-	0.8	0.8	-	-	-	-
Arthropoda	Trichoptera	Leptoceridae	Triaenodes	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	3.3	-	-	2.4	-	0.8	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	8.3
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	0.8	-	3.3	-	-	-	-	0.8	4.8	2.8
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	3.4	-	-	0.8	-	0.8	4.7	3.3	-	0.9
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	-	-	-	-	-	-	-
Mollusca	Veneroida	Pisidiidae	na	M	-	-	-	-	-	-	0.8	-	-	-
Nematomorpha	Gordioidea	Gordiidae	na	M	-	0.7	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Timber Run (LIBE-102-S)

Site LIBE-102-S is located on Timber Run in the Eastern Piedmont region of Maryland. It is in the Liberty Reservoir watershed in Baltimore County. This site was sampled from 2000 to 2020.

Timber Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	79.88	77.94	77.94	77.94	77.94	77.63	77.86
Urban	7.49	7.49	7.49	7.49	7.49	7.49	7.49
Agriculture	12.51	12.51	12.51	12.51	12.51	12.51	12.51
Other	0.11	2.05	2.05	2.05	2.05	2.36	2.13

Water Chemistry

Water chemistry measurements collected at Timber Run (2000 to 2020).

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.069, p = 0.766	6.97	7.14	7.01	6.55	7.03	7.11	7.13	7.02	7.00	7.01	7.06	7.01
Specific Conductance (µS/cm)	**R = 0.965, p < 0.001**	90.2	98.0	102.6	110.0	97.1	94.9	113.2	111.5	120.7	123.9	126.0	128.7
Acid Neutralizing Capacity (µeq/L)	**R = 0.571, p = 0.007**	242.0	221.6	276.7	191.6	206.9	229.3	234.8	244.9	266.6	284.4	231.7	283.7
Dissolved Organic Carbon (mg/L)	R = -0.127, p = 0.585	0.900	1.100	1.200	2.400	0.700	0.626	0.747	0.663	0.621	0.605	0.739	2.754
Chloride (mg/L)	**R = 0.971, p < 0.001**	12.98	13.74	13.54	19.02	14.26	14.00	18.53	18.07	19.50	20.21	21.02	23.69
Sulfate (mg/L)	R = 0.043, p = 0.853	4.83	4.27	4.27	6.24	4.8	5.56	4.60	5.14	4.86	4.56	5.49	7.80
Total Nitrogen (mg/L)	**R = 0.750, p < 0.001**	1.338	1.466	1.270	1.384	1.250	1.204	1.512	1.503	1.383	1.536	1.523	1.290
Nitrate-Nitrogen (mg/L)	**R = 0.809, p < 0.001**	1.1260	1.270	1.2100	1.2650	1.1870	1.2820	1.4010	1.4471	1.3085	1.4459	1.3998	1.1088
Nitrite-Nitrogen (mg/L)	**R = 0.641, p = 0.002**	0.0013*	0.0013*	0.0020	0.0020	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.248, = 0.279	0.0176*	0.0028*	0.0068	0.0121	0.0064	0.0063	0.0065	0.0043	0.0045	0.0054	0.0044	0.0098
Total Phosphorus (mg/L)	R = -0.314, = 0.165	0.0150	0.0070	0.0100	0.0320	0.0140	0.0077	0.0076	0.0083	0.0037*	0.0090	0.0115	0.0098
Ortho-phosphate (mg/L)	R = 0.237, p = 0.301	0.0019*	0.0007*	0.0057	0.0007*	0.0035	0.0044	0.0044	0.0050	0.0017	0.0040	0.0041	0.0011*
Bromide (mg/L)	R = 0.144, p = 0.734												
Magnesium (mg/L)	R = 0.660, p = 0.107										4.699		
Calcium (mg/L)	R = 0.592, p = 0.161										6.717		
Copper (µg/L)	R = -0.065, p = 0.890												
Zinc (µg/L)	R = -0.027, p = 0.954												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.05	7.04	6.99	7.13	6.85	7.02	6.92	6.90	7.18
Specific Conductance (µS/cm)	134.6	145.9	156.7	165.0	168.2	176.6	185.8	168.1	198.3
Acid Neutralizing Capacity (µeq/L)	253.6	260.2	262.3	275.1	275.4	284.4	281.6	237.7	273.8
Dissolved Organic Carbon (mg/L)	0.694	0.240	0.941	0.775	0.819	1.205	1.076	0.848	0.827
Chloride (mg/L)	24.84	26.31	30.13	31.60	33.66	33.67	35.70	36.59	40.43
Sulfate (mg/L)	4.76	4.79	5.32	5.09	5.06	4.90	4.73	4.92	4.82
Total Nitrogen (mg/L)	1.616	1.836	1.676	1.743	1.641	1.636	1.818	1.468	1.910
Nitrate-Nitrogen (mg/L)	1.5352	1.7591	1.6151	1.7155	1.6373	1.5877	1.7922	1.4656	1.7346
Nitrite-Nitrogen (mg/L)	0.0031	0.0021	0.0016	0.0013	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0037	0.0035	0.0035	0.0037	0.0039	0.0111	0.0037	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0111	0.0088	0.0081	0.0100	0.0055	0.0082	0.0086	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0036	0.0025	0.0045	0.0042	0.0054	0.0031*	0.0035	0.0032*	0.0036
Bromide (mg/L)		0.0228	0.0220	0.0252	0.0293	0.0287	0.0221	0.0189	0.0292
Magnesium (mg/L)			4.905	5.396	5.676	5.855	6.427	5.233	6.410
Calcium (mg/L)			7.594	8.208	8.299	9.984	8.850	7.940	10.130
Copper (µg/L)			0.232	0.173	0.172	1.301	0.207	0.141	0.122
Zinc (µg/L)			1.924	3.848	2.051	5.533	0.936	3.025	2.669

Physical Habitat

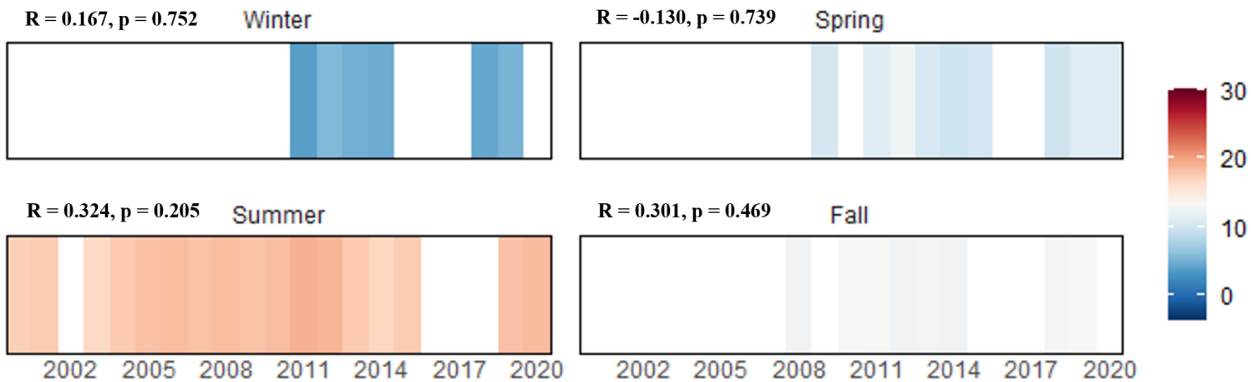
Physical habitat measurements collected at Timber Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.648, p = 0.001**	18	17	16	17	16	16	16	14	17	16	17	16	15	16	16	16	17	15	14	11	10
Epifaunal substrate (0-20)	**R = -0.437, p = 0.048**	18	17	17	16	15	14	16	16	16	17	16	15	16	14	17	17	18	16	15	11	13
Velocity/Depth Diversity (0-20)	R = 0.031, p = 0.893	12	15	10	10	12	10	12	12	12	11	10	11	12	12	11	14	14	14	12	11	9
Pool Quality (0-20)	R = -0.242, p = 0.290	15	16	10	10	13	10	13	11	12	13	11	11	14	13	16	12	12	11	12	11	9
Riffle Quality (0-20)	R = -0.216, p = 0.347	15	13	14	15	14	15	14	12	16	14	15	8	14	16	14	16	15	14	14	11	11
Shading (%)	**R = -0.782, p < 0.001**	95	88	95	96	95	95	95	95	95	90	80	90	80	80	85	85	80	90	70	75	80
Embeddedness (%)	R = 0.287, p = 0.207	12	25	35	20	30	40	40	30	35	20	30	30	35	25	30	40	25	20	65	35	25
Discharge (cfs)	R = 0.337, p = 0.135	0.63	0.52	0.34	1.93	0.79	1.62	0.49	0.84	0.74	0.48	1.12	0.51	0.89	0.97	2.26	0.99	1.99	0.64	1.22	1.31	1.20
Stream Area (m2)	**R = 0.472, p = 0.031**	170.6	191.3	153.8	213.8	208.1	189.4	142.5	187.5	178.1	166.9	195.0	198.8	210.0	189.4	227.4	183.8	223.1	191.3	202.5	210.0	206.3

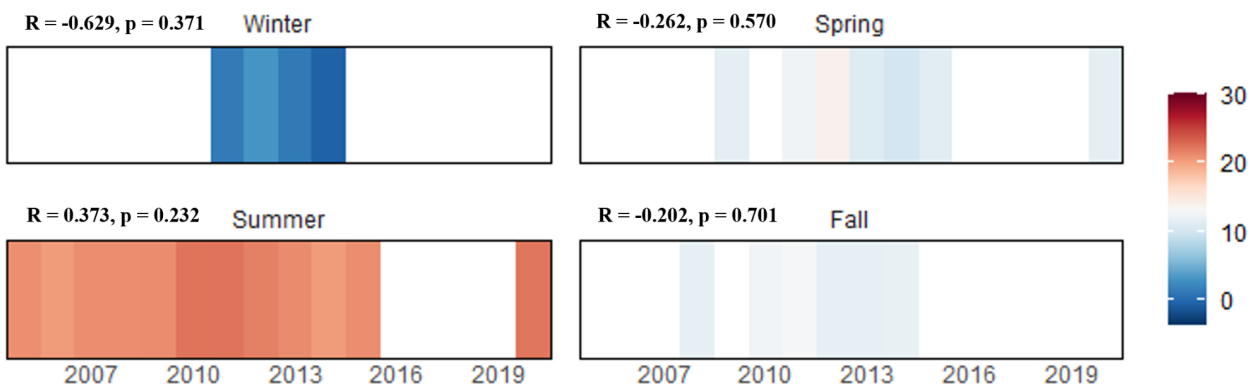
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Timber Run (only calculated for summers missing no less than 2 weeks of data).

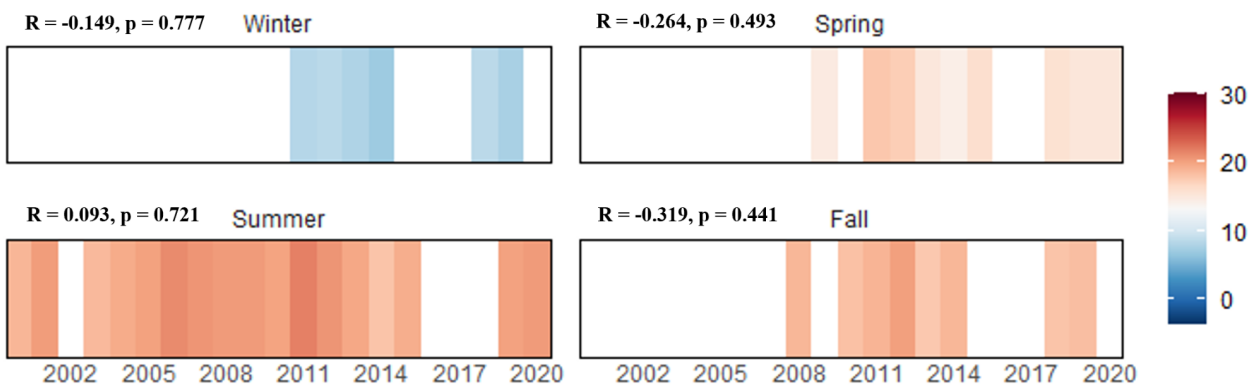
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.303, p = 0.236	0.5	5.5	-	0.1	4.5	11.3	17.2	11.9	14.8	12.3	9.8	31.7	27.4	1.9	0.1	3.7	-	-	-	11.5	19.3
% above 24°C	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0	0	0	-	-	-	0	0



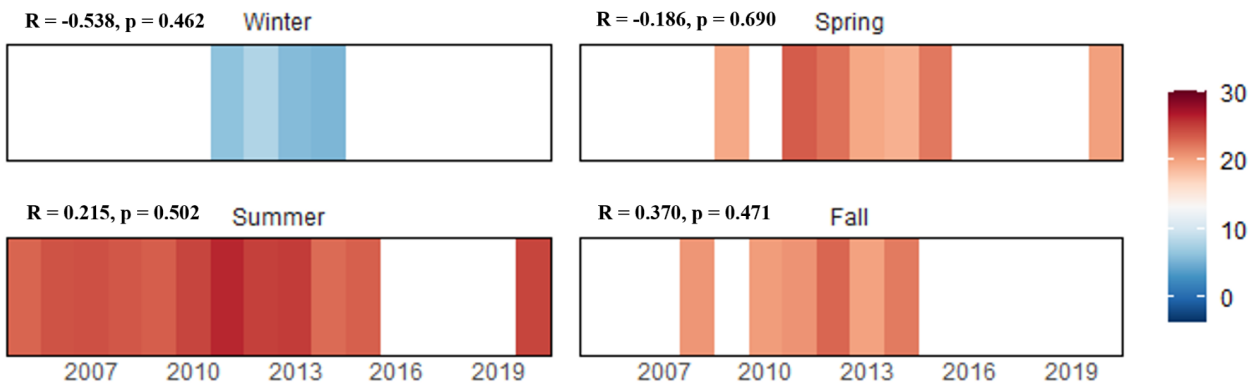
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Timber Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Timber Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Timber Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Timber Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.063, p = 0.788	4.67	5.00	4.33	4.00	4.67	4.33	4.00	4.67	5.00	5.00	4.33	4.33	3.67	4.67	4.00	5.00	4.33	5.00	4.00	4.00	5.00
# Taxa	**R = 0.438, p = 0.047**	24	27	30	34	30	21	21	28	27	35	34	26	31	37	21	36	37	30	26	36	38
# Ephemeroptera Taxa	R = -0.085, p = 0.714	5	6	4	4	3	3	3	4	4	4	3	2	3	2	2	5	5	5	3	5	4
# EPT	R = 0.388, p = 0.082	13	11	11	10	16	12	8	10	11	16	14	10	11	13	8	15	15	16	12	14	17
% Chironomidae	R = 0.252, p = 0.271	4.0	12.2	42.7	24.4	12.6	8.0	13.4	14.9	10.2	17.2	18.3	17.8	35.5	15.1	14.9	17.6	24.8	11.1	32.8	41.6	10.6
% Clingers	R = -0.177, p = 0.442	94.4	84.0	55.6	66.4	83.2	88.4	85.7	79.2	83.9	78.9	71.2	84.1	62.0	79.0	90.1	83.2	71.5	74.1	74.1	59.2	85.4
% Intolerant Urban Taxa	**R = -0.456, p = 0.038**	74.6	68.7	64.1	55.5	61.5	86.6	77.7	79.2	81.4	77.3	70.2	76.6	44.6	59.7	73.6	62.6	56.9	67.4	37.4	39.4	67.6

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.429, p = 0.052	5.00	4.67	5.00	3.67	4.67	5.00	4.67	4.33	4.33	4.00	4.67	4.33	4.67	4.67	4.33	4.67	4.33	4.67	4.00	3.33	4.33
Abundance per m2	R = -0.371, p = 0.097	2.37	2.49	1.97	0.53	1.53	1.47	2.17	1.23	1.44	2.15	1.37	1.5	1.96	2.84	1.74	1.32	1.08	1.61	1.23	0.72	1.14
Biomass per m2	**R = -0.548, p = 0.010**	10.67	8.55	21.36	2.88	7.16	9.45	7.02	4.19	3.35	5.23	5.07	3.98	6.03	6.76	3.75	5.14	4.09	4.39	4.36	3.82	4.12
# Benthic Sp. (Adjusted)	R = 0.369, p = 0.099	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
% Generalists/ Omnivores/ Invertivores	R = -0.043, p = 0.853	55.6	47.6	46.5	54.9	50.8	47.3	45.6	50.9	54.7	64.3	57.5	44.6	27.9	57.4	57.8	58.0	38.8	53.8	57.8	58.3	35.3
% Tolerant	R = -0.270, p = 0.237	42.7	37.7	35.0	45.1	41.7	39.8	38.8	41.3	44.9	51.7	44.8	37.3	21.1	35.6	27.5	31.7	22.5	41.4	45.8	47.0	29.4
% Lithophilic Spawners	R = -0.015, p = 0.948	70.4	73.2	74.6	69.0	77.4	74.2	69.3	66.5	63.3	56.7	62.7	67.8	84.0	72.4	79.0	71.2	80.8	67.1	65.5	58.3	79.6

Fish

Cumulative list of fish species (with abundance) collected in Timber Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	120	128	77	35	72	72	95	77	94	155	100	96	66	148	83	70	46	101	86	63	48
Blue Ridge Sculpin	I	180	250	162	51	157	147	168	113	116	128	114	165	297	229	167	102	147	142	105	63	152
Brook Trout	I	18	2	17	3	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek Chub	T	53	52	29	16	61	39	25	18	21	30	20	15	21	43	26	7	8	26	28	8	21
River Chub	I	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosyside Dace	M	34	45	18	8	29	21	19	22	25	45	34	22	28	117	120	64	39	38	30	17	14

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Timber Run by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	D	N	D	D	N	N	N	N	D
Faxonius Virilis	N	D	D	D	N	D	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Timber Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Timber Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	Cope's gray treefrog, Eastern American toad, Fowler's toad, Northern green frog, Northern spring peeper, Pickerel frog, Southern leopard frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Northern dusky salamander, Northern red salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Eastern garter snake, Northern ring-necked snake
Testudines (Turtles)	Eastern box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Timber Run by sampling year, RA = %Relative Abundance.

PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA 2000*	*RA 2001*	*RA 2002*	*RA 2003*	*RA 2004*	*RA 2005*	*RA 2006*	*RA 2007*	*RA 2008*	*RA 2009*	*RA 2010*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.8	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	0.8	-	0.9	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	0.8	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	1.8	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	1.5	4.3	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	0.8	1.5	0.9	0.8	-	-	7.1	2.0	6.8	2.3	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.6	-	3.4	-	-	3.6	2.7	-	0.8	0.8	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	-	0.9	0.8	0.7	2.7	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	RA 2000	RA 2001	RA 2002	RA 2003	RA 2004	RA 2005	RA 2006	RA 2007	RA 2008	RA 2009	RA 2010
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	0.8	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Apsectrotanypus	M	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	0.8	-	-	-	-	-	-	-	-	1.9
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	1.6	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	0.8	0.7	-	-	1.0	0.8	1.6	1.9
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	2.3	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	2.3	-	2.5	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	1.7	-	-	5.4	2.0	2.5	3.1	4.8
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	0.8	-	-	0.9	3.0	0.8	0.8	1.0
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	1.5	18.8	-	-	2.7	0.9	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	0.9	0.8	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.8	-	0.9	-	0.7	-	1.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	1.5	2.6	0.8	-	-	0.9	3.0	0.8	1.6	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	1.7	4.2	2.8	-	-	1.0	-	-	4.8
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	0.8	-	0.9	-	-	-	2.3	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	RA 2000	RA 2001	RA 2002	RA 2003	RA 2004	RA 2005	RA 2006	RA 2007	RA 2008	RA 2009	RA 2010
Arthropoda	Diptera	Chironomidae	Platysmittia	M	-	-	1.7	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	1.7	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	2.8	3.6	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	0.8	1.0
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	0.8	-	10.9	-	-	-	1.0	2.5	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	1.4	-	-	-	-	2.3	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	8.5	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	2.6	0.8	-	-	2.7	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	0.8	2.6	-	1.4	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	0.7	0.9	-	1.0	0.8	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	0.8	-	-	2.1	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	0.8	1.9
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	0.8	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	1.5	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	0.7	-	-	-	-	-	1.9
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Sciomyzidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	3.2	48.9	1.7	23.5	35.7	13.4	24.1	41.6	11.0	10.9	39.4
Arthropoda	Diptera	Simuliidae	Simulium	M	14.3	-	1.7	-	-	-	-	1.0	0.8	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	RA 2000	RA 2001	RA 2002	RA 2003	RA 2004	RA 2005	RA 2006	RA 2007	RA 2008	RA 2009	RA 2010
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	1.7	1.4	0.9	-	-	-	-	1.9
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	2.3	1.7	0.8	1.4	3.6	0.9	3.0	4.2	3.9	1.9
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	1.8	-	0.8	0.8	1.9
Arthropoda	Diptera	Tipulidae	Limonia	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	-	-	-	-	-	-	-	-	-	1.9
Arthropoda	Diptera	Tipulidae	Tipula	M	0.8	-	-	2.5	1.4	-	0.9	2.0	0.8	0.8	1.0
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	2.4	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	1.7	-	-	-	-	1.0	-	-	1.0
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	7.7	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	35.7	5.3	12.8	11.8	6.3	41.1	35.7	6.9	29.7	27.3	1.0
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	11.9	11.0	3.9	2.9
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	2.4	0.8	13.7	-	-	2.7	5.4	-	6.8	2.3	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	0.8	1.5	-	-	-	-	1.8	2.0	2.5	1.6	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	0.8	-	0.9	-	-	0.9	-	2.0	-	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	1.7	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.8	0.8	-	5.0	4.9	0.9	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	RA 2000	RA 2001	RA 2002	RA 2003	RA 2004	RA 2005	RA 2006	RA 2007	RA 2008	RA 2009	RA 2010
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	1.5	-	-	-	-	-	-	-	0.8	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	0.8	-	-	-	-	-	0.8	1.9
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	0.8	-	1.7	0.7	-	-	1.0	2.5	0.8	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	0.8	-	-	-	1.0	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	-	-	2.9
Arthropoda	Plecoptera	Leuctridae	na	I	4.8	-	0.9	-	2.8	6.3	-	-	-	2.3	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	13.5	-	1.7	-	2.8	7.1	-	-	1.7	10.9	1.9
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	2.5	2.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	13.7	-	5.0	-	-	0.9	-	-	0.8	1.0
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	0.7	-	-	-	0.8	-	1.0
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	0.7	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	0.7	-	-	-	-	-	1.0
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	1.4	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	3.2	-	-	-	2.8	0.9	-	-	-	0.8	1.9
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	na	na	M	-	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	0.9	-	1.0	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	RA 2000	RA 2001	RA 2002	RA 2003	RA 2004	RA 2005	RA 2006	RA 2007	RA 2008	RA 2009	RA 2010
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.8	-	-	-	2.8	0.9	-	2.0	0.8	0.8	3.8
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.6	-	-	2.5	0.7	1.8	-	-	0.8	0.8	1.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	2.8	2.7	-	2.0	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	0.9	-	-	0.9	-	1.0	-	-	1.9
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	0.8	-	-	2.1	-	-	-	-	0.8	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	4.0	-	-	-	-	-	0.9	-	-	-	1.0
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	0.9	0.8	-	-	-	1.0	-	0.8	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	0.8	0.7	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	-	0.9	1.7	-	-	0.9	-	0.8	0.8	1.0
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	2.4	3.8	3.4	4.2	1.4	0.9	0.9	2.0	4.2	4.7	1.0
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	0.9	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	-	1.7	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	0.7	-	1.4	3.3
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Coleoptera	Dryopidae	Helichus	M	-	-	-	-	0.8	1.5	-	-	-	0.7
Arthropoda	Coleoptera	Elmidae	Ancyronyx	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	3.8	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	1.9	0.8	2.5	1.7	3.8	1.5	5.2	6.9	1.4	5.3
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.9	3.3	4.2	0.8	0.8	0.7	1.5	3.1	2.1	6.6
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Coleoptera	Hydrophilidae	Hydrobius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	0.8	0.8	-	-	-	-	-	0.7
Arthropoda	Coleoptera	Ptilodactylidae	Anchytarsus	M	-	1.7	4.2	-	3.1	1.5	-	1.5	1.4	2.0
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	0.8	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	0.8	0.8	-	-	-	-	-	-	1.3
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Apsectrotanypus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	0.8	3.6	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	0.9	5.0	-	-	-	-	1.5	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	2.5	-	-	0.8	-	-	-	0.7	0.7
Arthropoda	Diptera	Chironomidae	Diamesinae	T	0.9	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	5.6	0.8	3.4	3.3	0.8	-	1.5	1.5	2.8	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	1.9	-	0.8	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Hydrobaenus	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.8	-	0.8	3.8	6.6	1.5	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	1.9	-	1.7	-	-	0.7	-	1.5	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	2.5	-	0.8	0.8	-	0.7	0.8	6.3	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	6.6	-	0.8	1.5	5.1	0.7	-	6.3	2.6
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	1.9	2.5	3.4	0.8	1.5	3.6	-	6.9	7.0	0.7
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.9	1.7	1.7	-	-	0.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Platysmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	3.5	1.3
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	1.9	-	-	6.6	-	2.2	-	10.7	2.1	2.0
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	0.8	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	0.8	-	-	-	-	1.5	-	0.7	0.7
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	0.8	1.7	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	1.5	-	-	1.5	-	2.0
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.9	9.9	-	-	-	0.7	-	-	7.0	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.9	-	-	1.7	0.8	1.5	1.5	6.1	0.7	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	1.7	0.8	-	1.5	-	0.7	3.8	3.5	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Hemerodromia	T	-	-	0.8	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	2.2	-	-	0.7	-
Arthropoda	Diptera	Sciomyzidae	na	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	36.4	5.0	12.6	28.1	8.4	1.5	-	1.5	0.7	1.3
Arthropoda	Diptera	Simuliidae	Simulium	M	-	5.8	-	-	-	0.7	-	-	4.9	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.9	0.8	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tabanidae	Chrysops	I	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	1.7	-	0.8	0.7	-	0.8	1.4	1.3
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	0.8	-	-	1.5	0.7	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.9	-	-	0.8	-	0.7	0.7	-	-	-
Arthropoda	Diptera	Tipulidae	Limonia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Ormosia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	0.8	0.8	0.8	1.5	-	0.8	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	0.7	0.7	-	2.1	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	0.7	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	4.6	3.6	-	-	2.8	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	0.7	1.5	-	0.7	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	15.9	13.2	18.5	19.8	27.5	22.6	33.3	15.3	-	19.9
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	2.5	1.7	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	4.7	1.7	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	11.9	5.3	1.4	2.0
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	-	-	-	-	-	-	0.7	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	0.8	-	0.7	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Leptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	0.8	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	0.8	-	0.7	-	-	0.7	0.7
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Calopterygidae	Calopteryx	T	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Odonata	Gomphidae	na	I	-	-	1.7	-	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	-	6.0
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.9	-	2.5	-	2.3	2.9	-	0.8	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	2.2	0.8	4.2	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	0.8	-	9.6	-	-	3.3
Arthropoda	Plecoptera	Leuctridae	na	I	0.9	12.4	1.7	-	-	-	2.2	5.3	14.1	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	1.7	-	3.1	7.3	5.9	2.3	9.9	15.9

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Nemouridae	na	I	3.7	-	0.8	-	-	-	1.5	0.8	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	6.6	3.4	1.7	0.8	-	-	-	0.7	1.3
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	1.7	0.8	-	0.8	1.5	0.7	-	-	0.7
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Plecoptera	Perlidae	na	I	1.9	-	-	0.8	3.1	0.7	-	0.8	-	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	0.8	-	-	-	-	2.2	-	-	2.0
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.8	-	0.8	-	0.7	-	-	1.4	0.7
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	na	na	M	-	-	-	-	-	-	-	-	-	2.0
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	0.8	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	4.7	2.5	5.9	5.0	6.1	7.3	2.2	8.4	-	0.7
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.9	-	1.7	-	-	0.7	-	-	-	0.7
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	2.5	3.3	2.3	3.6	2.2	1.5	1.4	0.7
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	0.8	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Hydatophylax	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	0.7	-	-	1.4	-
Arthropoda	Trichoptera	Philopotamidae	na	I	0.9	-	-	-	-	-	0.7	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	0.7	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	2.5	-	1.5	-	-	-	0.7	2.0
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	3.7	0.8	5.0	19.0	7.6	5.1	0.7	4.6	0.7	4.0

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Mollusca	Basommatophora	Ancylidae	Ferrissia	T	-	-	-	-	-	-	-	-	-	0.7
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	0.7	-
Platyhelminthes	Tricladida	Dugesiidae	Girardia	T	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Appendix D
Sentinel Sites in the Highlands Region

Bear Creek (YOUG-432-S)
Buzzard Branch (UMON-119-S)
Crabtree Creek (SAVA-204-S)
Double Lick Run (SAVA-276-S)
Unnamed Tributary to Edgemont Reservoir (ANTI-101-S)
Fifteenmile Creek (FIMI-207-S)
High Run (UMON-288-S)
Mill Run (PRLN-626-S)
Savage River (SAVA-225-S)

Bear Creek (YOUG-432-S)

Site YOUG-432-S is located on Bear Creek in the Highlands region of Maryland. It is in the Youghiogheny River watershed in Garrett County. This site was sampled from 2000 to 2020. Summer sampling was not performed in 2005 and 2006 due to contamination concerns at the Bear Creek Hatchery and starting in 2007, this site was relocated slightly upstream on the same reach to avoid potentially contaminated sediments.

Bear Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	66.08	66.66	65.99	65.28	65.76	66.23	66.24
Urban	4.04	4.04	4.04	4.04	4.14	4.14	4.36
Agriculture	24.76	24.19	24.20	24.14	24.17	24.19	24.03
Other	5.12	5.11	5.76	6.53	5.93	5.44	5.38

Water Chemistry

Water chemistry measurements collected at Bear Creek (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	**R = 0.560, p = 0.007**	7.01	6.47	7.11	7.10	7.24	7.14	7.28	7.25	7.37	7.23	7.41	7.20
Specific Conductance (µS/cm)	R = -0.221, p = 0.322	54.1	56.6	58.4	50.0	51.4	50.3	55.7	50.9	51.8	54.1	50.2	55.1
Acid Neutralizing Capacity (µeq/L)	**R = 0.603, p = 0.003**	105.1	116.4	100.0	122.3	146.1	148.6	156.2	148.6	156.4	151.5	208.6	160.1
Dissolved Organic Carbon (mg/L)	R = -0.013, p = 0.954	2.300	1.000	1.400	0.800	1.400	1.735	0.922	1.308	1.295	0.755	1.536	2.038
Chloride (mg/L)	R = -0.141, p = 0.530	1.96	2.28	2.53	2.06	1.60	1.71	2.05	1.81	1.77	1.56	1.46	1.91
Sulfate (mg/L)	R = -0.311, p = 0.159	9.77	8.59	9.60	8.37	8.30	8.34	9.34	9.14	8.90	9.49	8.06	9.29
Total Nitrogen (mg/L)	R = -0.396, p = 0.068	1.192	1.145	1.285	0.818	0.690	0.684	0.863	0.808	0.967	0.715	0.480	0.852
Nitrate-Nitrogen (mg/L)	R = -0.240, p = 0.281	0.7880	1.0230	1.2340	0.7380	0.6000	0.6653	0.6839	0.5954	0.5388	0.6279	0.3618	0.5962
Nitrite-Nitrogen (mg/L)	**R = 0.628, p = 0.002**	0*	0.0013*	0.0008	0.0004*	0.0014	0.0030	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = 0.393, p = 0.071	0	0.0038*	0.0055	0.0025*	0.0053	0.0054	0.0033	0.0042	0.0058	0.0035	0.0044	0.0040
Total Phosphorus (mg/L)	R = -0.189, p = 0.398	0.0090	0.0110	0.0160	0.0100	0.0130	0.0129	0.0142	0.0120	0.0043	0.0169	0.0097	0.0108
Ortho-phosphate (mg/L)	**R = 0.717, p < 0.001**	0*	0.0007*	0.0007*	0.0007*	0.0037	0.0007*	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	**R = 0.749, p = 0.020**												
Magnesium (mg/L)	R = 0.396, p = 0.379										1.2188		
Calcium (mg/L)	R = 0.727, p = 0.064										5.7221		
Copper (µg/L)	R = -0.709, p = 0.075												
Zinc (µg/L)	R = -0.103, p = 0.826												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.31	7.28	7.17	7.27	7.39	7.38	7.23	7.22	7.30
Specific Conductance (µS/cm)	49.2	47.5	46.9	55.2	55.1	53.4	50.7	54.0	53.1
Acid Neutralizing Capacity (µeq/L)	164.5	166.5	101.9	166.4	167.1	195.3	161.0	182.7	151.8
Dissolved Organic Carbon (mg/L)	1.163	1.070	1.073	1.030	1.166	2.140	1.328	1.698	1.202
Chloride (mg/L)	1.58	1.76	1.87	2.263	2.07	1.65	1.93	2.19	1.90
Sulfate (mg/L)	9.40	8.97	9.19	9.13	8.97	8.38	8.35	7.72	8.59
Total Nitrogen (mg/L)	0.776	0.627	0.774	0.771	0.831	0.693	0.767	0.866	1.014
Nitrate-Nitrogen (mg/L)	0.6520	0.4717	0.6822	0.6768	0.7103	0.5167	0.7190	0.8538	0.9226
Nitrite-Nitrogen (mg/L)	0.0010*	0.0011*	0.0014	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0036	0.0037	0.0043	0.0027	0.0033	0.0049	0.0028	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0182	0.0091	0.0089	0.0070	0.0108	0.0112	0.0119	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0020	0.0012	0.0042	0.0033	0.0030*	0.0038	0.0031*	0.0065	0.0032*
Bromide (mg/L)		0.0057	0.0077	0.0065	0.0080	0.0075	0.0057	0.0179*	0.0179*
Magnesium (mg/L)		1.174	1.090	1.135	1.168	1.179	1.162	1.106	1.171
Calcium (mg/L)		5.565	4.607	5.627	5.616	5.653	5.549	6.007	5.759
Copper (µg/L)			0.780	0.355	0.162	0.299	0.176	0.258	0.174
Zinc (µg/L)			5.040	2.880	1.732	2.115	2.087	2.535	4.575

Physical Habitat

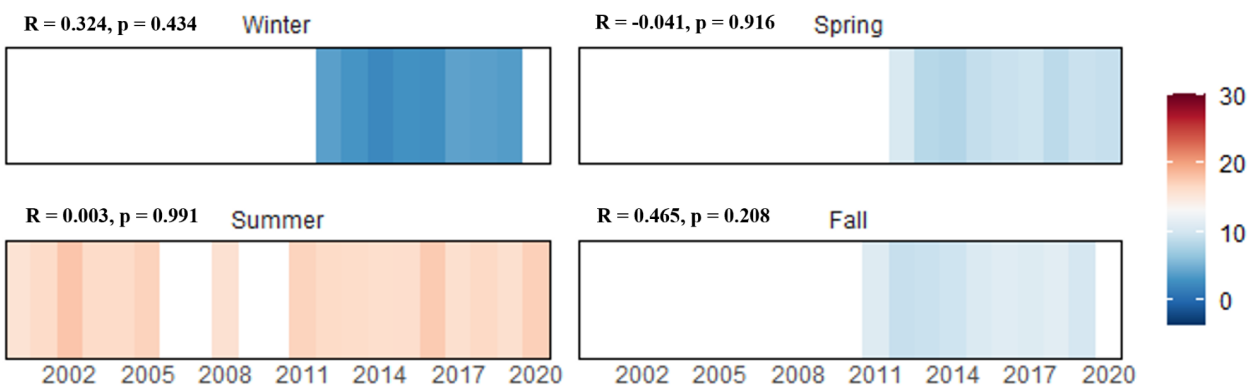
Physical habitat measurements collected at Bear Creek (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale. The site was not sampled in the summer of 2005 or 2006.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.042, p = 0.866	18	18	18	16	16			17	17	17	17	19	15	19	18	17	16	17	17	18	17
Epifaunal substrate (0-20)	**R = 0.610, p = 0.006**	18	17	15	14	14			17	19	19	18	19	16	18	19	18	18	18	19	19	19
Velocity/Depth Diversity (0-20)	R = 0.440, p = 0.059	12	17	10	9	15	Not Sampled		10	14	16	18	17	14	19	15	15	15	17	16	15	14
Pool Quality (0-20)	**R = 0.605, p = 0.006**	13	16	17	9	14			10	12	14	16	17	16	18	17	16	17	17	18	18	17
Riffle Quality (0-20)	R = 0.035, p = 0.888	18	17	17	16	11			17	17	18	19	18	17	15	18	17	16	18	16	17	15
Shading (%)	**R = -0.534, p = 0.019**	85	85	92	93	88			97	85	85	80	85	90	85	80	80	70	80	80	85	85
Embeddedness (%)	**R = -0.514, p = 0.024**	10	20	35	35	35			35	20	35	20	5	20	10	10	5	15	10	20	15	15
Discharge (cfs)	R = 0.382, p = 0.087	2.55	2.86	1.33	1.16	2			1.19	5.85	2.22	9.33	6.25	5.39	4.47	2.11	6.08	3.52	3.24	3.67	6.26	1.52
Stream Area (m2)	R = -0.417, p = 0.075	515.6	528.8	511.9	410.6	468.8			356.3	399.4	346.9	433.1	465.0	382.5	457.5	391.9	487.5	397.5	414.4	422.3	442.5	405.0

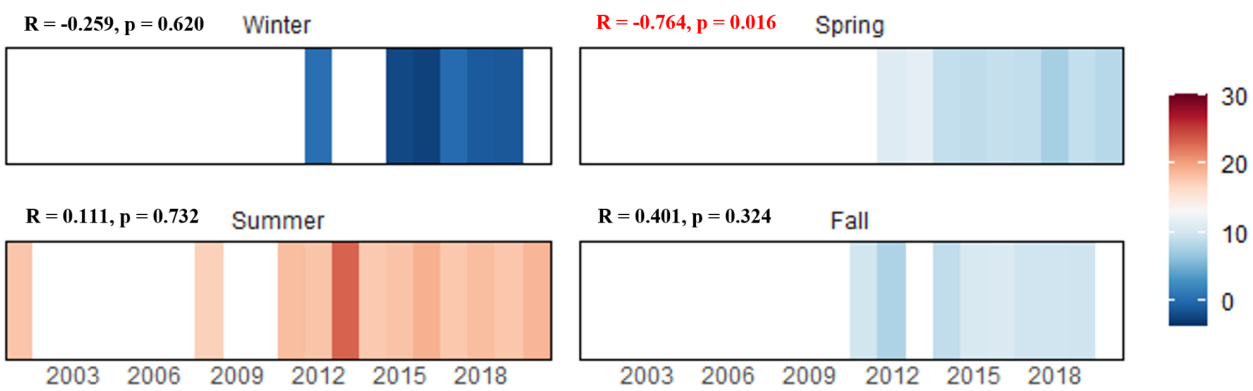
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Bear Creek (only calculated for summers missing no less than 2 weeks of data).

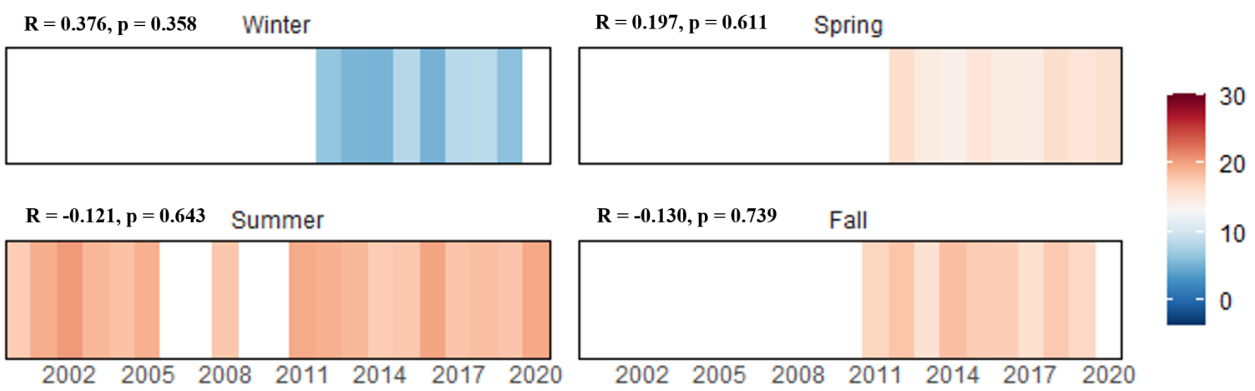
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = -0.242, p = 0.349	0	1.9	11.9	1.1	0	1.4	-	-	0	-	-	2.8	1.8	0.6	0	0	4.2	0	0	0.05	2.9
% above 24°C	-	0	0	0	0	0	0	-	-	0	-	-	0	0	0	0	0	0	0	0	0	0



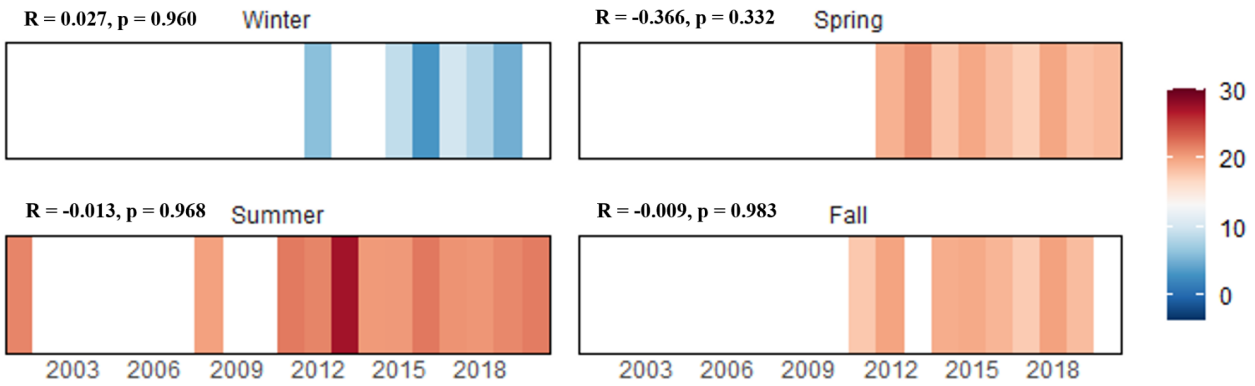
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Bear Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Bear Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Bear Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Bear Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.328, p = 0.147	4.75	4.50	4.75	4.00	4.50	3.75	4.25	4.25	4.25	4.75	4.25	4.25	4.25	4.00	3.00	4.25	4.75	4.50	4.50	4.00	3.50
# Taxa	R = -0.073, p = 0.752	31	27	28	21	24	22	27	30	33	31	24	24	33	22	16	26	26	27	32	28	23
# Ephemeroptera Taxa	R = -0.282, p = 0.216	10	7	7	8	10	5	7	9	11	7	8	7	9	8	4	7	8	6	9	7	6
# EPT	R = -0.190, p = 0.410	19	17	20	14	19	13	17	19	22	19	14	15	21	16	10	16	18	18	19	13	17
% Diptera	R = 0.348, p = 0.123	21.4	33.3	22.5	28.5	4.7	19.6	37.7	15.5	15.9	7.6	14.5	34.8	13.4	40.7	81.4	47.4	24.6	21.7	15.4	32.5	56.8
% Intolerant Urban Taxa	R = 0.092, p = 0.692	77.0	82.1	78.3	83.9	80.2	61.7	84.6	73.3	71.4	84.8	47.9	83.0	74.1	95.6	92.9	86.2	86.0	69.6	77.8	66.9	87.4
% Scrapers	R = -0.355, p = 0.115	25.4	18.0	30.8	20.0	34.0	24.3	21.5	31.0	40.5	21.0	23.1	20.5	33.9	23.9	4.4	12.1	40.4	13.0	14.5	16.3	16.2
% Swimmers	R = -0.102, p = 0.660	38.9	23.1	20.0	37.7	45.3	38.3	18.5	31.0	26.2	41.0	51.3	25.9	28.6	14.2	8.0	25.0	19.3	36.5	53.0	42.2	12.6
% Tanytarsini	R = -0.281, p = 0.217	5.6	2.6	13.3	0	0	0	0	0	0	1.9	0	0	0	1.8	2.7	0.9	1.8	1.7	3.4	1.2	0

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.392, p = 0.097	4.50	4.50	4.50	3.50	4.00	na	na	4.50	4.50	4.50	5.00	5.00	4.50	4.50	4.50	5.00	5.00	4.50	4.50	4.50	4.50
Abundance per m2	R = -0.298, p = 0.215	0.40	0.64	0.58	1.04	0.78	na	na	0.60	0.32	0.27	0.07	0.12	0.42	0.54	0.88	0.27	0.38	0.51	0.50	0.49	0.34
% Brook Trout	**R = 0.475, p = 0.040**	5.8	8.6	6.7	1.9	8.7	na	na	3.7	6.3	9.8	24.1	16.4	13.8	13.0	11.6	15.7	14.6	11.7	10.5	9.2	11.8
% Tolerant	R = -0.438, p = 0.060	2.4	8.6	4.0	31.2	26.2	na	na	1.4	1.6	3.3	10.3	9.1	3.8	1.6	6.1	0.7	4.6	5.6	1.9	1.8	1.5
% Sculpins	R = 0.144, p = 0.557	91.8	82.8	89.2	66.9	65.1	na	na	94.4	91.4	81.5	65.5	74.5	82.5	85.0	81.7	83.6	80.8	81.7	87.6	89.0	86.8

Fish

Cumulative list of fish species (with abundance) collected in Bear Creek by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	4	29	11	100	60			2	-	-	-	1	-	-	12	1	4	-	2	3	-
Brook Trout	I	12	29	20	8	32			8	8	9	7	9	22	32	40	21	22	25	22	20	16
Brown Trout	M	-	-	-	-	-			-	1	5	-	-	-	-	1	-	-	-	-	-	-
Creek Chub	T	-	-	-	10	8			-	-	-	-	1	-	-	3	-	-	3	-	-	1
Golden Shiner	T	-	-	-	-	-			-	-	-	-	-	-	-	-	-	2	-	-	-	-
Longnose Dace	M	-	-	-	-	-	Not sampled		1	-	-	-	-	-	-	-	-	-	-	-	-	-
Mottled Sculpin	I	190	279	265	287	239			203	117	75	19	41	132	210	281	112	122	174	184	194	118
Pumpkinseed	T	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	3	-	-	-
Rainbow Trout	M	-	-	-	-	-			-	-	-	-	-	-	1	1	-	-	-	-	-	-
Smallmouth Bass	M	-	-	-	-	-			-	-	-	-	-	-	-	-	-	-	2	-	-	-
White Sucker	T	1	-	1	24	28			1	2	3	3	3	6	4	6	-	1	6	2	1	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Bear Creek by sampling year

Species	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus carinirostris	D	D	D	D	D	D	D	D	D	D	D	D	D	D
Cambarus dubius	N	N	N	N	N	D	D	N	N	N	N	N	N	N

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Bear Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Bear Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Northern green frog
Caudata (Salamanders and Newts)	Allegheny mountain dusky salamander, Eastern red-backed salamander, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander, Seal salamander
Squamata (Snakes and Lizards)	Eastern garter snake, Northern watersnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Bear Creek by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Branchiobdellida	na	na		-	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	1.7	-	-	-	-	0.9	-	-	1.7
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	2.5	-	2.8	10.3	3.1	11.2	7.9	1.9	3.4
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.4	3.4	9.2	10.8	-	8.4	2.3	8.6	15.9	2.9	2.6
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	0.9	-	-	-	-	-	1.7	-	1.0	1.7
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	0.8	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	1.0	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Diptera	Athericidae	Atherix	I	-	-	-	-	-	0.9	-	-	-	1.0	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	4.0	-	-	-	1.9	-	1.5	0.9	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	1.5	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.9	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	0.9	3.3	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	2.6	1.7	0.8	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	0.8	-	2.4	1.0	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	3.2	2.6	-	3.1	-	4.7	0.8	-	2.4	-	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	1.6	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	1.6	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	5.6	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	1.7	10.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	1.9	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	1.6	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	0.9	-	-	0.8	1.0	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	0.8	-	0.9	-	2.6	-	-	0.9
Arthropoda	Diptera	Simuliidae	Prosimulium	I	3.2	21.4	5.8	20.0	0.9	9.3	30.8	8.6	-	1.0	2.6
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-	7.7
Arthropoda	Diptera	Tipulidae	Antocha	T	0.8	0.9	0.8	-	0.9	0.9	0.8	1.7	1.6	1.0	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	0.9	-	1.5	-	-	-	0.9	3.2	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.6	-	0.8	0.8	0.9	1.9	-	-	0.8	1.0	0.9
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	6.3	-	-	3.1	2.8	0.9	-	-	-	-	26.5
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	0.8	-	0.8	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	0.8	0.9	-	1.5	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	3.4	0.8	4.6	8.5	19.6	4.6	3.4	6.3	4.8	9.4
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	2.4	-	0.9
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	0.8	-	-	1.5	4.7	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	13.5	6.0	5.0	15.4	19.8	7.5	2.3	23.3	8.7	21.9	6.0
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	2.3	-	-	-	5.1
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	1.5	-	-	2.3	1.7	0.8	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	1.6	2.6	1.7	-	5.7	-	0.8	-	3.2	1.0	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	11.9	6.0	10.8	5.4	15.1	4.7	13.8	2.6	8.7	9.5	12.0
Arthropoda	Ephemeroptera	Heptageniidae	Heptagenia	I	0.8	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	2.4	0.9	1.7	1.5	-	-	-	-	2.4	-	1.7
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	0.9	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	0.8	1.0	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	-	-	-	-	-	1.5	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	0.9	-	0.8	-	-	-	0.9	-	2.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	0.9	3.3	-	0.9	-	-	2.6	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	1.7	2.5	9.2	-	2.8	7.7	3.4	8.7	-	2.6
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	15.9	11.1	10.8	3.8	13.2	7.5	1.5	-	-	14.3	0.9
Arthropoda	Plecoptera	Chloroperlidae	na	I	2.4	2.6	1.7	-	3.8	0.9	-	4.3	0.8	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	1.5	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	0.8	-	-	1.9	-	-	-	1.0	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	2.4	0.9	5.0	0.8	-	-	2.3	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	1.7	-	2.3	-	2.8	-	-	4.0	1.0	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	2.4	7.7	1.7	1.5	1.9	-	0.8	1.7	-	-	1.7
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	na	I	0.8	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	0.8	-	1.9	0.9	-	1.7	-	2.9	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	0.8	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Perlidae	Agnetina	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Paragnetina	I	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	1.9	-	0.8	0.9	-	-	-
Arthropoda	Plecoptera	Perlodidae	Cultus	I	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	4.0	1.7	1.7	0.8	-	0.9	4.6	-	4.0	7.6	1.7
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.9	0.8	2.3	1.9	1.9	2.3	1.7	-	-	2.6
Arthropoda	Plecoptera	Perlodidae	Yugus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Bolotoperla		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Trichoptera	na	na	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Brachycentridae	Micrasema	I	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	0.8	-	1.9	-	0.8	0.9	2.4	1.0	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	2.4	3.4	8.3	1.5	3.8	6.5	3.8	4.3	0.8	5.7	1.7
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	0.9	-	1.5	-	-	-	-	-	1.0	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	3.2	-	0.8	-	-	-	-	0.9	0.8	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	0.9	-	-	-	0.9	-	-	0.8	1.9	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	0.9	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	0.8	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	0.8	-	-	-	0.8	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Trichoptera	Psychomyiidae	Psychomyia	M	-	-	-	-	-	-	-	2.6	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	1.7	0.8	-	-	0.9	1.5	-	0.8	1.9	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.8	3.4	1.7	0.8	0.9	0.9	-	1.7	-	2.9	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Branchiobdellida	na	na		-	-	-	-	-	0.9	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	0.9	0.6	0.9
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	0.9	2.7	-	-	0.9	-	-	4.3	-	1.8
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	2.7	-	-	0.9	2.6	0.9	1.7	0.6	0.9
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	0.9	-	0.9	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	1.8	-	-	-	-	0.9	-	-	-
Arthropoda	Collembola	Isotomidae	Isotomurus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Athericidae	Atherix	I	0.9	0.9	-	-	1.7	-	-	0.9	0.6	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	0.9	1.8	-	-	-	0.9	-	0.9	1.2	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	0.9	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	3.6	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	1.8	-	-	-	0.9	0.6	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	1.8	1.8	-	1.8	0.9	3.4	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.9	-	-	-	-	0.9	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	0.9	0.9	-	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	1.7	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	0.9	-	-	1.7	-	-	0.9	-	2.7
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	1.8	-	-	-	0.9	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	0.9	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	4.5	0.9	-	3.5	-	-	0.9	0.9	0.6	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	19.6	4.5	35.4	72.6	37.9	20.2	14.8	4.3	23.5	53.2
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	2.6	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	0.9	-	-	-	-	-	0.6	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.9	1.8	-	-	-	0.9	1.7	0.9	1.8	0.9
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	0.9	-	1.7	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	6.1	0.9	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	0.9	-	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	11.6	-	-	6.0	5.3	10.4	9.4	24.1	2.7
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	0.9	1.8	3.5	-	-	-	-	1.7	-	1.8
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	0.9	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	3.6	8.0	2.7	-	9.5	5.3	-	34.2	15.1	2.7
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	9.8	-	-	3.5	-	-	17.4	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		1.8	0.9	-	-	-	2.6	6.1	-	-	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	2.7	4.5	-	-	0.9	1.8	1.7	-	3.0	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	15.2	16.1	19.5	0.9	7.8	30.7	7.0	4.3	10.2	11.7
Arthropoda	Ephemeroptera	Heptageniidae	Heptagenia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	0.9	-	1.2	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	0.9	-	0.9	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	0.9	-	1.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	1.8	-	-	-	-	-	-	2.4	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	0.9	-	1.7	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	-	-	-	0.9	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	1.8	7.1	7.1	3.5	8.6	6.1	2.6	6.0	2.4	5.4
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	9.8	-	0.9	-	-	1.8	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	1.8	-	-	0.9	-	1.7	1.7	-	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	2.7	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	0.9	-	-	-	0.9	-	0.9	1.7	2.4	0.9
Arthropoda	Plecoptera	Leuctridae	na	I	1.8	0.9	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	-	-	-	-	-	2.6	-	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	1.8	-	0.9	-	0.9	1.7	-	-	1.8
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	1.8	-	0.9	-	0.9	1.7	0.6	-
Arthropoda	Plecoptera	Perlidae	Agnetina	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Paragnetina	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlidae	na	I	-	-	0.9	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Cultus	I	-	-	1.8	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.9	2.7	4.4	2.7	2.6	-	0.9	4.3	1.2	0.9
Arthropoda	Plecoptera	Perlodidae	na	I	5.4	2.7	-	0.9	-	-	1.7	0.9	-	0.9
Arthropoda	Plecoptera	Perlodidae	Yugus	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Bolotoperla		-	-	-	-	-	-	-	-	1.2	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	2.7	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	na	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Brachycentridae	Micrasema	I	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	0.9	-	-	-	0.9	0.9	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	0.9	1.8	2.6	-	-	2.7
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	1.8	2.7	-	0.9	5.2	6.1	7.0	0.9	1.2	1.8
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	1.8	0.9	-	-	0.9	-	-	0.6	1.8
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	1.8	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	0.9	-	2.6	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.9	-	2.7	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	2.7	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Psychomyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	2.7	3.5	0.9	0.9	-	0.9	2.6	-	0.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	1.8	2.7	2.7	1.7	1.8	0.9	0.9	-	0.9

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Buzzard Branch (UMON-119-S)

Site UMON-119-S is located on Buzzard Branch in the Highlands region of Maryland. It is in the Upper Monocacy River watershed in Frederick County. This site was sampled from 2002 to 2020.

Buzzard Branch in the spring of 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	96.14	96.03	96.05	96.05	96.07	96.16	96.16
Urban	3.70	3.70	3.70	3.70	3.70	3.70	3.70
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.16	0.27	0.25	0.25	0.23	0.14	0.14

Water Chemistry

Water chemistry measurements collected at Buzzard Branch (2002 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
pH	R = 0.152, p = 0.535	7.46	7.25	7.39	7.52	7.37	7.40	7.51	7.30	7.48	7.48	7.37	7.47
Specific Conductance (µS/cm)	**R= 0.716, p = 0.001**	80.2	80.0	67.0	57.5	63.9	67.8	70.9	78.5	75.1	70.6	69.5	81.6
Acid Neutralizing Capacity (µeq/L)	**R = 0.714, p = 0.001**	330.3	248.9	248.8	289.4	279.6	274.6	339.0	368.9	321.2	303.3	329.2	325.6
Dissolved Organic Carbon (mg/L)	R = -0.061, p = 0.805	2.700	2.300	1.900	1.409	1.337	1.643	3.042	1.620	1.810	2.020	1.578	0.925
Chloride (mg/L)	**R = 0.763, p < 0.001**	6.14	9.91	5.79	5.22	6.51	7.17	4.44	7.44	7.23	7.06	5.55	11.09
Sulfate (mg/L)	**R = -0.498, p = 0.030**	8.35	7.12	4.75	3.65	4.41	4.49	6.74	5.05	5.51	5.32	6.01	5.15
Total Nitrogen (mg/L)	**R = 0.536, p = 0.018**	0.276	0.467	0.501	0.299	0.286	0.335	0.328	0.289	0.485	0.321	0.412	0.495
Nitrate-Nitrogen (mg/L)	**R = 0.504, p = 0.028**	0.1890	0.3870	0.4300	0.2442	0.2286	0.2297	0.1584	0.1729	0.3040	0.2032	0.3174	0.4565
Nitrite-Nitrogen (mg/L)	**R = 0.617, p = 0.005**	0.0006	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*	0.0014	0.0011*
Ammonia-Nitrogen (mg/L)	R = 0.324, p = 0.177	0.0037	0.0064	0.0030	0.0030	0.0035	0.0034	0.0060	0.0045	0.0036	0.0036	0.0027	0.0033
Total Phosphorus (mg/L)	R = 0.057, p = 0.815	0.0080	0.0070	0.0100	0.0097	0.0052	0.0078*	0.0077	0.0047*	0.0093	0.0078*	0.0096	0.0080*
Ortho-phosphate (mg/L)	**R = 0.860, p < 0.001**	0.0007*	0.0007*	0.0007*	0.0016	0.0007*	0.0011*	0.0011*	0.0011*	0.0031	0.0011*	0.0027	0.0013
Bromide (mg/L)	R = 0.091, p = 0.830												0.0259
Magnesium (mg/L)	R = 0.599, p = 0.155								2.646				
Calcium (mg/L)	R = 0.440, p = 0.323								13.344				
Copper (µg/L)	R = -0.604, p = 0.151												
Zinc (µg/L)	R = 0.054, p = 0.908												

Water Chemistry continued

Parameter	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.30	7.48	7.61	7.39	7.45	7.29	7.50
Specific Conductance (µS/cm)	81.1	89.1	83.8	107.3	130.7	101.2	94.3
Acid Neutralizing Capacity (µeq/L)	298.7	373.3	336.3	351.1	364.8	350.9	374.1
Dissolved Organic Carbon (mg/L)	1.703	1.757	1.647	3.325	2.288	1.690	1.663
Chloride (mg/L)	10.30	12.29	11.67	16.10	22.43	16.45	12.80
Sulfate (mg/L)	5.16	4.45	3.99	5.72	4.26	3.43	4.42
Total Nitrogen (mg/L)	0.513	0.350	0.304	0.558	0.475	0.584	0.550
Nitrate-Nitrogen (mg/L)	0.4230	0.2443	0.2301	0.4402	0.3515	0.5069	0.5265
Nitrite-Nitrogen (mg/L)	0.0014	0.0011*	0.0006*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0035	0.0020*	0.0031	0.0073	0.0028	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0078*	0.0046	0.0101	0.0044*	0.0070	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0019	0.0030*	0.0030*	0.0032	0.0031*	0.0032*	0.0036
Bromide (mg/L)	0.0198	0.0196	0.0260	0.0454	0.0341	0.0179*	0.0224
Magnesium (mg/L)	2.443	2.819	2.305	3.058	3.193	2.745	3.057
Calcium (mg/L)	5.073	5.886	5.467	7.229	7.363	5.733	6.192
Copper (µg/L)	1.601	0.609	0.510	0.970	0.594	0.422	0.635
Zinc (µg/L)	2.190	1.759	0.769	1.152	0.395	0.665	3.283

Physical Habitat

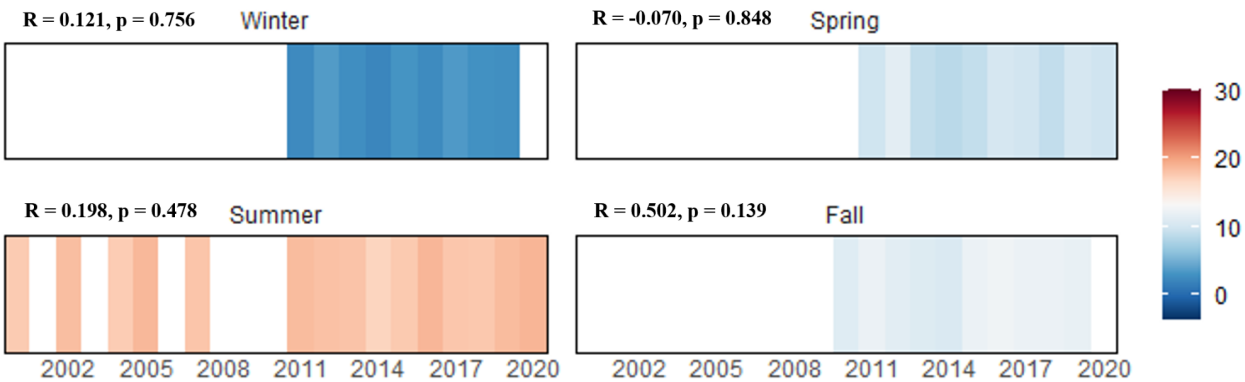
Physical habitat measurements collected at Buzzard Branch (2002 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.693, p = 0.001**	17	16	16	17	18	18	17	17	18	18	18	14	14	15	15	14	14	14	14
Epifaunal substrate (0-20)	R = -0.020, p = 0.936	17	17	17	17	19	18	16	17	19	19	17	13	17	18	18	19	19	16	16
Velocity/Depth Diversity (0-20)	R = 0.023, p = 0.925	9	10	12	10	10	10	10	10	10	9	15	15	11	10	10	10	10	10	9
Pool Quality (0-20)	R = -0.045, p = 0.854	9	10	10	10	10	10	10	10	10	10	16	9	11	10	10	9	10	9	9
Riffle Quality (0-20)	R = 0.146, p = 0.551	14	15	16	16	19	17	13	14	14	15	19	14	13	17	16	18	17	15	16
Shading (%)	R = -0.442, p = 0.058	86	98	90	90	90	90	80	80	95	95	95	85	85	90	85	75	80	85	85
Embeddedness (%)	**R = -0.517, p = 0.023**	20	20	20	20	20	50	35	35	10	10	5	5	5	10	10	10	10	15	10
Discharge (cfs)	**R = 0.604, p = 0.006**	0.09	0.38	1.39	0.81	2.17	0.89	0.16	1.02	1.46	0.32	2.95	0.51	3.15	5.48	1.84	1.96	6	2.21	2.44
Stream Area (m2)	R = 0.122, p = 0.620	232.5	255.0	318.8	369.4	337.5	320.6	365.6	337.5	363.8	105.0	378.8	198.8	442.5	345.0	279.4	326.3	381.0	317.3	286.9

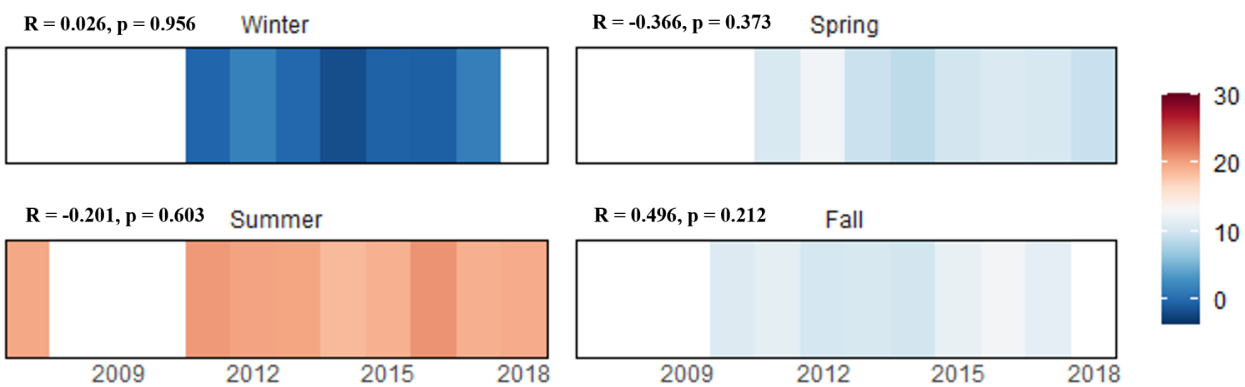
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Buzzard Branch (only calculated for summers missing no less than 2 weeks of data).

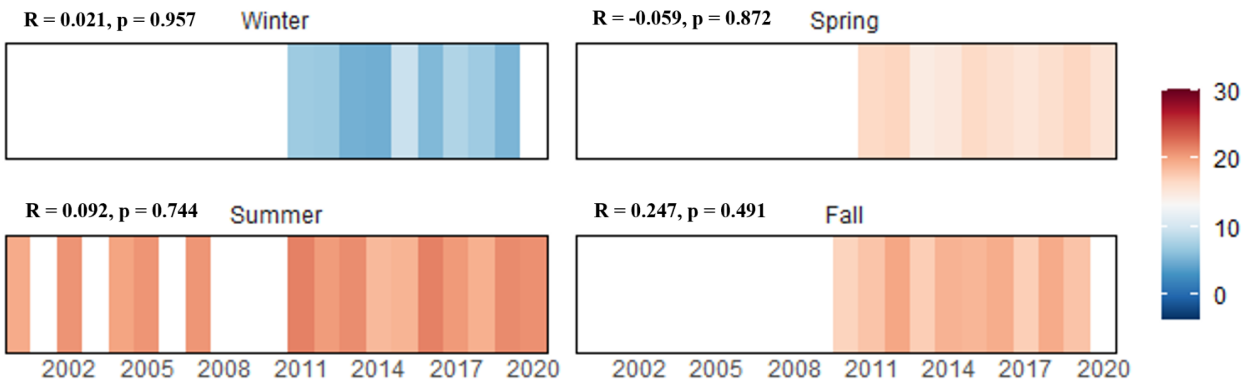
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.169, p = 0.548	6.0	-	20.6	-	4.9	25.6	-	8.8	-	-	-	20.1	18.3	13.1	0.4	2.2	30.2	10.0	3.9	22.1	30.8
% above 24°C	R = 0.073, p = 0.796	0	-	0	-	0	0	-	0	-	-	-	0.1	0	0	0	0	0	0	0	0.05	0



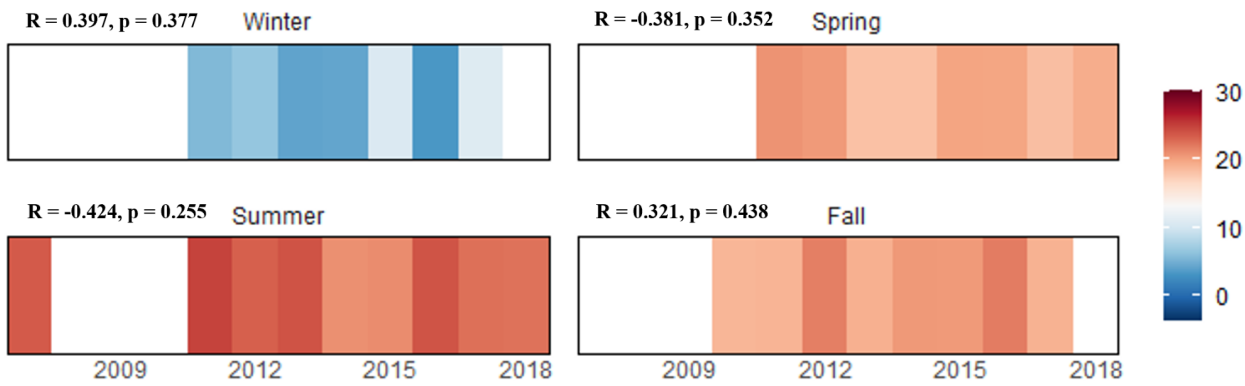
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Buzzard Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Buzzard Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Buzzard Branch (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Buzzard Branch (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.205, p = 0.401	5.00	4.25	3.00	4.25	3.50	3.50	4.25	3.75	4.25	4.25	3.00	2.50	2.75	1.50	4.25	3.50	4.25	4.25	4.00
# Taxa	R = -0.288, p = 0.231	28	38	22	23	24	20	34	23	36	33	20	15	26	17	30	22	22	27	22
# Ephemeroptera Taxa	R = -0.085, p = 0.728	6	6	3	6	4	4	8	6	8	8	3	3	2	0	6	4	7	6	6
# EPT Taxa	R = -0.159, p = 0.514	15	19	11	15	12	9	14	13	21	19	11	8	9	3	19	13	15	11	15
% Diptera	R = 0.266, p = 0.271	20.8	37.8	31.1	8.0	45.8	41.1	49.1	48.7	36.0	41.1	71.1	82.8	79.0	93.6	36.2	41.5	35.3	36.0	23.3
% Intolerant Urban Taxa	R = -0.065, p = 0.791	92.0	77.2	58.9	88.4	78.8	81.3	60.4	84.1	79.8	65.2	93.4	92.2	56.3	16.9	80.2	84.6	82.0	77.0	89.3
% Scrapers	R = 0.096, p = 0.696	44.0	8.7	2.2	36.6	27.1	27.1	17.0	24.8	26.3	19.6	18.2	9.5	5.0	0.8	19.0	23.6	32.0	28.0	51.5
% Swimmers	**R = -0.504, p = 0.028**	18.4	20.5	47.8	23.2	13.6	7.5	8.5	12.4	15.8	17.0	3.3	0.9	1.7	0	11.2	3.3	10.7	19.0	10.7
% Tanytarsini	R = -0.136, p = 0.580	11.2	10.2	1.1	0	2.5	1.9	6.6	3.5	4.4	10.7	0	0	10.1	1.6	1.7	2.4	9.8	7.0	0

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = -0.407, p = 0.084	3.50	3.50	3.50	3.50	4.00	3.50	3.50	3.50	3.50	3.50	3.50	3.00	2.50	3.50	3.50	3.00	3.00	3.50	3.50
Abundance per m2	R = 0.119, p = 0.627	0.43	0.17	0.27	0.19	0.13	0.26	0.30	0.18	0.13	0.51	0.21	0.58	0.17	0.45	0.47	0.19	0.22	0.29	0.22
% Brook Trout	**R = -0.755, p < 0.001**	57.0	56.8	50.6	62.3	70.5	52.4	50.9	33.9	34.8	20.4	29.6	17.4	10.5	47.4	42.4	14.8	14.6	28.0	22.6
% Tolerant	**R = 0.774, p < 0.001**	33.0	38.6	43.5	31.9	15.9	36.6	40.7	66.1	65.2	79.6	70.4	82.6	89.5	52.6	57.6	85.2	85.4	72.0	77.4
% Sculpins	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fish

Cumulative list of fish species (with abundance) collected in Buzzard Branch by sampling year.

Species	*Tolerance*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	33	17	37	22	7	30	43	41	30	43	56	95	68	81	76	52	70	67	48
Brook Trout	I	57	25	43	43	32	43	55	20	16	11	24	20	8	73	56	9	12	26	14
Brown Trout	M	10	2	5	4	6	9	9	-	-	-	-	-	-	-	-	-	-	-	-
Largemouth Bass	T	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Buzzard Branch by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	D	N	D	D	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Buzzard Branch by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Buzzard Branch.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Pickerel frog, Northern green frog, Northern spring peeper

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Eastern red-spotted newt, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Eastern garter snake, Northern watersnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Buzzard Branch by sampling year, RA = %Relative Abundance.

					2002	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	1.6	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	0.8	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	27.2	0.8	2.2	8.0	12.7	0.9	2.8	8.0	7.9
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	0.9	1.7	0.9	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	1.6	0.8	-	1.8	0.8	-	0.9	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	0.9	0.8	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	-	-	0.9	-	-	1.9	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Ceratopogonidae	na	M	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	1.6	-	-	4.2	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	2.2	-	1.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	0.8	1.1	-	7.6	0.9	-	6.2	1.8
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	10.4	3.9	-	-	2.5	0.9	-	-	0.9
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	2.4	-	-	-	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	3.1	-	0.9	-	-	-	-	2.6
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	0.9	1.8	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	0.8	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	0.8	2.2	-	0.8	7.5	2.8	-	0.9
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	0.8	-	-	0.9	-
Arthropoda	Diptera	Chironomidae	Podonominae		-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	0.8	2.2	-	0.8	4.7	11.3	-	0.9
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	1.1	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellina	M	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	3.9	1.1	-	-	-	0.9	3.5	3.5
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	0.8	-	1.1	-	-	-	-	0.9	0.9
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	2.4	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	5.7	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-

					2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	1.1	-	-	-	3.8	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	0.8	-	-	-	0.9	0.9	-	4.4
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Empididae	Chelifera	T	1.6	-	-	-	-	0.9	0.9	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	1.6	8.7	10.0	3.6	25.4	16.8	9.4	32.7	15.8
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	2.8	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Dicranota	I	1.6	-	1.1	-	1.7	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.6	6.3	7.8	1.8	-	4.7	0.9	0.9	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	0.8	-	-	-	2.8	0.9	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	0.9	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	1.8
Arthropoda	Ephemeroptera	Baetidae	na	I	3.2	0.8	-	3.6	-	-	0.9	2.7	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	27.8	6.3	2.5	-	0.9	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	1.9	-	2.6
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	1.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	3.2	8.7	6.7	5.4	6.8	1.9	2.8	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	5.6	-	-	6.3	-	-	-	3.5	6.1
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-

					2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	-	-	-	-	-	-	-	3.5	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	9.6	6.3	-	18.8	11.9	24.3	6.6	10.6	13.2
Arthropoda	Ephemeroptera	Heptageniidae	na	I	2.4	-	-	4.5	-	0.9	1.9	1.8	3.5
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	0.8	-	-	-	-	-	0.9	-	1.8
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	0.8	-	-	-	-	-	1.8	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.8	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	10.2	-	1.8	4.2	5.6	1.9	0.9	4.4
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	6.4	-	13.3	-	-	-	-	5.3	0.9
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	1.6	1.6	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	1.6	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	1.6	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	0.8	2.2	3.6	-	6.5	0.9	-	0.9
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	0.8	6.3	4.4	2.7	0.8	12.1	4.7	2.7	2.6
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.6	3.3	6.3	0.8	-	-	-	0.9
Arthropoda	Plecoptera	Leuctridae	na	I	1.6	-	-	-	-	-	14.2	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	1.6	0.8	-	6.3	-	-	-	4.4	2.6
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	1.6	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	3.1	1.1	-	0.8	0.9	1.9	-	2.6
Arthropoda	Plecoptera	Perlidae	na	I	-	0.8	-	0.9	0.8	-	2.8	1.8	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.8	-	3.3	-	0.8	2.8	-	0.9	1.8

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Perlodidae	na	I	1.6	0.8	-	2.7	0.8	-	0.9	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	2.4	-	-	2.7	1.7	-	-	1.8	0.9
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	0.8	1.1	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	-	-	-	-	0.9	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	0.9	-	-	-	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	4.0	3.1	1.1	3.6	3.4	0.9	1.9	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	0.8	1.1	-	0.8	-	-	0.9	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	1.6	0.8	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.8	3.1	1.1	1.8	-	-	-	-	0.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	1.6	0.8	-	-	-	-	0.9	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	8.0	0.8	0.9	1.7	0.8	0.9	0.8	-	7.0	11.7
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	0.8	-	0.9	-	-	-	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	0.9	-	-	-	0.8	0.9	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	0.8	-	0.9	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Chironomini	M	-	-	-	-	0.8	-	-	0.8	-	1.9
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	0.8	1.0	-
Arthropoda	Diptera	Chironomidae	Demicryptochironomus	I	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	1.7	-	0.8	0.8	-	0.8	1.6	2.0	1.0
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	1.6	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.9	0.8	-	-	4.0	-	4.1	5.7	-	1.0
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	-	1.7	0.8	1.7	-	9.8	6.0	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	4.5	-	-	0.8	0.8	-	1.6	-	1.0	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.9	-	1.7	-	-	0.9	0.8	1.6	1.0	1.0
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.9	-	0.9	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	3.6	0.8	-	1.7	-	1.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	3.6	-	0.9	-	-	0.9	-	0.8	1.0	1.0
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Podonominae		-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	5.4	0.8	-	5.9	62.1	-	3.3	2.5	6.0	1.0
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	10.7	-	-	6.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stenochironomus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	1.6	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	0.9	21.8	5.6	-	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	1.6	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	1.7	0.8	-	0.8	-	1.0	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.9	-	-	0.8	-	-	0.8	-	1.0	1.0
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.9	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	5.4	64.5	76.7	32.8	10.5	26.7	26.8	10.7	9.0	15.5
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.8	0.8	0.9	0.8	-	-	-	-	2.0	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	0.8	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Tipula	M	0.9	-	0.9	0.8	2.4	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	3.6	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	-	-	-	-	7.8	-	1.6	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	1.9
Arthropoda	Ephemeroptera	Baetidae	Plauditus		-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	1.8	0.8	0.9	0.8	-	1.7	0.8	2.5	9.0	2.9
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	3.0	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	6.3	13.2	6.9	-	-	15.5	20.3	31.1	19.0	32.0
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	2.7	-	-	-	-	0.9	1.6	-	2.0	1.9
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	0.9	-	1.7	-	-	0.9	-	0.8	-	1.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	8.0	2.5	-	0.8	-	1.7	0.8	4.9	10.0	5.8
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	1.8	-	-	-	-	-	1.6	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	0.8	-	-	-	-	-	-	4.0	2.9
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	2.7	0.8	2.6	4.2	0.8	1.7	3.3	4.1	3.0	1.0
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	1.8	-	-	-	-	0.9	0.8	4.1	-	1.0
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	4.1	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	1.7	-	-	-	3.4	8.1	3.3	-	2.9
Arthropoda	Plecoptera	Nemouridae	na	I	0.9	1.7	-	0.8	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	0.8	0.9	-	-	-	-	-	-	1.0
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	2.7	-	-	0.8	-	1.7	0.8	3.3	-	1.0
Arthropoda	Plecoptera	Perlidae	na	I	1.8	0.8	-	1.7	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	2.7	-	-	-	-	1.7	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	0.9	-	-	-	0.8	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	0.9	0.8	-	1.7	-	2.6	-	-	-	1.9
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	0.9	1.7	-	3.4	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	0.8	-	0.9	-	0.8	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	1.7	-	-	1.0	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	5.4	0.8	0.9	3.4	3.2	10.3	9.8	4.9	2.0	2.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	1.7	-	-	1.7	0.8	0.8	1.0	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.9	-	-	-	0.8	3.4	0.8	0.8	2.0	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.9	-	-	-	-	1.7	1.6	-	-	1.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.9	1.7	-	-	-	-	-	-	-	1.9

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Crabtree Creek (SAVA-204-S)

Site SAVA-204-S is located on Crabtree Creek in the Highlands region of Maryland. It is in the Savage River watershed in Garrett County. This site was sampled from 2002 to 2020 and was relocated slightly on the same reach starting in 2003.

Crabtree Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	86.13	85.48	84.14	86.00	84.71	84.72	85.17
Urban	3.46	3.46	3.49	3.49	3.50	3.50	3.50
Agriculture	8.11	8.01	7.86	7.81	7.89	7.95	7.80
Other	2.30	3.05	4.52	2.71	3.90	3.84	3.53

Water Chemistry

Water chemistry measurements collected at Crabtree Creek (2002 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*
pH	R = 0.327, p = 0.160	6.93	7.66	7.59	7.46	7.56	7.31	7.52	7.37	7.76	7.14	7.60	7.61
Specific Conductance (µS/cm)	R = -0.296, p = 0.206	101.5	120.0	118.9	101.0	132.8	128.9	137.0	120.6	119.7	140.2	115.1	114.4
Acid Neutralizing Capacity (µeq/L)	R = 0.323, p = 0.165	198.3	348.5	281.4	256.5	329.8	186.8	332.3	266.7	374.2	252.4	410.7	307.9
Dissolved Organic Carbon (mg/L)	R = 0.301, p = 0.197	0.900	0.700	0.600	0.710	0.535	1.275	0.834	0.244	0.622	0.978	0.791	0.717
Chloride (mg/L)	R = -0.157, p = 0.508	10.02	13.28	13.85	11.28	18.15	18.23	19.23	14.73	12.55	22.06	13.87	16.75
Sulfate (mg/L)	**R = -0.893, p < 0.001**	14.10	14.27	13.62	13.39	13.13	13.74	13.37	13.43	13.27	12.69	12.82	12.61
Total Nitrogen (mg/L)	R = -0.105, p = 0.661	0.829	0.546	1.101	0.946	0.759	0.948	0.807	0.792	0.534	0.768	0.593	0.656
Nitrate-Nitrogen (mg/L)	R = -0.064, p = 0.789	0.7910	0.5190	0.9050	0.9729	0.6343	0.8704	0.6901	0.7440	0.4660	0.6199	0.5614	0.5699
Nitrite-Nitrogen (mg/L)	**R = 0.558, p = 0.011**	0.0015	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*	0.0010*	0.0011*
Ammonia-Nitrogen (mg/L)	R = 0.401, p = 0.080	0.0027	0.0039	0.0034	0.0025	0.0047	0.0023	0.0095	0.0041	0.0020*	0.0035	0.0031	0.0044
Total Phosphorus (mg/L)	R = 0.170, p = 0.473	0.0120	0.0100	0.0110	0.0090	0.0059	0.0090	0.0037*	0.0143	0.0134	0.0078*	0.0102	0.0080*
Ortho-phosphate (mg/L)	R = 0.382, p = 0.097	0.0046	0.0007*	0.0038	0.0037	0.0007*	0.0030	0.0036	0.0033	0.0030	0.0011*	0.0031	0.0036
Bromide (mg/L)	R = 0.651, p = 0.058												0.0069
Magnesium (mg/L)	R = -0.473, p = 0.284								1.971				2.016
Calcium (mg/L)	R = -0.357, p = 0.432								8.700				9.119
Copper (µg/L)	R = -0.627, p = 0.132												
Zinc (µg/L)	**R = -0.794, p = 0.033**												

Water Chemistry continued

Parameter	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.43	7.59	7.69	7.67	7.55	7.37	7.61
Specific Conductance (µS/cm)	131.7	110.7	121.4	101.5	94.8	109.3	104.2
Acid Neutralizing Capacity (µeq/L)	265.7	278.8	361.4	302.3	310.2	335.5	312.5
Dissolved Organic Carbon (mg/L)	1.036	1.060	0.826	0.982	1.181	0.652	0.908
Chloride (mg/L)	20.54	13.31	14.34	10.43	9.33	11.94	11.46
Sulfate (mg/L)	12.30	12.88	13.22	12.07	11.10	11.46	11.04
Total Nitrogen (mg/L)	0.813	0.638	0.618	0.794	0.720	1.069	0.832
Nitrate-Nitrogen (mg/L)	0.6934	0.5493	0.6108	0.6480	0.6406	1.1366	0.7507
Nitrite-Nitrogen (mg/L)	0.0022	0.0011*	0.0005*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0037	0.0028	0.0036	0.0047	0.0042	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0078*	0.0089	0.0075	0.0141	0.0164	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0036	0.0030*	0.0030*	0.0049	0.0037	0.0032*	0.0058
Bromide (mg/L)	0.0082	0.0040*	0.0107	0.0084	0.0043	0.0179*	0.0179*
Magnesium (mg/L)	2.127	1.882	2.090	1.983	1.785	1.955	1.941
Calcium (mg/L)	9.082	9.079	9.942	8.726	8.575	9.132	8.816
Copper (µg/L)	2.060	0.189	0.151	0.236	0.233	0.112	0.155
Zinc (µg/L)	2.694	0.984	0.784	0.519	0.451	0.735	0.064*

Physical Habitat

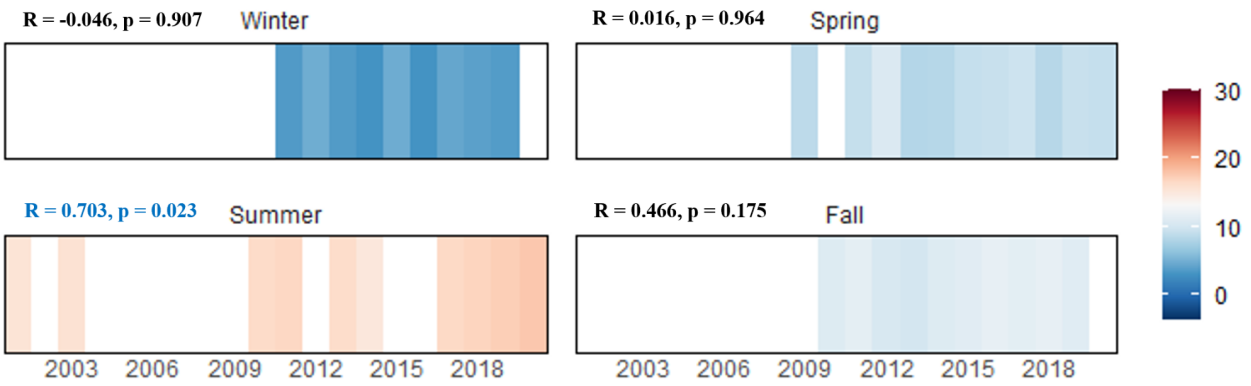
Physical habitat measurements collected at Crabtree Creek (2002 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.062, p = 0.801	19	20	18	17	18	19	18	18	19	20	15	18	19	19	19	18	18	19	18
Epifaunal substrate (0-20)	R = -0.019, p = 0.939	16	20	17	17	18	18	18	18	19	19	18	19	19	19	19	17	17	17	17
Velocity/Depth Diversity (0-20)	R = 0.289, p = 0.230	15	17	16	15	17	20	17	17	20	20	14	19	17	17	18	18	18	18	17
Pool Quality (0-20)	R = -0.231, p = 0.341	18	18	18	16	16	18	17	15	17	18	15	18	17	17	18	17	16	17	16
Riffle Quality (0-20)	R = -0.008, p = 0.975	18	19	18	16	19	20	19	19	20	19	15	19	17	18	19	19	18	19	18
Shading (%)	**R = -0.588, p = 0.008**	85	75	91	90	92	92	80	85	90	85	65	65	75	75	60	80	60	75	80
Embeddedness (%)	**R = -0.640, p = 0.003**	20	10	30	20	20	20	15	0	5	5	15	5	5	10	10	5	10	5	5
Discharge (cfs)	R = 0.158, p = 0.519	3.15	8.22	3.8	2.04	7.16	7.96	7.38	3.8	4.17	4.35	2.68	5.73	5.08	4.22	4.47	5.16	6.65	5.63	8.18
Stream Area (m2)	**R = 0.620, p = 0.005**	386.3	643.1	641.3	699.4	802.5	682.5	761.3	631.9	791.3	721.9	714.4	765.0	735.0	768.8	740.6	768.8	761.3	780.0	768.8

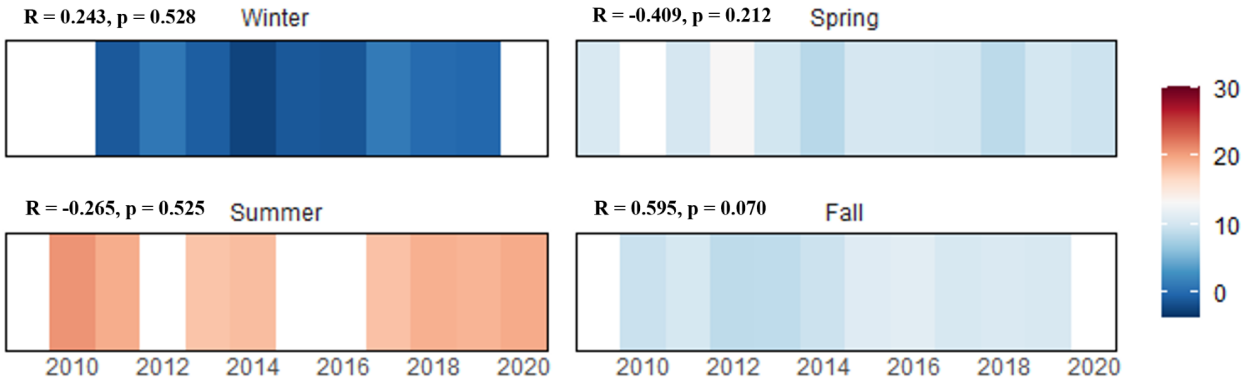
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Crabtree Creek (only calculated for summers missing no less than 2 weeks of data).

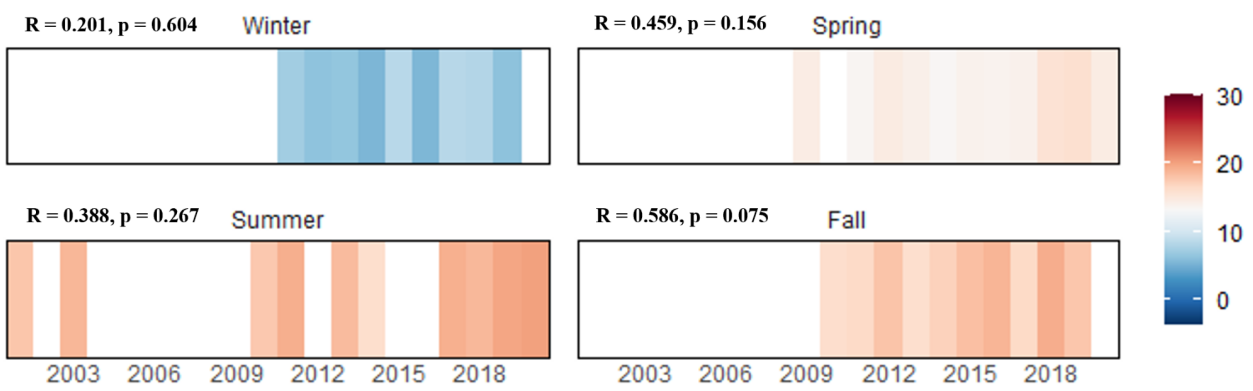
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.472, p = 0.169	-	0.9	-	0.8	-	-	-	-	-	-	0	2.9	-	0.1	0	-	-	0.8	0.3	5.1	12.2
% above 24°C	-	-	0	-	0	-	-	-	-	-	-	0	0	-	0	0	-	-	0	0	0	0



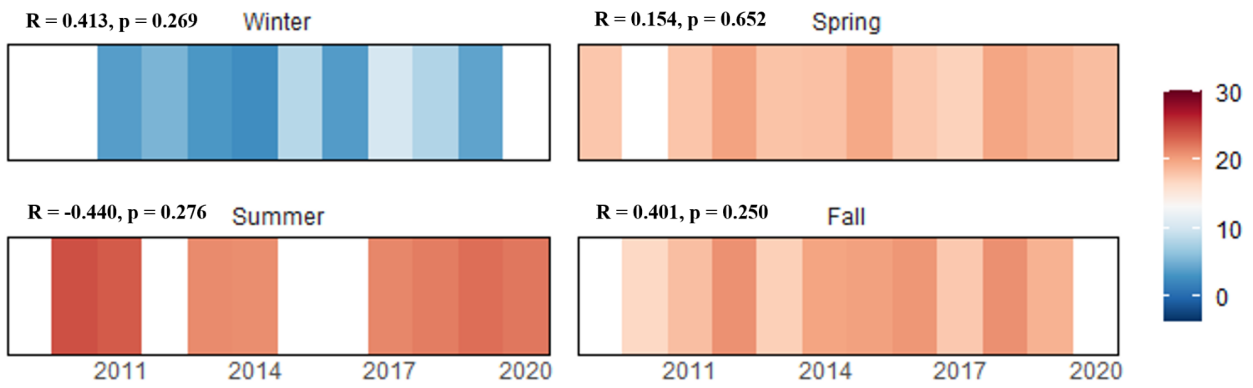
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Crabtree Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Crabtree Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Crabtree Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Crabtree Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.041, p = 0.868	4.50	4.25	3.00	4.25	4.25	4.75	4.75	4.00	4.25	4.25	4.00	4.50	4.00	4.25	4.25	4.25	4.75	4.50	3.50
# Taxa	R = 0.212, p = 0.384	20	26	18	19	33	25	29	34	19	31	20	27	27	27	21	24	26	28	28
# Ephemeroptera Taxa	R = 0.165, p = 0.499	6	6	4	7	5	7	8	6	6	6	7	5	5	6	6	9	7	8	4
# EPT Taxa	R = 0.446, p = 0.056	13	13	12	14	15	15	16	16	16	15	16	18	17	14	13	15	18	14	16
% Diptera	R = -0.024, p = 0.921	24.1	14.3	42.4	4.4	44.0	33.0	24.6	32.5	1.8	36.2	2.8	16.2	54.5	45.5	18.1	27.0	9.8	17.3	29.8
% Intolerant Urban Taxa	R = -0.052, p = 0.831	90.2	81.8	47.5	86.1	60.3	87.7	70.0	64.3	83.8	55.2	61.1	85.5	82.8	79.7	81.0	58.7	81.3	77.4	64.0
% Scrapers	R = 0.254, p = 0.294	31.3	19.8	10.2	27.8	16.4	21.7	22.3	26.2	34.2	27.6	33.3	56.4	11.0	9.8	42.2	47.6	16.1	26.3	31.6
% Swimmers	R = 0.038, p = 0.878	20.5	47.6	22.0	31.3	14.7	19.8	27.7	16.7	44.1	19.8	41.7	7.7	13.8	24.4	26.7	32.5	50.0	40.6	7.9
% Tanytarsini	R = -0.016, p = 0.947	17.9	0	0	0	10.3	25.5	4.6	2.4	0	0.9	0	3.4	45.5	32.5	1.7	0.8	1.8	1.5	0

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.411, p = 0.080	4.50	4.00	4.00	4.00	4.50	4.00	4.50	4.50	3.50	4.00	4.00	4.00	4.50	4.50	5.00	4.00	4.50	4.50	5.00
Abundance per m2	**R = -0.652, p = 0.002**	0.77	0.44	0.32	0.57	0.26	0.40	0.52	0.47	0.33	0.44	0.41	0.44	0.34	0.20	0.40	0.33	0.21	0.28	0.17
% Brook Trout	R = 0.096, p = 0.694	31.8	10.4	10.8	12.8	16.3	13.2	6.3	9.1	10.4	5.4	4.7	8.8	14.9	21.7	23.5	16.0	19.5	11.0	19.8
% Tolerant	R = 0.018, p = 0.942	16.1	21.4	17.6	9.8	7.7	5.9	8.3	10.8	24.7	14.9	15.9	20.6	8.5	20.4	8.5	23.4	9.4	19.2	8.4
% Sculpins	R = 0.197, p = 0.419	37.5	21.4	22.1	42.3	42.6	37.7	47.7	47.5	27.0	38.7	17.2	20.6	31.5	24.8	44.4	34.0	39.6	47.0	46.6

Fish

Cumulative list of fish species (with abundance) collected in Crabtree Creek by sampling year.

Species	*Tolerance*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	44	53	32	33	10	15	28	19	56	34	37	47	15	28	24	55	15	41	11
Blue Ridge Sculpin	I	112	59	44	167	87	97	188	141	70	121	51	69	78	39	123	85	61	102	61
Bluntnose Minnow	T	-	-	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Brook Trout	I	95	29	22	51	34	36	25	27	27	17	14	30	37	34	69	41	31	24	26
Brown Trout	M	1	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Central Stoneroller	I	-	-	1	1	-	-	-	17	-	3	-	-	-	-	-	1	-	-	-
Common Shiner	I	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	2	-	-	-
Creek Chub	T	2	-	-	1	3	-	-	5	2	5	6	12	3	2	-	2	-	-	-
Cutlip Minnow	M	-	-	-	-	1	-	-	-	-	1	3	-	-	-	-	-	-	-	-
Fantail Darter	M	13	51	14	24	16	44	57	24	21	51	100	92	43	21	25	23	20	20	11
Golden Shiner	T	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Longnose Dace	M	30	43	48	58	25	48	72	51	64	61	60	47	51	26	42	41	29	28	21
Potomac Sculpin	M	-	1	1	1	2	6	2	-	-	1	-	1	-	-	7	2	2	1	-
Pumpkinseed	T	-	-	-	-	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-
Rainbow Trout	M	-	-	1	-	-	-	-	-	-	-	-	1	4	1	-	1	-	-	-
Rock Bass	M	-	37	36	55	27	26	21	4	12	10	21	28	13	3	2	-	-	-	-
Rosyside Dace	M	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Smallmouth Bass	M	-	-	-	-	-	-	-	-	-	3	-	2	1	1	-	-	1	2	1
Tessellated Darter	T	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-

Species	*Tolerance*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
White Sucker	T	2	7	1	3	3	1	2	8	6	7	4	11	3	2	1	3	-	1	-
Yellow Perch	M	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Crabtree Creek by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	N	D	D	D	D
Faxonius obscurus	N	N	N	N	N	N	N	N	N	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) in Crabtree Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Crabtree Creek.

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Allegheny mountain dusky salamander, Eastern red-spotted newt, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander, Long-tailed salamander, Seal salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Northern watersnake, Eastern gartersnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Crabtree Creek by sampling year, RA = %Relative Abundance.

					2002	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Naididae	na	T	-	0.8	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	1.8	-	-	-	0.9	0.9	-	0.8	-
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	15.2	1.6	-	3.5	-	2.8	3.8	6.3	4.5
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	0.9	-	-	-	0.8	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	1.6	-	-	0.9	1.9	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	29.7	-	3.4	-	1.5	7.9	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	3.4	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	2.4	2.5	-	-	-	2.3	1.6	-
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	1.8	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	17.9	-	-	-	7.8	25.5	3.8	1.6	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	1.7	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	1.6	0.8	-	3.4	-	1.5	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	0.9	0.9	1.5	3.2	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	2.7	-	2.5	1.7	4.3	-	0.8	3.2	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	5.6	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	2.4	0.8	-	5.2	-	3.8	0.8	0.9
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	0.8	0.8	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	1.7	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	0.9	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	0.8	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	2.4	-	-	6.0	0.9	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.9	-	-	-	0.9	0.9	2.3	3.2	0.9
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	0.9	-	-	-	1.7	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	0.9	-	1.5	-	-
Arthropoda	Diptera	Empididae	na	T	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	-	-	0.9	0.9	1.9	1.5	0.8	-
Arthropoda	Diptera	Simuliidae	na	M	-	0.8	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	0.9	0.9	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	0.8	-	-	1.7	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	1.7	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Ephemeroptera	Baetidae	na	I	0.9	15.1	-	-	-	2.8	-	1.6	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	0.9	-	6.8	3.5	1.7	-	5.4	-	9.9
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Fallceon	I	0.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	-	-	1.9	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	9.8	7.1	8.5	13.9	-	4.7	10.8	3.2	16.2
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	1.8	20.6	-	-	4.3	0.9	1.5	4.0	9.9
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	-	-	-	6.1	-	-	3.1	2.4	2.7
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	13.4	13.5	10.2	18.3	14.7	12.3	10.8	11.9	26.1
Arthropoda	Ephemeroptera	Heptageniidae	na	I	1.8	2.4	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	0.9	2.3	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	0.8	1.6	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.9	0.8	-	-	-	1.9	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	0.8	-	0.9	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	3.6	2.4	5.9	9.6	6.0	9.4	6.9	4.8	3.6
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	3.6	1.6	0.8	3.5	1.7	1.9	3.1	3.2	3.6
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	0.8	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	0.9	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.9	1.6	10.2	15.7	-	0.9	0.8	0.8	2.7

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	3.4	-	2.3	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	0.8	-	0.9	0.9	-	-	1.6	1.8
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	1.8	-	-	-	0.9	-	0.8	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	4.5	4.0	5.9	-	-	10.4	13.1	5.6	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	3.2	1.7	-	0.9	4.7	0.8	0.8	1.8
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	-	-	-	-	0.9
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	1.7	0.9	-	0.8	0.9
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	1.8	-	2.5	7.0	6.0	-	1.5	6.3	2.7
Arthropoda	Plecoptera	Perlodidae	na	I	0.9	0.8	-	0.9	-	-	0.8	0.8	1.8
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	0.8	-	-	0.9	-	-	0.8	0.9
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	6.3	-	-	0.9	6.9	1.9	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	-	-	-	0.8	2.4	0.9
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	0.8	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	3.2	3.6
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	0.9	2.3	2.4	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	0.8	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	0.9	1.6	2.5	7.8	3.4	2.8	3.1	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	na	M	0.9	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	1.8	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	0.9	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.9	4.0	0.8	0.9	-	-	-	-	0.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	-	-	0.9	-	0.8	1.6	-
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	0.8	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	0.8	-
Annelida	Lumbriculida	Lumbriculidae	na	M	0.9	-	-	-	-	-	2.4	-	0.8	0.9
Arthropoda	Coleoptera	Elmidae	Dubiraphia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	1.9	1.7	1.4	4.1	-	-	2.7	6.8	3.5
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	0.9	0.9	0.9	-	-	0.9	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	1.9	-	-	-	-	16.7	2.7	1.5	1.8
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	0.7	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	0.8	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	5.2	-	-	-	1.6	-	0.8	1.8	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.9	-	-	-	-	0.9	-	-	1.5	0.9
Arthropoda	Diptera	Chironomidae	Heterotrissocladius	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	-	3.4	45.5	32.5	1.7	-	-	0.8	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Microtendipes	M	2.6	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	0.8	1.7	-	-	0.8	1.8
Arthropoda	Diptera	Chironomidae	Orthocladius	T	1.7	-	3.4	0.7	-	-	-	-	4.5	4.4
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	0.7	0.8	-	-	-	1.5	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	7.8	-	3.4	1.4	0.8	0.9	1.6	0.9	0.8	3.5
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	1.7	-	-	0.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	3.4	-	-	-	0.8	-	-	-	-	3.5
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	0.8	-	0.8	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.9	-	-	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.9	-	-	0.7	0.8	-	-	-	0.8	0.9
Arthropoda	Diptera	Chironomidae	Tvetenia	M	6.9	-	0.9	3.4	-	4.3	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	1.6	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	1.6	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	0.9	0.9	2.6	-	-	6.9	2.4	-	2.3	9.6
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	3.2	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	1.7	-	0.8	-	-	-	-	0.9
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	0.8	-	-	0.9

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.7	-	0.9	-	1.6	-	-	0.9	1.5	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	4.0	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	0.9	24.1	-	-	2.4	6.0	7.9	4.5	8.3	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	0.9	-	0.9	-	2.4	-	1.6	-	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Fallceon	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	-	-	-	1.6	0.9	0.8	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	5.2	10.2	-	7.6	13.0	12.9	15.1	33.9	20.3	3.5
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	3.4	1.9	0.9	0.7	-	-	-	-	2.3	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	-	5.6	-	0.7	0.8	-	-	1.8	0.8	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	14.7	21.3	34.2	7.6	4.1	41.4	28.6	8.0	14.3	15.8
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	0.8	-	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	1.7	0.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	1.9	1.7	-	-	1.7	0.8	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	4.3	2.8	4.3	4.8	6.5	5.2	3.2	11.6	9.0	4.4
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	5.2	0.9	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	0.8	3.5
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	1.7	5.6	-	1.4	0.8	-	1.6	2.7	3.0	2.6
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	0.9	-	-	-	4.1	1.7	-	0.9	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	0.9	-	0.9	0.7	0.8	-	-	0.9	-	0.9
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	0.9	-	-	2.4	-	0.8	-	-	0.9
Arthropoda	Plecoptera	Leuctridae	na	I	0.9	-	-	3.4	-	-	-	10.7	7.5	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	0.9	0.9	0.9	-	0.8	-	0.8	1.8	-	1.8
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	2.6	0.7	2.4	0.9	-	0.9	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	1.9	5.1	2.1	2.4	4.3	0.8	0.9	3.0	4.4
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	0.9	-	-	0.9	-	-	-	1.8
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	10.3	-	17.9	0.7	-	-	-	-	1.5	7.9
Arthropoda	Plecoptera	Taeniopterygidae	na	M	-	0.9	-	4.1	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	0.7	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Goeridae	Goera	M	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	3.4	4.6	0.9	0.7	5.7	0.9	2.4	2.7	-	7.9
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	0.9	-	0.9	0.7	-	-	-	-	-	0.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	4.3	6.5	2.6	3.4	-	1.7	0.8	1.8	-	5.3

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Hydropsychidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.9	-	0.9	2.1	-	2.6	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	0.9	3.4	0.7	0.8	-	-	0.9	0.8	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	0.9	-	0.7	-	-	-	-	-	0.9
Nemertea	Hoplonemertea	Tetrastemmatidae	Prostoma	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Double Lick Run (SAVA-276-S)

Site SAVA-276-S is located on Double Lick Run in the Highlands region of Maryland. It is in the Savage River watershed in Garrett County. This site was sampled from 2000 to 2020.

Double Lick Run in the spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	87.99	87.99	88.77	89.93	89.60	89.65	89.98
Urban	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Agriculture	10.79	9.08	9.02	9.02	8.97	8.97	8.97
Other	0.28	1.99	1.27	0.11	0.50	0.44	0.11

Water Chemistry

Water chemistry measurements collected at Double Lick Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.144, p = 0.521	6.75	6.76	6.46	6.70	6.86	6.82	6.88	6.81	6.90	6.76	6.75	6.64
Specific Conductance (µS/cm)	**R = -0.734, p < 0.001**	47.9	49.6	46.6	40.0	45.4	50.3	47.2	46.0	45.2	46.5	44.4	43.3
Acid Neutralizing Capacity (µeq/L)	R = 0.218, p = 0.329	65.9	59.2	48.4	54.0	55.0	73.2	54.1	54.0	59.6	63.6	67.8	48.1
Dissolved Organic Carbon (mg/L)	**R = 0.532, p = 0.011**	0.700	0.300*	0.500	0.400	0.200	0.507	0.240	0.464	0.421	0.557	0.352	0.754
Chloride (mg/L)	**R = -0.910, p < 0.001**	0.99	1.15	1.20	1.09	1.03	1.10	0.98	1.04	1.04	0.97	0.91	0.86
Sulfate (mg/L)	**R = -0.821, p < 0.001**	12.11	10.70	11.63	11.31	11.22	11.17	11.11	11.69	11.07	11.11	10.59	10.30
Total Nitrogen (mg/L)	R = 0.126, p = 0.577	0.469	0.567	0.599	0.595	0.785	0.720	0.810	0.657	0.686	0.596	0.554	0.885
Nitrate-Nitrogen (mg/L)	R = 0.238, p = 0.285	0.3290	0.5420	0.5700	0.5570	0.6260	0.7304	0.6770	0.5514	0.6030	0.5728	0.4905	0.7955
Nitrite-Nitrogen (mg/L)	**R = 0.730, p < 0.001**	0*	0.0010*	0.0005	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	**R = 0.444, p = 0.044**	0*	0.0024*	0.0027	0.0020*	0.0033	0.0051	0.0038	0.0035	0.0073	0.0031	0.0020*	0.0034
Total Phosphorus (mg/L)	R = -0.010, p = 0.965	0.0070	0.0100	0.0140	0.0100	0.0130	0.0123	0.0087	0.0113	0.0087	0.0108	0.0134	0.0078*
Ortho-phosphate (mg/L)	R = 0.294, p = 0.184	0*	0.0040*	0.0061	0.0067	0.0078	0.0085	0.0072	0.0071	0.0090	0.0072	0.0072	0.0054
Bromide (mg/L)	**R = 0.830, p = 0.011**												
Magnesium (mg/L)	R = -0.516, p = 0.236										1.433		
Calcium (mg/L)	R = -0.137, p = 0.769										3.248		
Copper (µg/L)	R= -0.661, p = 0.106												
Zinc (µg/L)	R = -0.040, p = 0.933												

Water Chemistry

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.48	6.73	6.85	6.82	6.86	6.86	6.69	6.73	6.86
Specific Conductance (µS/cm)	43.9	40.0	43.9	42.6	42.9	42.0	40.1	41.6	39.1
Acid Neutralizing Capacity (µeq/L)	76.4	49.6	69.8	70.1	64.2	67.4	60.5	61.1	63.6
Dissolved Organic Carbon (mg/L)	0.433	0.497	0.646	0.896	0.586	0.687	0.644	0.524	0.751
Chloride (mg/L)	0.89	0.84	0.77	0.79	0.83	0.75	0.60	0.81	0.70
Sulfate (mg/L)	11.00	10.57	10.82	10.82	10.64	10.34	9.88	9.72	9.09
Total Nitrogen (mg/L)	0.678	0.708	0.566	0.480	0.515	0.615	0.657	0.694	0.847
Nitrate-Nitrogen (mg/L)	0.6605	0.6676	0.5219	0.4290	0.4819	0.5253	0.6368	0.7486	0.7677
Nitrite-Nitrogen (mg/L)	0.0010*	0.0033	0.0011*	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0025	0.0024	0.0066	0.0023	0.0027	0.0026*	0.0026*	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0139	0.0108	0.0094	0.0104	0.0096	0.0102	0.0129	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0079	0.0042	0.0060	0.0064	0.0077	0.0068	0.0071	0.0074	0.0072
Bromide (mg/L)		0.0041	0.0041	0.0040*	0.0073	0.0054	0.0063	0.0179*	0.0179*
Magnesium (mg/L)			1.592	1.426	1.275	1.498	1.379	1.344	1.379
Calcium (mg/L)			3.044	3.250	2.614	3.049	2.961	2.872	3.063
Copper (µg/L)			0.114	0.125	0.047	0.078	0.100*	0.039*	0.057
Zinc (µg/L)			1.131	1.443	0.931	1.017	0.715	1.230	1.303

Physical Habitat

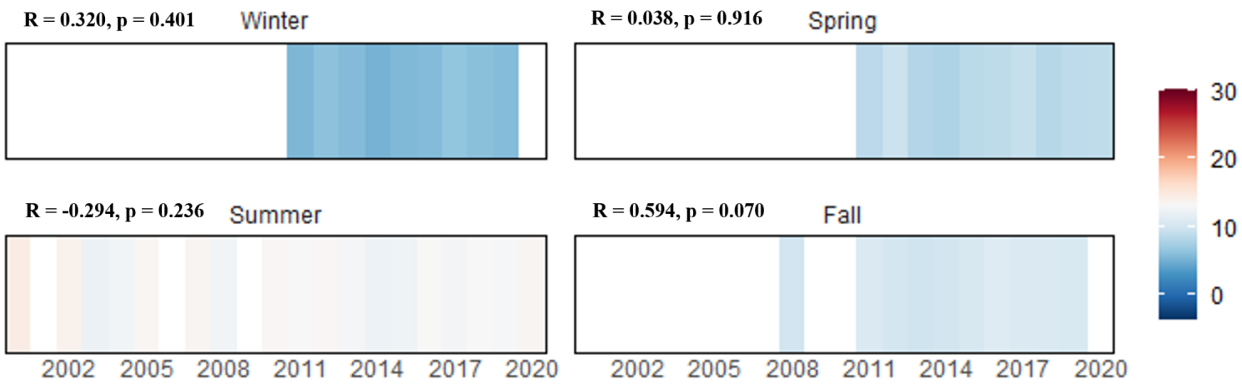
Physical habitat measurements collected at Double Lick Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.642, p = 0.002**	16	16	14	17	12	12	11	18	17	16	18	18	14	9	9	12	7	12	7	9	8
Epifaunal substrate (0-20)	R = -0.169, p = 0.464	18	19	18	19	15	15	16	17	18	18	19	19	18	17	17	19	17	18	15	15	18
Velocity/Depth Diversity (0-20)	**R = -0.549, p = 0.010**	10	13	10	15	10	7	8	10	10	10	10	10	10	7	9	10	7	10	8	8	7
Pool Quality (0-20)	**R = -0.733, p < 0.001**	10	15	10	16	10	9	7	10	10	10	10	10	9	7	7	8	4	8	7	7	5
Riffle Quality (0-20)	R = -0.024, p = 0.918	9	15	10	17	13	10	11	16	15	14	15	15	15	11	8	17	11	17	15	11	8
Shading (%)	**R = -0.634, p = 0.002**	98	93	95	98	96	95	95	95	90	85	90	85	85	95	95	90	85	90	90	90	85
Embeddedness (%)	R = -0.388, p = 0.082	10	15	20	15	30	25	20	40	25	15	5	5	10	25	10	10	5	15	15	10	10
Discharge (cfs)	R = 0.211, p = 0.359	0.04	0.2	0.07	0.64	1.12	0.16	0.1	0.15	0.37	0.2	0.16	0.6	0.31	0.46	0.17	2.19	0.17	1.49	0.13	0.18	0.23
Stream Area (m2)	R = 0.349, p = 0.121	210.0	172.5	108.8	200.6	138.8	65.6	112.5	127.5	118.1	101.3	232.5	181.9	208.1	208.1	230.6	279.4	225.0	301.9	107.3	152.3	172.5

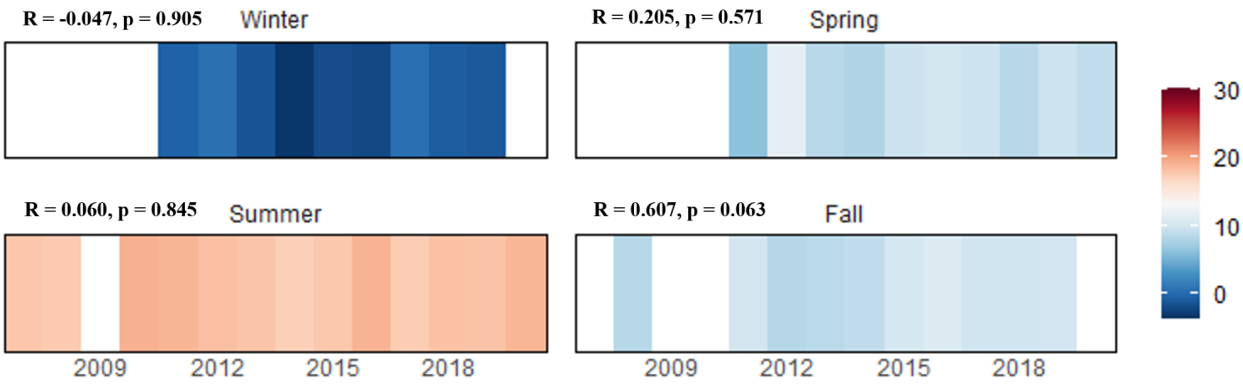
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Double Lick Run (only calculated for summers missing no less than 2 weeks of data).

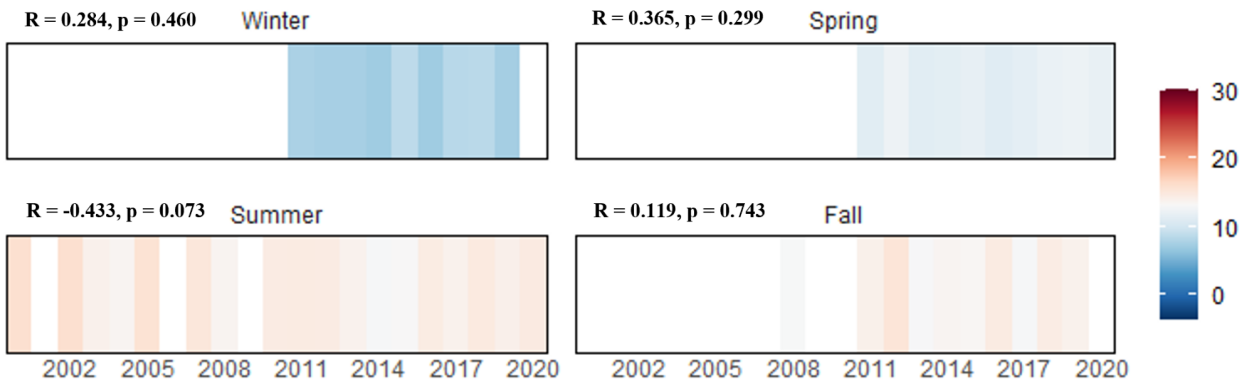
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	-	0	-	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0
% above 24°C	-	0	-	0	0	0	0	-	0	0	-	0	0	0	0	0	0	0	0	0	0	0



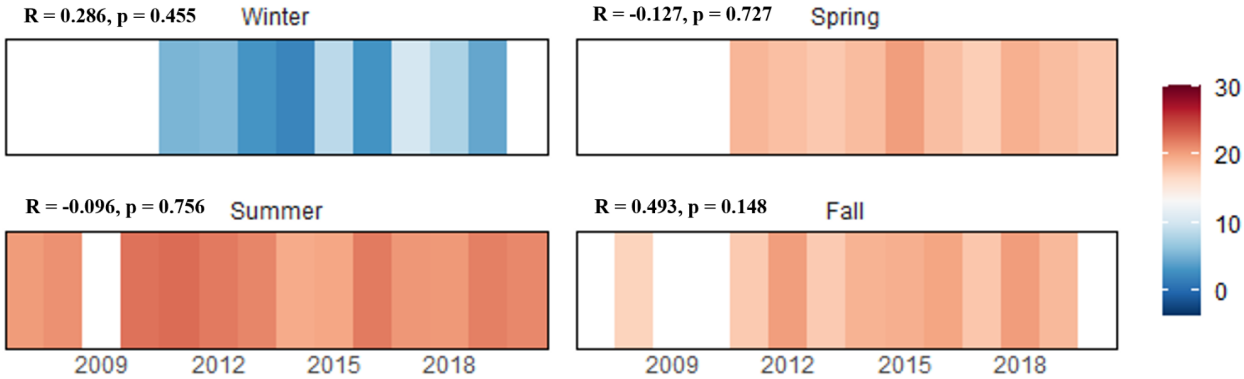
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Double Lick Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Double Lick Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Double Lick Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Double Lick Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.252, p = 0.271	4.50	4.25	4.50	3.75	3.75	4.00	4.25	4.50	4.25	4.50	4.50	4.00	4.25	4.00	4.00	3.75	3.75	3.75	3.50	3.75	5.00
# Taxa	R = -0.347, p = 0.124	27	19	31	20	22	20	21	23	29	24	21	20	19	21	19	19	18	19	22	22	24
# Ephemeroptera Taxa	R = -0.234, p = 0.307	7	5	7	4	5	7	6	6	7	6	7	6	6	4	7	5	5	6	3	6	6
# EPT Taxa	R = -0.371, p = 0.098	16	12	20	13	13	14	14	14	15	15	16	13	12	13	14	11	13	14	13	13	14
% Diptera	R= -0.269, p = 0.239	14.8	7.6	14.7	10.3	5.8	9.5	5.8	8.2	6.4	9.0	8.3	7.4	5.1	13.0	4.1	5.8	4.2	3.2	5.0	5.0	18.6
% Intolerant Urban Taxa	R= -0.218, p = 0.344	80.9	85.7	59.6	77.0	68.6	71.6	86.7	88.8	48.2	84.3	80.6	67.8	81.4	77.4	70.3	62.0	58.0	69.6	65.0	67.4	84.8
% Scrapers	R = 0.028, p = 0.905	32.2	40.3	30.3	19.8	5.8	18.1	45.0	37.8	15.3	21.6	30.6	20.7	39.0	28.7	33.9	36.5	13.5	40.8	10.0	17.0	47.6
% Swimmers	R = 0.061, p = 0.794	14.8	25.2	9.2	27.0	37.2	31.0	25.8	19.4	10.6	14.9	22.2	19.8	27.1	26.1	16.5	14.6	28.6	17.6	20.7	36.2	19.3
% Tanytarsini	R = -0.075, p = 0.746	1.7	3.4	6.4	2.4	0.8	0	0	1.0	1.1	1.5	2.8	3.3	3.4	4.4	0.8	1.5	0	0	0.7	0	6.9

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.161, p = 0.485	4.50	4.50	4.50	4.50	4.00	4.00	5.00	4.50	5.00	5.00	4.50	4.50	4.50	4.00	5.00	5.00	4.00	4.50	4.50	4.50	5.00
Abundance per m2	**R = -0.520, p = 0.016**	0.23	0.45	0.55	0.43	1.23	0.94	0.22	0.25	0.25	0.28	0.06	0.14	0.19	0.14	0.04	0.06	0.04	0.04	0.14	0.51	0.08
% Brook Trout	**R = -0.473, p = 0.030**	66.7	75.6	73.3	77.9	88.9	85.5	28.0	59.4	31.0	39.3	57.1	11.5	56.4	0	50.0	27.8	0	8.3	73.3	76.6	35.7
% Tolerant	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Sculpins	**R = 0.473, p = 0.030**	33.3	24.4	26.7	22.1	11.1	14.5	72.0	40.6	69.0	60.7	42.9	88.5	43.6	100	50.0	72.2	100	91.7	26.7	23.4	64.3

Fish

Cumulative list of fish species (with abundance) collected in Double Lick Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blue Ridge Sculpin	I	16	19	16	19	19	9	18	13	20	17	6	23	17	29	5	13	9	11	4	18	9
Brook Trout	I	32	59	44	67	152	53	7	19	9	11	8	3	22	-	5	5	-	1	11	59	5

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Double Lick Run by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Double Lick Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Double Lick Run.

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Allegheny mountain dusky salamander, Northern dusky salamander, Northern slimy salamander, Northern spring salamander, Northern two-lined salamander, Eastern red-spotted newt, Seal salamander
Squamata (Snakes and Lizards)	Eastern gartersnake, Northern red-bellied snake

Order (Common)	*Species*
Testudines (Turtles)	Eastern snapping turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Double Lick Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Lumbriculida	Lumbriculidae	na	M	0.0	0.8	0.9	0.8	1.7	0.0	0.0	0.0	0.5	0.7	0.0
Arthropoda	Amphipoda	na	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	41.3	0.0	10.2
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.0	0.0	0.0	0.0
Arthropoda	Amphipoda	Gammaridae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	5.2	10.1	27.5	16.7	21.5	19.8	6.7	6.1	5.3	8.2	5.6
Arthropoda	Coleoptera	Elmidae	na	M	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	0.0	0.0	0.0	0.0	0.8	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Collembola	Isotomidae	Isotomurus	M	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Arthropoda	Decapoda	Cambaridae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	0.0	0.8	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Brillia	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Brundiniella	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	1.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Diamesa	T	0.0	0.0	0.9	4.0	1.7	6.0	1.7	2.0	0.5	1.5	0.0
Arthropoda	Diptera	Chironomidae	Diamesinae	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	2.6	0.0	0.0	0.0	0.8	0.0	1.7	0.0	0.5	0.0	2.8
Arthropoda	Diptera	Chironomidae	Micropsectra	I	0.9	3.4	3.7	2.4	0.0	0.0	0.0	1.0	0.5	1.5	2.8

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.0	0.0	0.9	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.9	1.7	0.9	0.0	0.8	0.0	0.0	1.0	0.5	1.5	0.0
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Platysmittia	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Polypedilum	M	5.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.7	0.0
Arthropoda	Diptera	Chironomidae	Stempellinella	M	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	0.0	0.0	1.8	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.0	0.0	0.0	1.6	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Arthropoda	Diptera	Empididae	Chelifera	T	0.9	0.0	0.0	0.0	0.0	0.9	0.0	1.0	0.0	0.0	0.0
Arthropoda	Diptera	Empididae	Neoplasta		0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Simuliidae	Prosimulium	I	0.9	0.8	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9
Arthropoda	Diptera	Simuliidae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Simuliidae	Simulium	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Tipulidae	Antocha	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.0	0.0	1.8	1.6	0.8	2.6	0.0	1.0	0.5	2.2	0.0
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.9	0.0	0.9	0.8	0.0	0.0	0.0	1.0	1.1	0.0	0.0
Arthropoda	Diptera	Tipulidae	na	M	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.0	2.5	1.8	0.8	0.0	0.0	0.8	1.0	0.5	0.0	0.9
Arthropoda	Ephemeroptera	Baetidae	na	I	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	0.0	0.0	0.9	0.0	2.5	0.9	0.0	0.0	0.5	0.0	0.0
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	0.9	0.0	0.0	0.0	0.8	0.9	2.5	3.1	0.0	1.5	0.9
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	5.2	19.3	1.8	24.6	34.7	25.9	5.8	12.2	3.7	6.7	13.9
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	13.3	6.1	0.0	0.0	3.7
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	13.9	0.0	6.4	0.0	0.0	5.2	19.2	2.0	1.6	2.2	2.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	14.8	31.1	17.4	17.5	3.3	11.2	17.5	31.6	12.7	17.2	25.0
Arthropoda	Ephemeroptera	Heptageniidae	Heptagenia	I	0.0	0.0	0.0	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Heptageniidae	na	I	0.0	8.4	0.9	0.0	0.8	0.0	3.3	1.0	0.0	0.0	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.1	0.0	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.0	0.0	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	0.0	0.0	4.6	0.8	0.0	1.7	3.3	0.0	4.8	6.0	3.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	8.7	3.4	0.0	0.8	0.0	1.7	2.5	0.0	1.1	0.7	0.0
Arthropoda	Isopoda	Asellidae	Caecidotea	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Odonata	Gomphidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	0.0	0.0	3.7	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.0	0.0	0.0	2.4	3.3	2.6	0.0	6.1	1.1	0.0	0.9
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	2.6	0.0	1.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	14.8	0.0	1.8	9.5	9.9	4.3	10.8	6.1	7.4	26.1	1.9
Arthropoda	Plecoptera	Leuctridae	na	I	0.0	4.2	0.9	0.0	0.0	0.0	0.0	0.0	5.8	0.0	0.0
Arthropoda	Plecoptera	Leuctridae	Paraleuctra	I	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	7.8	6.7	0.9	4.8	1.7	1.7	0.8	5.1	1.1	6.0	5.6
Arthropoda	Plecoptera	Nemouridae	na	I	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Peltoperlidae	Peltoperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Peltoperlidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.7	0.0
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Perlodidae	Malirekus	I	0.0	0.0	0.0	0.0	5.0	0.9	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Perlodidae	na	I	1.7	1.7	0.9	3.2	2.5	6.0	0.8	1.0	0.0	1.5	0.0
Arthropoda	Plecoptera	Perlodidae	Yugus	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.6	2.2	3.7
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	1.7	1.7	0.9	0.0	0.8	0.9	2.5	5.1	0.0	3.7	5.6
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	0.9	0.0	0.9	1.6	0.0	0.0	0.0	0.0	1.1	0.7	0.9
Arthropoda	Trichoptera	Hydropsychidae	na	M	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Hydropsychidae	Parapsyche	M	0.0	0.0	0.0	0.0	0.8	0.0	0.0	1.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.0	0.0	0.9	0.0	0.0	0.9	0.0	0.0	0.0	0.7	0.0
Arthropoda	Trichoptera	Philopotamidae	na	I	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.5	0.0	0.0
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	0.0	0.0	0.9	0.0	0.8	0.0	0.0	1.0	0.0	0.0	0.9
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.9	0.8	0.9	2.4	2.5	2.6	0.8	1.0	1.6	2.2	1.9
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.0	0.8	1.8	2.4	0.0	0.0	0.8	0.0	0.0	0.7	0.0
Nematomorpha	Gordioidea	Gordiidae	na	M	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Lumbriculida	Lumbriculidae	na	M	0.0	0.8	0.0	0.0	0.7	0.0	0.0	0.7	2.8	1.4
Arthropoda	Amphipoda	na	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Amphipoda	Crangonyctidae	Synurella	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Amphipoda	Gammaridae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	28.9	14.4	17.4	26.4	32.8	37.0	26.4	30.7	19.1	2.8
Arthropoda	Coleoptera	Elmidae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.7	0.0
Arthropoda	Collembola	Isotomidae	Isotomurus	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Decapoda	Cambaridae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Brillia	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Arthropoda	Diptera	Chironomidae	Brundiniella	M	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Diamesa	T	0.8	0.8	0.9	0.0	0.7	0.0	1.6	0.0	1.4	5.5
Arthropoda	Diptera	Chironomidae	Diamesinae	T	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.8	0.0	0.0	0.0	0.7	0.8	0.0	0.7	0.0	2.1
Arthropoda	Diptera	Chironomidae	Micropsectra	I	2.5	1.7	4.3	0.8	0.7	0.0	0.0	0.7	0.0	6.2
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.0	0.0	0.9	0.8	0.7	0.8	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.7	0.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.7	0.0
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Paratanytarsus	T	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Platysmittia	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Stempellinella	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	0.0	0.8	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.0	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.7
Arthropoda	Diptera	Empididae	Chelifera	T	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Empididae	Neoplasta		0.0	0.0	0.0	0.8	0.7	0.0	0.0	0.0	0.0	1.4
Arthropoda	Diptera	Simuliidae	Prosimulium	I	0.0	0.8	2.6	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Simuliidae	na	M	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Simuliidae	Simulium	M	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Diptera	Tipulidae	Antocha	T	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0
Arthropoda	Diptera	Tipulidae	Dicranota	I	1.7	0.0	0.0	0.0	0.0	0.8	0.8	0.0	0.7	1.4
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.0	0.0	0.9	0.8	0.7	0.0	0.0	0.7	0.7	0.0
Arthropoda	Diptera	Tipulidae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.7
Arthropoda	Ephemeroptera	Baetidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	0.0	0.0	0.0	0.8	0.0	1.7	0.8	0.0	5.0	0.0
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	0.0	1.7	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.7
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	7.4	22.9	22.6	13.2	8.0	23.5	13.6	12.1	24.8	11.7
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	0.0	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	2.5	11.0	8.7	9.9	3.6	0.0	0.8	0.0	5.7	22.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	17.4	25.4	18.3	22.3	28.5	13.4	36.8	10.0	9.2	21.4
Arthropoda	Ephemeroptera	Heptageniidae	Heptagenia	I	0.8	0.0	0.0	0.0	0.0	0.0	1.6	0.0	0.0	0.0

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	na	I	0.0	0.8	0.0	0.8	4.4	0.0	0.0	0.0	0.7	0.0
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	0.8	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	5.0	1.7	3.5	2.5	3.6	3.4	1.6	8.6	6.4	6.9
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	6.6	2.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	0.0
Arthropoda	Isopoda	Asellidae	Caecidotea	I	0.0	0.0	0.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Odonata	Gomphidae	na	I	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	na	I	2.5	2.5	0.9	1.7	0.7	0.8	0.0	0.7	0.0	0.7
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	0.0	0.8	0.0	0.0	0.7	0.0	0.0	0.0	0.7	0.0
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	9.1	0.0	3.5	5.0	4.4	4.2	4.0	2.1	10.6	2.1
Arthropoda	Plecoptera	Leuctridae	na	I	0.0	0.0	0.0	0.8	0.0	0.0	0.0	20.7	0.0	0.0
Arthropoda	Plecoptera	Leuctridae	Paraleuctra	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	4.1	5.9	0.0	0.8	0.7	0.8	0.8	0.7	0.0	2.1
Arthropoda	Plecoptera	Nemouridae	na	I	0.0	0.8	0.9	0.0	0.0	0.0	0.0	1.4	0.0	0.0
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Peltoperlidae	Peltoperla	I	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Peltoperlidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.7	0.0	0.0
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.0	0.0	0.9	0.0	0.7	0.0	0.0	0.0	0.0	0.0
Arthropoda	Plecoptera	Perlodidae	Malirekus	I	0.0	0.0	0.9	4.1	0.7	3.4	0.0	0.0	0.7	0.0
Arthropoda	Plecoptera	Perlodidae	na	I	0.8	0.8	1.7	2.5	0.0	0.0	0.8	0.7	2.1	0.0
Arthropoda	Plecoptera	Perlodidae	Yugus	I	0.0	0.0	0.0	0.0	0.0	1.7	0.0	0.7	0.0	0.0
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	3.3	0.8	3.5	1.7	0.0	3.4	4.8	0.0	2.1	2.1
Arthropoda	Trichoptera	Calamoceratidae	Heteroplectron	I	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	2.5	0.0	0.9	0.0	0.0	0.0	0.0	0.7	0.0	0.7
Arthropoda	Trichoptera	Hydropsychidae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Hydropsychidae	Parapsyche	M	0.0	0.8	0.0	0.0	0.0	0.8	0.8	0.0	2.1	0.0
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	0.0	0.0	0.0	0.8	0.0	0.0	0.0	0.7	0.0	0.7
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.0	0.0	0.0	0.0	0.0	0.0	1.6	0.0	1.4	0.0
Arthropoda	Trichoptera	Philopotamidae	na	I	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	0.0	0.0
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	0.0	0.0	0.0	0.0	0.0	0.0	0.8	0.0	0.0	0.0
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	0.0	0.0	0.9	1.7	1.5	0.0	0.0	2.1	0.0	2.1
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.0	0.0	1.7	0.0	0.0	0.0	0.8	0.0	0.7	2.8
Nematomorpha	Gordioidea	Gordiidae	na	M	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Unnamed Tributary to Edgemont Reservoir (ANTI-101-S)

Site ANTI-101-S is located on an unnamed tributary to Edgemont Reservoir in the Highlands region of Maryland. It is in the Antietam Creek watershed in Washington County. This site was sampled from 2001 to 2002 and then from 2010 to 2020.

Unnamed tributary to Edgemont Reservoir in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	91.70	91.18	90.83	90.61	91.05	91.11	90.35
Urban	4.51	4.51	4.51	4.51	4.51	4.51	4.51
Agriculture	3.40	3.30	3.30	3.19	3.03	3.14	3.14
Other	0.40	1.02	1.36	1.70	1.41	1.24	2.00

Water Chemistry

Water chemistry measurements collected at the unnamed tributary to Edgemont Reservoir (2000 to 2001, and 2010 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	R = 0.218, p = 0.474	7.54	7.50	7.66	7.65	7.69	7.62	7.60	7.50	7.70	7.55	7.57	7.52	7.64
Specific Conductance (µS/cm)	**R = 0.570, p = 0.042**	110.3	123.2	111.3	116.6	123.0	148.3	183.8	142.5	146.1	241.6	260.0	179.9	135.1
Acid Neutralizing Capacity (µeq/L)	R = 0.437, p = 0.136	414.1	359.3	398.0	418.5	597.6	447.5	386.6	361.2	567.8	479.1	508.6	415.8	536.5
Dissolved Organic Carbon (mg/L)	R = -0.072, p = 0.815	1.800	1.300	1.262	1.368	1.350	0.465	1.209	1.850	1.186	2.161	1.325	1.323	1.272
Chloride (mg/L)	**R = 0.580, p = 0.038**	11.20	13.28	11.09	13.49	14.03	24.01	34.22	22.59	18.87	48.13	52.95	33.04	17.21
Sulfate (mg/L)	**R = -0.814, p = 0.001**	10.65	10.48	10.70	10.61	9.71	9.98	9.99	9.58	9.27	9.63	9.13	8.36	8.66
Total Nitrogen (mg/L)	R = 0.180, p = 0.555	0.636	1.024	0.743	0.592	0.436	0.717	0.835	1.065	0.525	0.776	0.755	1.229	0.897
Nitrate-Nitrogen (mg/L)	R = 0.322, p = 0.284	0.4630	0.8670	0.6269	0.4663	0.3505	0.6906	0.7630	0.9836	0.4137	0.6952	0.6846	1.2624	0.8315
Nitrite-Nitrogen (mg/L)	**R = 0.668, p = 0.013**	0*	0.0004*	0.0019*	0.0011*	0.0049	0.0038	0.0011*	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	**R = 0.726, p = 0.005**	0*	0.0020*	0.0028	0.0036	0.0048	0.0076	0.0033	0.0033	0.0034	0.0048	0.0037	0.0084*	0.0084*
Total Phosphorus (mg/L)	R = 0.081, p = 0.793	0.0060	0.0080	0.0111	0.0078*	0.0132	0.0081	0.0078*	0.0093	0.0062	0.0044*	0.0061	0.0102*	0.0102*
Ortho-phosphate (mg/L)	R = 0.497, p = 0.084	0.0023*	0.0013*	0.0057	0.0040	0.0063	0.0079	0.0049	0.0045	0.0042	0.0041	0.0046	0.0032*	0.0061
Bromide (mg/L)	**R = 0.771, p = 0.025**						0.0077	0.0089	0.0072	0.0093	0.0194	0.0103	0.0179*	0.0179*
Magnesium (mg/L)	R = 0.248, p = 0.592							4.510	3.738	4.335	5.981	6.038	4.294	4.519
Calcium (mg/L)	R = 0.263, p = 0.569							9.721	7.967	9.722	14.050	14.050	9.623	9.863
Copper (µg/L)	R = -0.567, p = 0.184							1.270	1.391	0.766	1.242	0.855	0.824	1.007
Zinc (µg/L)	R = -0.639, p = 0.123							1.391	1.446	0.475	0.241	0.300*	0.997	0.271

Physical Habitat

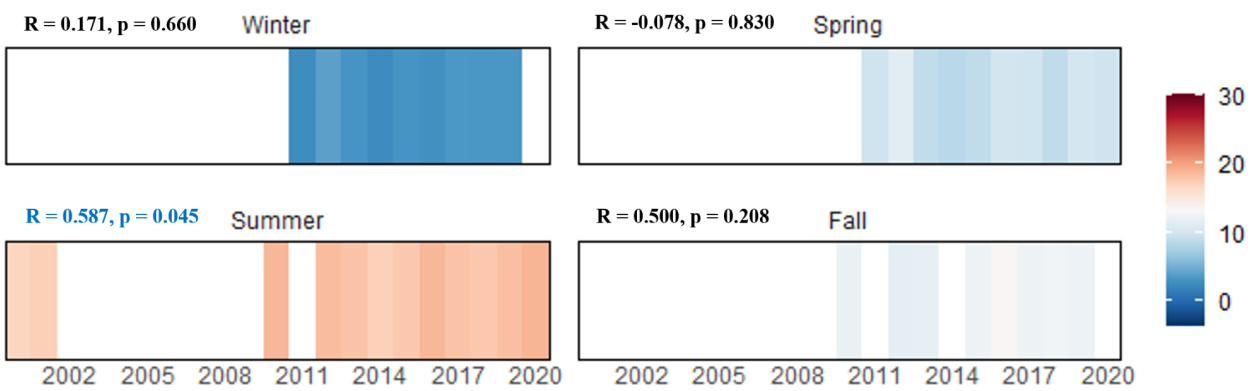
Physical habitat measurements collected at the unnamed tributary to Edgemont Reservoir (2000 to 2001, and 2010 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.647, p = 0.023**	18		18	18	15	16	16	17	17	16	16	16	15
Epifaunal substrate (0-20)	R = 0.062, p = 0.847	18		15	14	18	16	17	17	19	18	19	16	16
Velocity/Depth Diversity (0-20)	R = 0.224, p = 0.484	10		17	15	15	15	12	15	15	14	16	12	12
Pool Quality (0-20)	**R = 0.588, p = 0.044**	10	Data not available	15	15	15	14	12	16	14	15	15	14	14
Riffle Quality (0-20)	R = -0.221, p = 0.491	17		18	17	15	14	14	18	14	16	17	17	15
Shading (%)	R = -0.448, p = 0.144	90		85	90	85	80	60	65	70	70	75	80	85
Embeddedness (%)	R = 0.046, p = 0.886	10		35	20	15	10	5	10	10	25	15	20	15
Discharge (cfs)	R = 0.309, p = 0.304	0.85	0.06	3.34	0.16	0.84	0.66	1.9	3.42	1.16	1.06	4.23	1.56	0.36
Stream Area (m2)	R = 0.542, p = 0.056	255.0	144.4	352.5	103.1	408.8	369.4	453.4	489.4	303.8	373.1	437.3	386.3	290.6

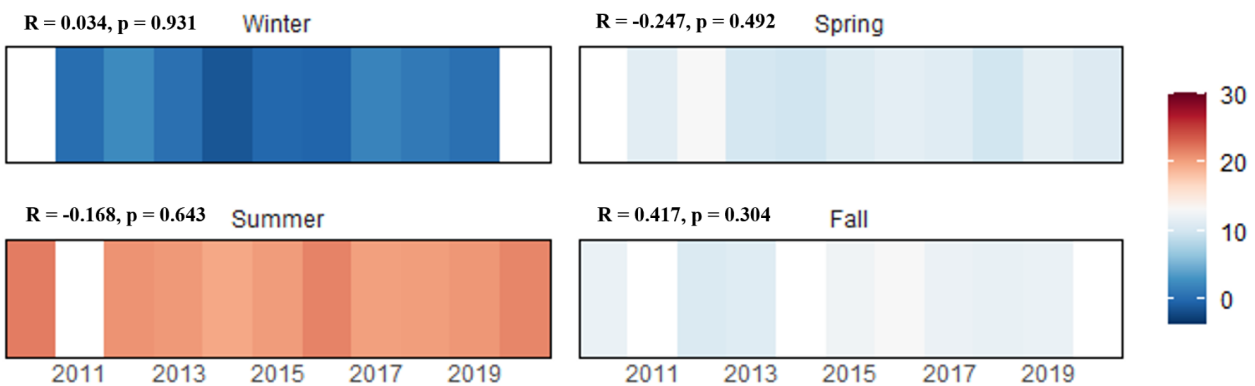
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at the unnamed tributary to Edgemont Reservoir (only calculated for summers missing no less than 2 weeks of data).

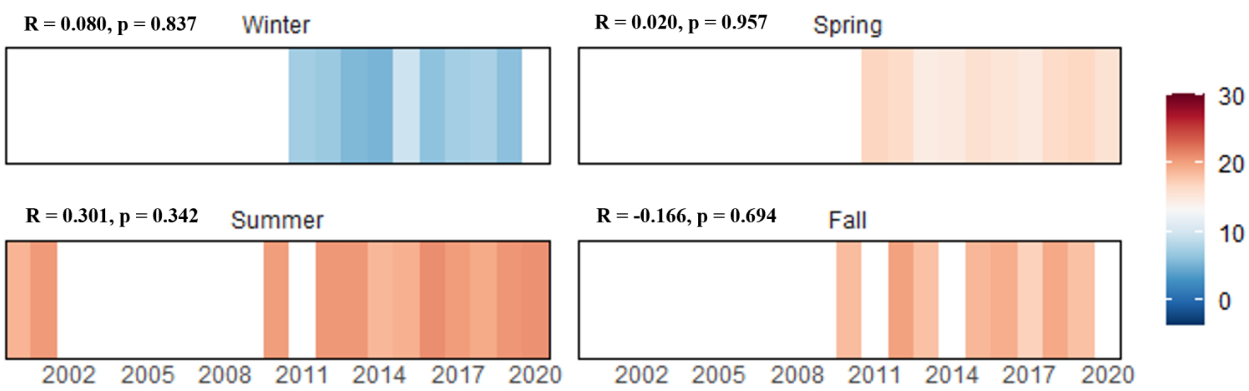
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.310, p = 0.327	2.0	6.8	-	-	-	-	-	-	-	-	14.3	-	22.4	9.7	0	1.5	23.6	7.1	2.0	11.6	26.6
% above 24°C	-	0	0	-	-	-	-	-	-	-	-	0	-	0	0	0	0	0	0	0	0	0



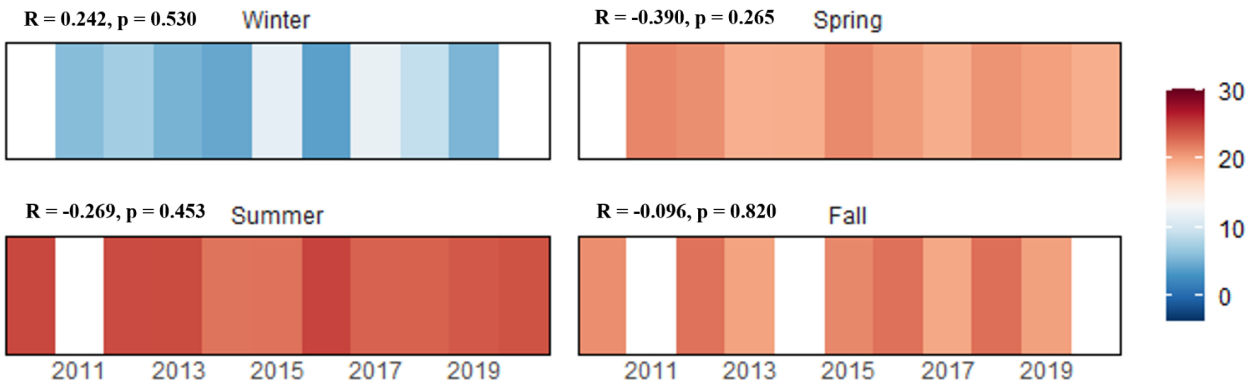
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Edgemont Reservoir (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at the unnamed tributary to Edgemont Reservoir (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Edgemont Reservoir (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at the unnamed tributary to Edgemont Reservoir (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.031, p = 0.919	4.25	4.25	4.25	4.00	4.50	4.00	4.00	4.00	4.25	4.25	4.00	4.50	4.25
# Taxa	R = 0.435, p = 0.137	19	24	21	25	17	18	24	17	25	25	35	27	27
# Ephemeroptera Taxa	R = 0.158, p = 0.607	5	5	7	6	7	6	4	5	6	6	6	5	6
# EPT Taxa	R = 0.547, p = 0.053	11	14	16	13	14	15	14	11	16	15	19	17	15
% Diptera	R = -0.059, p = 0.848	23.6	31.2	15.1	28.4	6.9	23.3	46.6	27.3	24.2	17.3	39.9	15.6	19.2
% Intolerant Urban Taxa	R = -0.219, p = 0.473	90.6	68.0	92.5	78.0	94.0	60.8	61.8	84.6	76.6	77.4	66.9	72.7	80.9
% Scrapers	R = 0.177, p = 0.563	15.1	16.0	34.9	22.9	58.6	30.0	13.7	39.1	23.4	16.5	14.3	32.5	27.7
% Swimmers	R = -0.111, p = 0.719	17.9	12.8	17.9	18.4	18.1	19.2	6.1	11.8	18.0	9.0	12.0	22.1	14.2
% Tanytarsini	R = -0.171, p = 0.576	6.6	9.6	0.94	1.83	0.86	0	19.08	24.55	1.56	0.75	1.5	1.3	0

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.066, p = 0.831	3.00	3.00	3.50	2.00	2.50	2.50	2.50	2.50	3.50	2.50	2.50	3.50	3.50
Abundance per m2	R = -0.487, p = 0.091	1.04	0.96	0.32	1.88	0.39	0.68	0.29	0.42	0.58	0.59	0.31	0.42	0.39
% Brook Trout	**R = -0.675, p = 0.011**	58.3	55.1	26.5	5.2	6.9	2.0	10.8	4.9	21.0	4.1	9.6	24.8	29.8
% Tolerant	**R = 0.675, p = 0.011**	41.7	44.9	73.5	94.8	93.1	98.0	88.5	95.1	79.0	95.9	90.4	75.2	70.2
% Sculpins	-	0	0	0	0	0	0	0	0	0	0	0	0	0

Fish

Cumulative list of fish species (with abundance) collected in the unnamed tributary to Edgemont Reservoir by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	110	61	83	182	146	238	102	179	130	194	114	112	79
Brook Trout	I	155	76	30	10	11	5	14	10	37	9	13	40	34
Brown Trout	M	-	-	-	-	-	-	1	-	-	-	-	-	-
Creek Chub	T	1	1	-	2	2	9	13	17	9	19	9	9	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Edgemont Reservoir by sampling year.

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in the unnamed tributary to Edgemont Reservoir by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the unnamed tributary to Edgemont Reservoir.

Order (Common)	*Species*
Anura (Frogs and Toads)	American Bullfrog, Eastern American toad, Northern green frog, Pickerel frog

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Long-tailed salamander, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Northern watersnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the unnamed tributary to Edgemont Reservoir by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	0.9	0.8	0.9	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	0.9	-	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	3.8	1.6	1.9	2.8	0.9	-	1.5	-	-	0.8	1.5	2.6	5.7
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	0.9	-	-	-	0.9	-	-	-	-	1.4
Arthropoda	Decapoda	Cambaridae	na	I	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	0.8	-	-	0.6	1.4
Arthropoda	Diptera	Chironomidae	Cardiocladius	T	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	1.9	1.6	-	2.8	-	0.8	0.8	-	2.3	1.5	1.5	-	1.4
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	0.8	-	-	-	0.8	-	-	-	-	-	1.3	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	1.9	-	-	0.9	-	-	3.8	-	3.1	2.3	6.0	-	1.4
Arthropoda	Diptera	Chironomidae	Micropsectra	I	6.6	0.8	-	1.8	0.9	-	8.4	22.7	1.6	-	-	0.6	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	2.8	-	-	-	-	0.8	-	1.5	0.6	1.4
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	4.8	-	-	-	-	-	-	1.6	1.5	-	-	0.7
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	-	2.3	1.3	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	0.8	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2010 RA	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	-	-	-	-	-	1.8	-	-	2.3	-	1.4
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	-	-	-	0.8	1.5	3.8	-	1.4
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	1.8	-	-	0.8	0.6	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	4.0	1.9	3.7	-	12.5	11.5	0.9	1.6	2.3	5.3	3.9	3.5
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	8.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	0.9	-	-	-	10.7	-	-	0.8	0.8	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	2.3	0.8	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	12.3	-	12.3	10.1	6.0	9.2	9.9	-	10.9	4.5	11.3	1.9	5.7
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	8.0	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	0.8	-	2.8	-	-	0.8	-	-	-	0.8	3.9	-
Arthropoda	Diptera	Tipulidae	Tipula	M	0.9	-	-	0.9	-	-	-	-	-	-	0.8	0.6	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	9.4	1.6	5.7	12.8	5.2	4.2	3.8	3.6	1.6	1.5	-	0.6	2.1
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	0.9	-	-	-	0.8	-	-	0.8	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	0.9	0.8	-	0.9	4.3	5.0	-	1.8	8.6	-	0.8	13.6	1.4
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	0.9	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	0.9	4.2	-	-	0.8	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	7.5	5.6	-	-	3.4	5.0	-	0.9	5.5	4.5	10.5	5.8	7.8
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	4.7	1.8	3.4	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	6.6	-	-	-	-	-	-	-	-	1.5	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	4.7	11.2	25.5	8.3	53.4	21.7	8.4	24.5	20.3	12.8	9.8	28.6	17.7

					2000	2001	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	2.4	1.9	0.9	1.7	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	1.9	1.8	-	-	-	-	-	-	0.8	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	1.6	4.7	1.8	0.9	-	1.5	5.5	1.6	1.5	-	1.9	2.8
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	3.2	0.9	0.9	-	0.8	-	-	-	-	0.8	-	-
Arthropoda	Hemiptera	Corixidae	na	M	-	-	-	-	-	-	-	-	-	0.8	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	0.9	-	-	-	-	0.7
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	-	-	-	0.6	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	5.6	7.5	15.6	2.6	7.5	4.6	7.3	1.6	11.3	1.5	1.3	2.1
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	10.4	-	0.9	-	-	0.8	-	0.9	4.7	-	3.0	6.5	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	5.6	-	-	-	-	1.5	-	-	2.3	3.8	-	7.8
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	22.6	10.4	4.7	0.9	10.3	0.8	8.4	-	19.5	25.6	11.3	3.2	16.3
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	3.8	0.9	-	-	1.5	2.7	-	-	-	0.6	0.7
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	3.8	6.4	0.9	15.0	10.7	7.3	-	9.0	3.0	2.6	2.8
Arthropoda	Plecoptera	Peltoperlidae	Peltoperla	I	-	1.6	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	0.9	1.8	0.9	-	1.5	1.8	0.8	-	1.5	0.6	0.7
Arthropoda	Plecoptera	Perlidae	na	I	2.8	4.0	-	1.8	-	-	-	-	-	0.8	-	1.3	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	-	-	-	0.8	-	-	-	-	0.8	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	0.9	0.9	-	-	-	-	1.5	0.8	-	1.4
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.9	-	-	-	-	-	-	-	0.8	-	0.8	0.6	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	3.8	8.0	5.7	1.8	-	1.7	1.5	-	4.7	5.3	5.3	8.4	5.0
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	0.9	-	-	-	-	0.8	-	0.9	1.6	-	0.8	1.3	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	0.8	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	-	-	-	-	0.8	0.6	1.4
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	0.8	0.9	-	-	-	1.5	-	0.8	-	-	-	-

					2000	*2001*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	0.8	-	-	-	-	0.6	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	1.6	2.8	-	1.7	4.2	0.8	-	-	1.5	0.8	1.3	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	0.8	3.8	8.3	1.7	4.2	3.8	13.6	2.3	1.5	1.5	1.3	2.1

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Fifteenmile Creek (FIMI-207-S)

Site FIMI-207-S is located on Fifteenmile Creek in the Highlands region of Maryland. It is in the Fifteen Mile Creek watershed in Allegany County. This site was sampled from 2000 to 2020.

Fifteenmile Creek in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	87.74	87.36	87.37	87.34	84.98	84.96	86.32
Urban	5.38	5.38	5.38	5.38	5.38	5.38	5.38
Agriculture	6.10	6.04	6.06	6.03	5.98	6.54	6.50
Other	0.78	1.21	1.18	1.24	3.65	3.11	1.79

Water Chemistry

Water chemistry measurements collected at Fifteenmile Creek (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.099, p = 0.670	7.09	7.10	7.28	7.14	7.01	7.36	7.19	6.97	7.20	7.25	7.12	7.26
Specific Conductance (µS/cm)	R = -0.319, p = 0.159	57.2	56.9	81.9	50.0	49.3	57.0	57.0	48.6	53.1	65.4	53.0	51.2
Acid Neutralizing Capacity (µeq/L)	R = 0.158, p = 0.493	167.8	174.2	255.5	141.0	124.6	225.3	186.1	122.9	166.7	258.9	149.0	137.1
Dissolved Organic Carbon (mg/L)	R = -0.123, p = 0.596	2.200	0.900	1.500	1.200	0.900	1.100	1.223	1.440	1.055	0.815	1.492	1.379
Chloride (mg/L)	R = 0.004, p = 0.986	2.58	2.48	4.86	2.47	1.75	2.07	2.79	2.25	2.40	3.76	2.96	2.65
Sulfate (mg/L)	**R = -0.732, p < 0.001**	9.02	8.79	11.78	9.51	8.38	8.72	10.03	8.96	8.81	9.59	8.67	8.59
Total Nitrogen (mg/L)	R = 0.210, p = 0.361	0.326	0.430	0.286	0.372	0.661	0.387	0.220	0.641	0.420	0.109	0.385	0.445
Nitrate-Nitrogen (mg/L)	R = 0.271, p = 0.235	0.1960	0.4020	0.2560	0.3010	0.5460	0.3264	0.1996	0.5240	0.3498	0.0425	0.2822	0.3326
Nitrite-Nitrogen (mg/L)	**R = 0.717, p < 0.001**	0.0002*	0.0006*	0.0004*	0.0004*	0.0012	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.041, p = 0.859	0.0154*	0.0020*	0.0026	0.0020*	0.0020*	0.0037	0.0020*	0.0028	0.0045	0.0025	0.0023	0.0027
Total Phosphorus (mg/L)	R = 0.202, p = 0.380	0.0060	0.0050*	0.0050	0.0070	0.0090	0.0049*	0.0037*	0.0097	0.0037*	0.0058*	0.0086	0.0078
Ortho-phosphate (mg/L)	**R = 0.912, p < 0.001**	0.0001*	0.0007*	0.0007*	0.0007*	0.0007*	0.0007*	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	**R = 0.778, p = 0.023**												
Magnesium (mg/L)	R = -0.161, p = 0.730										1.993		
Calcium (mg/L)	R = 0.642, p = 0.120										4.240		
Copper (µg/L)	**R = -0.772, p = 0.042**												
Zinc (µg/L)	R = -0.373, p = 0.409												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.13	7.04	7.20	7.05	7.40	7.30	7.22	6.96	7.21
Specific Conductance (µS/cm)	54.6	47.0	55.1	52.3	58.6	54.5	57.7	49.8	49.3
Acid Neutralizing Capacity (µeq/L)	241.3	148.0	169.6	149.0	248.3	233.5	218.1	173.4	181.3
Dissolved Organic Carbon (mg/L)	1.395	1.316	1.176	1.459	1.240	1.536	1.190	1.006	1.211
Chloride (mg/L)	2.18	2.65	3.22	3.82	3.23	2.33	2.93	2.40	2.42
Sulfate (mg/L)	8.43	8.16	8.06	8.16	8.25	7.77	7.92	6.75	7.34
Total Nitrogen (mg/L)	0.387	0.465	0.486	0.569	0.195	0.366	0.405	0.641	0.531
Nitrate-Nitrogen (mg/L)	0.2911	0.4405	0.4189	0.4909	0.1381	0.2742	0.3705	0.6204	0.4897
Nitrite-Nitrogen (mg/L)	0.0010*	0.0011*	0.0011*	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0031	0.0021	0.0029	0.0020*	0.0022	0.0026*	0.0026*	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0109	0.0080*	0.0078*	0.0053	0.0032	0.0044*	0.0044*	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0011*	0.0011*	0.0026	0.0030*	0.0030*	0.0031*	0.0031*	0.0032*	0.0032*
Bromide (mg/L)		0.0066	0.0063	0.0068	0.0059	0.0066	0.0075	0.0179*	0.0179*
Magnesium (mg/L)			1.946	1.786	1.985	2.149	1.991	1.906	1.774
Calcium (mg/L)			3.502	3.297	3.964	3.952	4.076	3.353	6.605
Copper (µg/L)			1.005	0.424	0.180	0.258	0.193	0.140	0.156
Zinc (µg/L)			0.788	2.726	0.809	0.588	0.300*	0.598	1.078

Physical Habitat

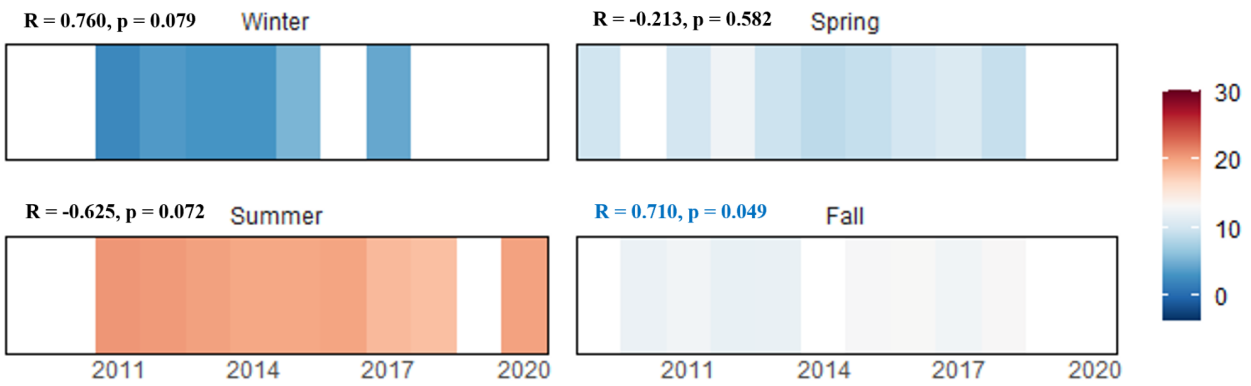
Physical habitat measurements collected at Fifteenmile Creek (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	R = -0.240, p = 0.294	15	11	11	11	13	10	10	9	8	10	10	15	12	17	11	10	9	10	11	9	9
Epifaunal substrate (0-20)	R = -0.338, p = 0.134	10	11	11	10	16	10	13	8	9	11	10	17	11	12	8	7	10	10	10	8	8
Velocity/Depth Diversity (0-20)	R = 0.272, p = 0.232	9	5	5	8	10	8	11	9	9	10	6	15	10	15	9	7	8	9	11	11	7
Pool Quality (0-20)	R = 0.248, p = 0.278	8	6	10	9	10	7	11	9	8	8	6	15	8	15	9	8	8	9	11	11	9
Riffle Quality (0-20)	R = 0.069, p = 0.768	11	5	11	8	15	9	12	12	12	13	8	20	8	16	8	6	8	12	15	12	8
Shading (%)	**R = -0.495, p = 0.022**	50	50	65	60	60	76	65	60	65	70	40	55	65	60	40	30	40	65	40	30	50
Embeddedness (%)	**R = -0.492, p = 0.023**	5	10	15	20	20	30	30	0	0	0	10	5	30	15	0	0	0	0	0	0	0
Discharge (cfs)	R = 0.260, p = 0.255	0.55	0.1	0.09	0.22	3.05	0.4	1.6	2.47	5.06	2.09	0.13	8.72	0.79	2.56	0.13	0.41	0.05	3.99	9.59	1.79	0.20
Stream Area (m2)	R = 0.222, p = 0.334	316.9	253.1	241.9	223.1	322.5	241.9	286.9	286.9	318.8	189.4	251.3	446.3	386.3	427.5	328.1	298.1	330.0	352.5	324.8	294.8	181.9

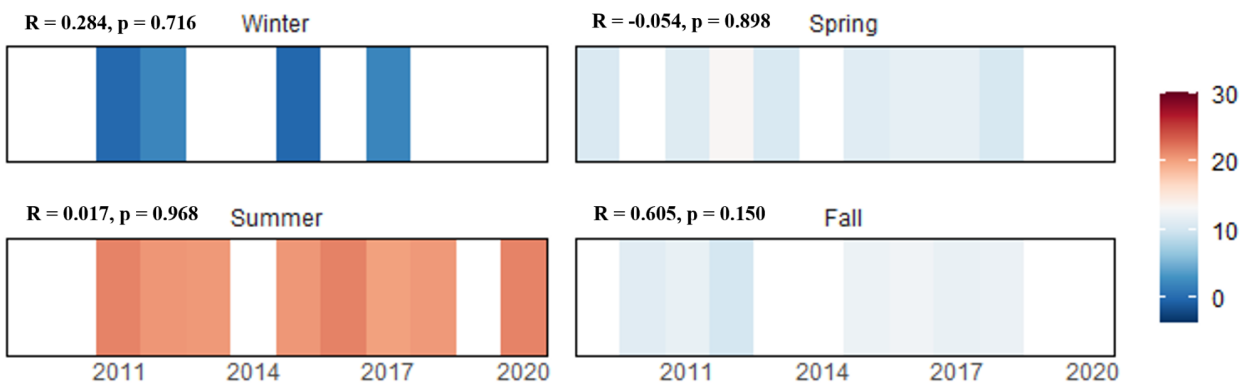
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Fifteenmile Creek (only calculated for summers missing no less than 2 weeks of data).

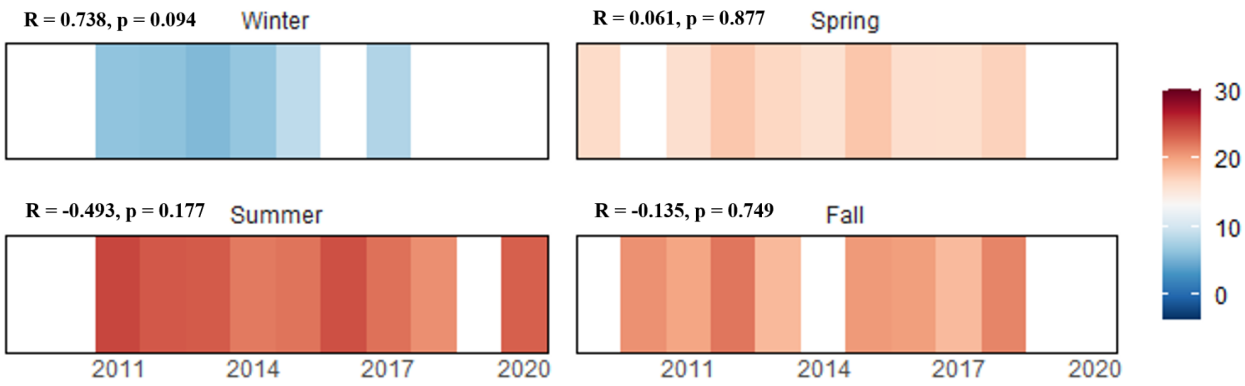
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = -0.490, p = 0.181	-	-	-	-	-	-	-	-	-	-	-	55.8	60.0	52.3	49.5	46.2	42.3	21.9	18.8	-	57.4
% above 24°C	R = -0.322, p = 0.398	-	-	-	-	-	-	-	-	-	-	-	11.0	7.2	3.3	0.6	2.8	7.8	0.3	0.2	-	7.7



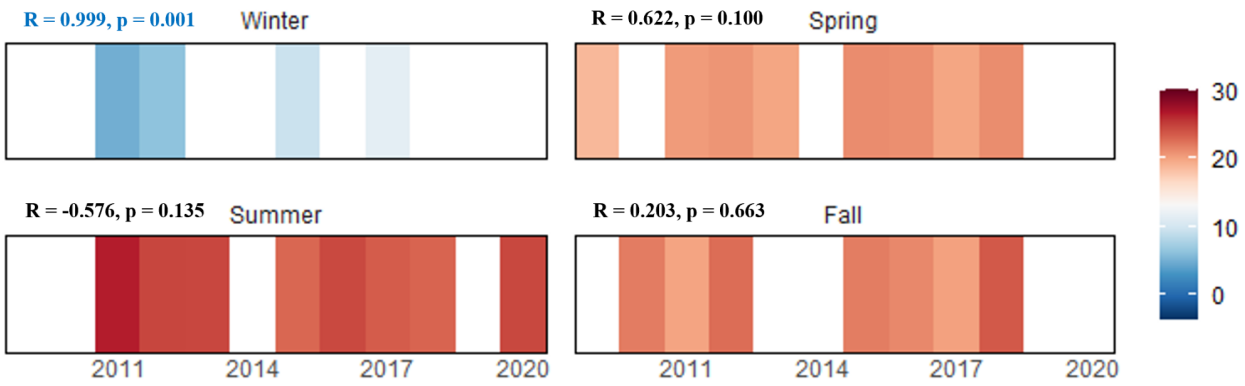
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Fifteenmile Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Fifteenmile Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Fifteenmile Creek (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Fifteenmile Creek (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.005, p = 0.983	3.75	3.75	3.75	4.25	4.00	4.00	3.75	4.25	4.00	4.50	3.75	3.50	4.00	4.00	3.75	3.00	3.00	4.75	4.00	4.25	4.00
# Taxa	**R = 0.563, p = 0.008**	16	19	24	21	18	19	21	17	19	20	20	19	15	21	24	23	17	38	34	22	32
# Ephemeroptera Taxa	R = 0.364, p = 0.105	6	5	4	8	7	8	6	5	5	7	6	4	5	11	6	4	4	13	9	8	9
# EPT Taxa	**R = 0.514, p = 0.017**	11	13	12	16	12	15	15	11	13	17	13	13	12	18	15	13	10	24	20	14	23
% Diptera	**R = 0.495, p = 0.022**	27.1	29.1	25.5	26.4	8.5	28.8	37.6	21.4	33.0	23.2	32.7	31.8	22.8	27.0	67.0	62.5	63.4	25.0	42.1	30.2	42.3
% Intolerant Urban Taxa	R = -0.112, p = 0.629	85.6	93.6	47.1	89.6	94.9	80.2	90.6	93.8	84.5	99.1	93.8	97.3	98.3	93.9	84.8	84.8	97.0	70.4	69.3	81.4	70.7
% Scrapers	R = 0.012, p = 0.959	5.9	15.5	18.6	12.0	53.4	18.0	7.7	16.1	20.4	27.8	31.9	10.9	47.4	28.7	10.2	8.9	6.9	25.0	19.3	20.2	17.9
% Swimmers	R = -0.273, p = 0.231	18.6	13.6	4.9	28.0	17.8	28.8	6.0	15.2	19.4	27.8	1.8	6.4	8.8	25.2	3.4	4.5	2.3	21.3	10.5	19.4	6.5
% Tanytarsini	R = -0.032, p = 0.890	3.4	3.6	2.0	12.0	3.4	0	0.9	7.1	2.9	0.9	11.5	14.6	0.9	0	3.4	2.7	6.9	6.5	3.5	3.1	1.6

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	**R = -0.671, p = 0.001**	5.00	5.00	5.00	5.00	4.67	4.67	4.67	4.67	4.67	4.67	5.00	3.67	4.67	4.67	4.67	4.00	4.33	4.33	4.33	4.33	4.33
Abundance per m2	**R = -0.724, p < 0.001**	2.49	3.58	3.44	1.58	2.4	2.96	1.37	1.87	1.58	3.1	1.6	0.08	1.47	2.58	1.74	1.04	0.58	1.01	0.46	0.66	0.87
# Benthic Sp. (Adjusted)	R = -0.323, p = 0.153	1.11	1.11	1.48	1.11	1.11	1.48	1.48	1.85	1.48	1.85	1.48	1.11	1.85	1.48	1.48	1.11	1.11	1.11	1.11	0.74	0.74
% Tolerant	**R = 0.609, p = 0.003**	34.9	35.7	19.7	20.1	11.5	31.8	24.6	25.3	28.0	24.7	38.0	44.4	28.5	29.6	48.3	63.9	48.4	59.7	24.3	43.4	48.7
% Generalists/ Omnivores/ Invertivores	**R = 0.629, p = 0.002**	38.6	40.3	21.7	22.4	14.6	34.8	25.9	25.9	29.0	25.3	39.5	44.4	34.3	31.4	51.7	68.4	54.7	63.3	27.7	48.5	56.3

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Insectivores	R = -0.116, p = 0.617	34.1	45.6	42.0	55.2	61.4	49.4	65.2	60.2	66.6	67.9	53.1	55.6	61.3	67.8	43.4	25.2	41.1	34.7	71.6	50.0	34.8
% Abundance of Dominant Sp.	R = 0.255, p = 0.265	27.2	24.0	36.1	34.6	44.5	39.5	40.4	43.6	54.9	48.5	32.8	38.9	42.6	57.0	31.4	28.4	34.2	29.1	57.4	45.9	39.2

Fish

Cumulative list of fish species (with abundance) collected in Fifteenmile Creek by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	215	211	83	34	17	50	29	67	91	75	79	4	52	38	137	88	58	59	18	68	62
Blue Ridge Sculpin	I	-	-	1	-	-	-	31	1	-	1	-	-	6	-	-	-	-	-	-	-	-
Bluntnose Minnow	T	23	5	28	26	43	85	63	40	19	29	32	10	66	225	72	50	20	104	10	6	-
Central Stoneroller	I	208	125	300	79	182	111	33	75	19	40	29	-	25	9	27	17	8	4	1	3	13
Chain Pickerel	M	-	2	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Creek Chub	T	28	85	43	5	24	82	5	21	21	34	26	1	32	59	64	52	10	45	7	11	14
Creek Chubsucker	M	-	-	-	2	-	-	-	-	-	1	-	-	1	-	-	-	-	-	-	-	-
Fallfish	I	-	-	-	3	-	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Fantail Darter	M	56	164	92	68	106	52	59	62	39	52	40	5	77	106	61	12	9	13	18	8	8
Green Sunfish	T	1	-	-	3	-	1	-	1	-	-	-	-	-	1	2	6	1	-	-	-	-
Greenside Darter	M	48	32	17	5	25	19	8	16	3	15	16	-	10	10	5	7	4	21	3	-	-
Longnose Dace	M	29	35	10	2	15	14	4	3	5	2	5	-	2	4	4	3	4	-	4	10	11
Northern Hogsucker	I	-	4	-	-	2	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-
Potomac Sculpin	M	165	217	239	122	345	283	159	234	276	285	132	14	241	628	179	59	65	90	85	90	47

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Rainbow Darter	M	-	-	-	-	-	-	-	10	17	46	26	1	13	3	3	-	-	-	-	-	-
Redbreast Sunfish	M	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rock Bass	M	-	3	6	-	7	6	1	-	-	-	1	-	30	14	15	11	8	13	1	-	1
Smallmouth Bass	M	8	-	2	-	4	-	2	-	3	-	1	-	-	-	1	3	-	3	-	-	1
Tessellated Darter	T	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
White Sucker	T	9	22	10	3	5	9	-	7	10	7	16	1	11	3	1	2	3	5	1	-	1

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Fifteenmile Creek by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	D	D	D	N	D
Cambarus sp.	N	N	D	N	N	N	N	N	N	N	N	N	N	N	N
Faxonius obscurus	N	D	D	D	D	D	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Fifteenmile Creek by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Fifteenmile Creek.

Order (Common)	*Species*
Anura (Frogs and Toads)	American bullfrog, Eastern American toad, Gray treefrog, Northern green frog, Pickerel frog
Caudata (Salamanders and Newts)	Northern dusky salamander, Northern two-lined salamander, Red-spotted newt
Squamata (Snakes and Lizards)	Northern black racer, Northern ring-necked snake, Northern watersnake
Testudines (Turtles)	Eastern snapping turtle, Wood turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Fifteenmile Creek by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Branchiobdellida	na	na		-	-	-	-	-	-	-	-	-	-	0.9
Annelida	Haplotaxida	Naididae	na	T	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	2.9	-	-	-	-	-	-	-	0.9
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Athericidae	Atherix	I	-	-	3.9	-	-	-	6.0	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	2.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	0.8	-	-	-	-	1.0	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	3.4	3.6	-	11.2	3.4	-	0.9	7.1	2.9	0.9	11.5
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	0.9	2.9	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	4.0	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	1.0	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	2.7	3.9	0.8	0.8	2.7	2.6	-	-	-	0.9
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	2.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	1.7	13.5	-	0.9	8.7	-	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	1.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	2.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	0.9	1.8	-	0.9	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	0.9	1.9	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	13.6	20.0	7.8	8.0	-	11.7	25.6	9.8	16.5	21.3	20.4
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	0.8	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	9.3	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	1.7	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	0.9	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	1.6	-	-	-	-	-	0.9	1.8
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	2.5	-	-	-	-	2.7	1.7	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	0.8	1.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	1.7	4.5	-	2.4	0.8	1.8	1.7	-	-	-	0.9
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	8.5	12.7	-	23.2	16.9	10.8	3.4	13.4	9.7	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	1.0	-	-	10.8	-	-	8.7	25.9	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	1.0	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Penelomax	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	1.7	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	3.4	-	-	-	43.2	9.0	-	10.7	1.0	-	8.0
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	0.8	3.6	-	1.6	7.6	6.3	4.3	3.6	5.8	8.3	0.9
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	7.3	-	5.6	-	-	0.9	-	9.7	11.1	12.4
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	0.8	-	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	1.0	0.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	1.0	-	-	0.9	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	9.8	0.8	-	-	0.9	1.8	-	-	0.9
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	0.9	3.9	-	-	0.9	-	-	-	0.9	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	7.6	-	-	1.6	-	1.8	0.9	1.8	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	1.6	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	0.9	-	-	1.7	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	6.9	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	2.0	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	5.9	0.9	-	-	-	-	-	8.0	2.9	-	0.9
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	13.5	-	-	-	0.9	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	-	-	5.9	1.8	0.9	0.9	1.9	0.9	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	0.9	-	0.8	2.5	-	-	-	1.0	-	2.7
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	32.2	20.9	2.9	18.4	4.2	4.5	5.1	23.2	12.6	0.9	17.7
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	6.9	-	-	-	2.6	-	-	4.6	3.5
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	-	-	-	3.2	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Paranemoura	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	-	0.8	-	-	2.6	-	1.0	-	0.9
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	0.9	-	-	-	-	0.9	-	-	0.9	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	2.0	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.8	-	-	1.6	4.2	1.8	20.5	11.6	6.8	10.2	0.9
Arthropoda	Plecoptera	Perlodidae	na	I	1.7	4.5	-	3.2	-	-	-	0.9	1.0	0.9	3.5
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	8.2	4.9	0.8	-	-	13.7	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	-	-	-	-	-	1.0	4.6	7.1
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.8	2.7	20.6	-	-	0.9	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	-	-	0.9	-
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	5.9	1.8	-	3.2	-	-	0.9	0.9	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	0.9	-	0.9	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	0.9	-	-	0.9	0.9
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	-	-	-	-	1.0	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	3.9	0.8	0.8	-	-	-	1.0	1.9	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	0.8	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	-	0.9
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	1.0	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Branchiobdellida	na	na		-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	0.9	0.9	-	-
Arthropoda	Coleoptera	Elmidae	Stenelmis	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	1.8	-	0.8	-	-	2.8	2.6	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Athericidae	Atherix	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	1.6
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	0.9	-	-	-	-	0.8	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	3.5	-	-
Arthropoda	Diptera	Chironomidae	Diplocladius	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	0.9	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	14.5	0.9	-	3.4	2.7	6.9	4.6	3.5	2.3	0.8
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	3.5	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	0.9	-	-	-	1.8	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	0.8	-	0.8	2.8	4.4	2.3	4.1
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.9	-	-	0.8	0.9	-	-	2.6	4.7	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	4.2	-	-	6.5	2.6	5.4	-
Arthropoda	Diptera	Chironomidae	Potthastia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	0.8	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	1.9	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	0.8	-	0.8	1.9	-	0.8	0.8
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.9	-	-	-	-	0.8	-	0.9	1.6	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	12.7	21.9	25.2	55.9	49.1	52.7	2.8	16.7	10.1	27.6
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	0.9	-	1.9	-	-	3.3
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.9	-	-	-	-	-	-	-	-	2.4
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	-	-	-	-	0.9	0.9	0.8	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	0.8	2.7	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.9	0.9	2.6	-	4.5	1.5	0.9	-	-	2.4
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	4.6	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	1.7	2.5	-	-	2.8	4.4	7.8	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	0.9	-	-	-	0.9	3.5	3.1	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	0.9	-	-	-	0.9	-	-	0.8
Arthropoda	Ephemeroptera	Caenidae	Caenis	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	0.9	0.9	-	-	0.8	0.9	-	-	4.9
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	1.8	7.0	17.4	-	-	0.8	10.2	0.9	7.8	-
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	3.6	0.9	1.7	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Penelomax	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	0.9	-	3.9	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	4.5	36.0	4.3	-	-	5.3	4.6	3.5	3.1	0.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	1.8	7.9	13.9	5.1	4.5	-	13.0	5.3	14.7	3.3

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	1.7	-	1.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	0.8	-	-	-	2.6	2.3	2.4
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	0.9	2.5	-	-	0.9	1.8	-	3.3
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	0.9	0.8	-	-	-	2.6	-	0.8
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	-	-	-	0.9	1.8	0.8	3.3
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Isopoda	Asellidae	Caecidotea	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Odonata	Coenagrionidae	na	T	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	0.8	-	-	1.9	-	-	-
Arthropoda	Odonata	Gomphidae	Lanthus	I	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	0.9	-	-	-	-	0.8
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	2.3	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	1.8	0.9	-	0.8	0.9	0.8	-	3.5	7.0	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	2.8	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	-	0.8	0.9	0.8	3.7	-	-	0.8
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	-	-	0.9	-	-	2.6	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	2.7	0.9	-	-	-	-	2.8	-	5.4	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	20.9	7.0	-	1.7	3.6	18.3	7.4	3.5	-	-
Arthropoda	Plecoptera	Nemouridae	na	I	0.9	-	1.7	0.8	4.5	-	-	-	-	5.7
Arthropoda	Plecoptera	Nemouridae	Ostrocerca	I	0.9	0.9	-	-	-	0.8	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Paranemoura	I	-	-	-	-	-	-	-	-	-	1.6

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Plecoptera	Nemouridae	Prostoia	M	-	-	0.9	-	2.7	-	-	1.8	0.8	13.0
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	-	-	-	-	-	-	0.9	-	0.8
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Clioperla	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	12.7	10.5	12.2	4.2	2.7	4.6	1.9	2.6	7.0	2.4
Arthropoda	Plecoptera	Perlodidae	na	I	3.6	-	-	-	1.8	1.5	-	-	2.3	-
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	3.5	0.8	0.9	-	-	-	-	0.8
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	3.6	0.9	2.6	-	-	-	-	1.8	-	2.4
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	0.8	-	-	0.9	1.8	0.8	1.6
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	0.9	2.5	1.8	0.8	-	-	-	1.6
Arthropoda	Trichoptera	Philopotamidae	Chimarra	M	-	-	-	5.1	-	-	2.8	1.8	-	0.8
Arthropoda	Trichoptera	Philopotamidae	na	I	6.4	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	0.9	-	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Nyctiophylax	I	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	0.9	5.3	-	0.8
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	-	-	-	-	-	0.9	-	0.8	0.8
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	0.9	-	3.5	0.8	2.7	0.8	-	0.9	-	-
Platyhelminthes	Tricladida	Dugesiidae	Cura	M	-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Dugesiidae	na		-	-	-	-	-	-	-	-	-	-
Platyhelminthes	Tricladida	Planariidae	na	T	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

High Run (UMON-288-S)

Site UMON-288-S is located on High Run in the Highlands region of Maryland. It is in the Upper Monocacy River watershed in Frederick County. This site was sampled from 2000 to 2020.

High Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	100.00	100.00	99.95	99.95	100.00	100.00	100.00
Urban	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.05	0.05	0.00	0.00	0.00

Water Chemistry

Water chemistry measurements collected at High Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.020, p = 0.931	6.52	6.52	6.87	6.54	6.67	6.77	6.87	6.60	6.64	6.66	6.50	6.80
Specific Conductance (µS/cm)	R = -0.410, p = 0.065	20.5	23.7	24.8	20.0	22.1	21.7	24.0	22.0	25.4	22.7	23.3	22.1
Acid Neutralizing Capacity (µeq/L)	R = -0.095, p = 0.681	38.1	35.2	87.0	34.1	38.1	41.0	71.8	43.5	38.1	62.4	29.6	51.2
Dissolved Organic Carbon (mg/L)	R = -0.258, p = 0.259	1.600	0.700	1.200	1.400	0.800	0.651	0.725	0.765	0.973	0.762	0.805	0.796
Chloride (mg/L)	**R = -0.674, p = 0.001**	1.10	1.24	1.28	1.16	1.20	1.19	1.26	1.09	1.50	1.16	1.07	1.11
Sulfate (mg/L)	R = -0.202, p = 0.380	3.65	3.66	3.19	4.62	3.60	3.43	3.54	3.63	4.39	3.17	4.52	4.02
Total Nitrogen (mg/L)	R = 0.295, p = 0.195	0.265	0.399	0.277	0.366	0.265	0.337	0.247	0.353	0.359	0.256	0.381	0.407
Nitrate-Nitrogen (mg/L)	R = 0.148, p = 0.521	0.1630	0.3960	0.2270	0.3210	0.2410	0.2939	0.2021	0.2163	0.2030	0.1660	0.2688	0.2966
Nitrite-Nitrogen (mg/L)	**R = 0.626, p = 0.002**	0*	0.0004*	0.0016	0.0004*	0.0004*	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	**R = 0.608, p = 0.003**	0*	0.0020*	0.0037	0.0028*	0.0020*	0.0035	0.0030	0.0031	0.0052	0.0040	0.0021	0.0024
Total Phosphorus (mg/L)	R = -0.311, p = 0.170	0.0070	0.0100	0.0130	0.0100	0.0090	0.0105	0.0056	0.0078*	0.0087	0.0081	0.0073	0.0078*
Ortho-phosphate (mg/L)	**R = 0.651, p = 0.001**	0.0005*	0.0013*	0.0032	0.0007*	0.0030	0.0026	0.0007*	0.0011*	0.0031	0.0011*	0.0032	0.0011*
Bromide (mg/L)	R = 0.704, p = 0.051												
Magnesium (mg/L)	R = -0.246, p = 0.596										0.649		
Calcium (mg/L)	R = -0.008, p = 0.986										1.211		
Copper (µg/L)	R = -0.572, p = 0.180												
Zinc (µg/L)	R = 0.395, p = 0.381												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	6.67	6.72	6.74	6.51	6.79	6.67	6.65	6.55	6.66
Specific Conductance (µS/cm)	22.4	20.8	21.2	20.4	19.9	22.5	21.6	20.5	20.3
Acid Neutralizing Capacity (µeq/L)	50.7	43.6	42.9	51.8	41.3	54.1	46.1	35.7	43.2
Dissolved Organic Carbon (mg/L)	0.798	0.610	0.699	0.833	0.802	1.264	0.884	1.059	0.788
Chloride (mg/L)	1.132	1.094	0.978	1.027	1.011	1.031	0.948	1.004	0.969
Sulfate (mg/L)	3.85	3.72	3.67	3.60	3.76	3.71	3.39	3.25	3.25
Total Nitrogen (mg/L)	0.302	0.322	0.297	0.305	0.208	0.322	0.468	0.400	0.423
Nitrate-Nitrogen (mg/L)	0.2362	0.2427	0.2625	0.2113	0.1661	0.2687	0.2208	0.3716	0.3879
Nitrite-Nitrogen (mg/L)	0.0013	0.0011*	0.0011*	0.0011*	0.0006*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0023	0.0021	0.0026	0.0036	0.0031	0.0048	0.0035	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0086	0.008*	0.0078*	0.0082	0.0065	0.0071	0.0044*	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0041	0.0020	0.0033	0.0044	0.0030*	0.0031*	0.0039	0.0032*	0.0048
Bromide (mg/L)		0.0093	0.0077	0.0085	0.0096	0.0168	0.0073	0.0179*	0.0179*
Magnesium (mg/L)			0.690	0.855	0.589	0.726	0.674	0.643	0.715
Calcium (mg/L)			1.126	1.218	0.829	1.309	1.098	0.897	1.244
Copper (µg/L)			0.402	0.060*	0.086	0.154	0.100*	0.084	0.086
Zinc (µg/L)			1.777	2.109	2.209	1.143	1.039	1.905	3.943

Physical Habitat

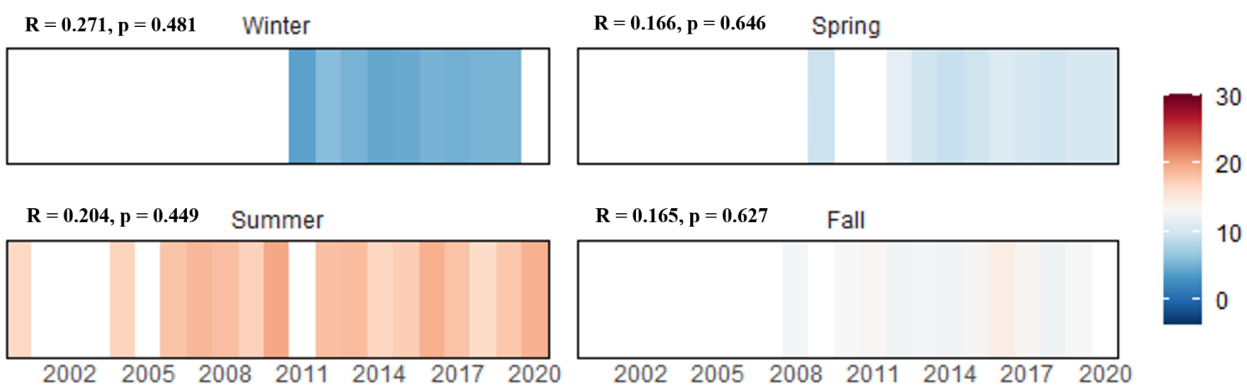
Physical habitat measurements collected at High Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.553, p = 0.009**	17	18	18	17	17	17	18	18	18	18	19	19	15	16	17	16	15	17	15	16	16
Epifaunal substrate (0-20)	R = 0.385, p = 0.085	18	16	18	16	19	18	18	18	18	18	15	16	18	18	19	19	19	19	18	19	18
Velocity/Depth Diversity (0-20)	R = 0.261, p = 0.253	14	10	10	11	16	15	15	10	10	10	15	15	15	10	14	16	10	12	16	15	14
Pool Quality (0-20)	R = -0.274, p = 0.230	17	15	13	14	16	16	18	10	10	10	12	15	15	10	13	15	10	16	12	12	15
Riffle Quality (0-20)	R = 0.089, p = 0.701	17	15	17	16	17	16	19	18	15	14	16	16	15	15	14	18	17	18	17	17	17
Shading (%)	R = -0.297, p = 0.192	95	85	92	95	95	98	95	90	85	85	70	75	95	95	80	90	90	80	85	90	90
Embeddedness (%)	**R = -0.667, p = 0.001**	20	20	20	35	20	25	35	25	25	25	15	15	10	5	5	5	10	5	15	20	5
Discharge (cfs)	**R = 0.647, p = 0.002**	1.11	0.28	0.46	0.84	1.48	0.89	1.44	0.58	0.4	1.6	1.85	1.05	1.71	0.82	2.21	5.15	1.25	3.56	6.07	1.22	3.92
Stream Area (m2)	R = 0.260, p = 0.254	181.9	230.6	185.6	174.4	251.3	251.3	226.9	187.5	153.8	163.1	262.5	146.3	225.0	223.1	230.6	277.5	210.0	238.1	257.3	176.3	240.0

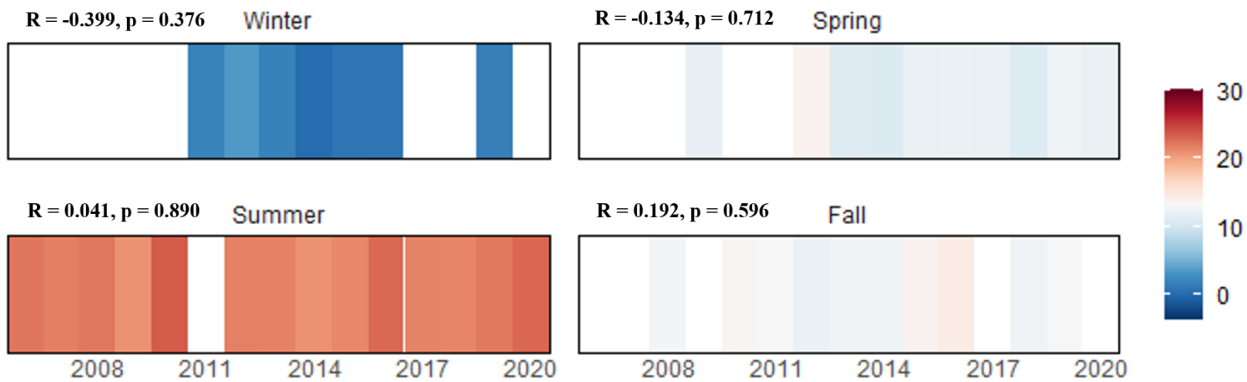
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at High Run (only calculated for summers missing no less than 2 weeks of data).

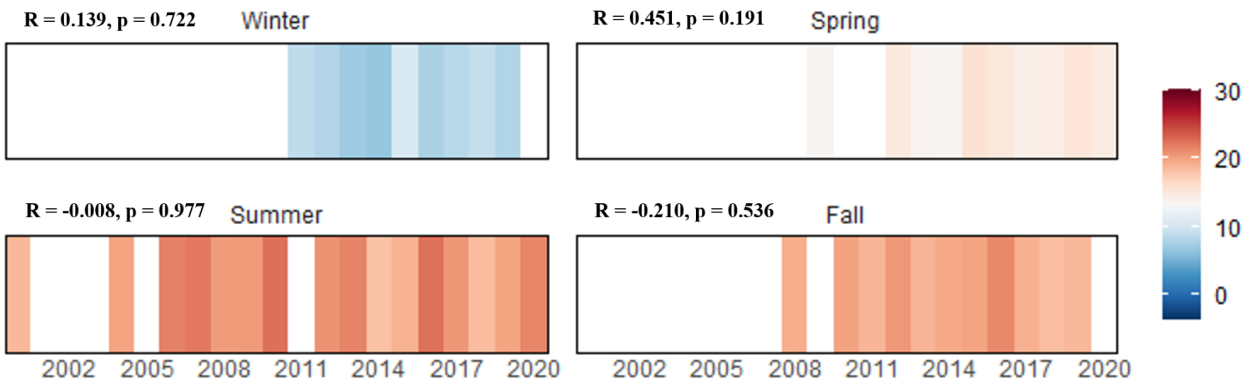
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.197, p = 0.464	0	-	-	-	5.8	-	15.1	27.0	14.2	9.8	49.5	-	23.7	18.0	0	0	46.0	11.5	0	6.6	47.1
% above 24°C	R = -0.129, p = 0.634	0	-	-	-	0	-	0	0.5	0	0	2.1	-	0	0	0	0	0	0	0	0	0



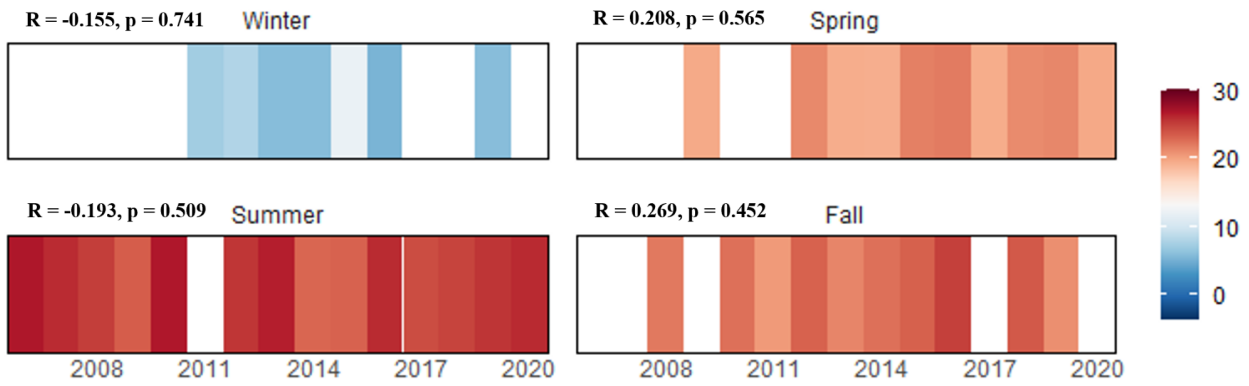
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at High Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at High Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at High Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at High Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.125, p = 0.589	4.50	4.50	4.50	4.75	4.00	4.75	3.50	4.75	4.50	4.75	4.50	4.75	4.50	4.50	4.25	4.75	4.75	4.75	4.25	4.50	4.50
# Taxa	**R = 0.689, p = 0.001**	23	17	18	28	17	22	21	26	25	23	27	26	20	27	28	33	24	28	25	30	33
# Ephemeroptera Taxa	**R = 0.476, p = 0.029**	7	5	5	4	5	5	4	6	7	6	6	5	7	6	6	6	5	6	5	8	9
# EPT Taxa	**R = 0.686, p = 0.001**	14	13	10	15	12	14	12	15	15	14	19	18	14	17	15	18	15	17	14	20	20
% Diptera	**R = 0.445, p = 0.043**	4.1	10.2	12.0	17.8	12.7	23.6	29.9	17.2	13.9	22.7	20.4	24.6	10.8	14.1	38.3	22.2	27.0	21.9	30.3	6.7	27.6
% Intolerant Urban Taxa	**R= -0.704, p < 0.001**	87.7	95.4	94.9	89.0	74.6	85.4	92.3	87.1	89.8	81.5	82.5	86.0	83.8	75.2	82.6	82.5	80.9	81.6	76.5	79.9	67.5
% Scrapers	R = 0.176, p = 0.445	17.2	24.1	39.3	21.2	15.9	17.9	24.8	21.6	17.6	32.8	6.8	23.7	35.1	29.8	29.6	38.1	27.8	28.1	11.8	22.4	30.1
% Swimmers	**R = -0.564, p = 0.008**	55.7	50.9	33.3	31.4	38.1	33.3	30.8	39.7	23.2	30.3	28.2	14.9	36.9	31.4	11.3	17.5	20.9	21.1	37.0	39.6	18.7
% Tanytarsini	R = -0.091, p = 0.695	0.8	6.5	6.0	6.8	4.0	16.3	0	1.7	0	10.1	1.0	10.5	0.9	1.7	2.6	6.4	9.6	0.9	5.0	1.5	5.7

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	-	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Abundance per m2	R = -0.296, p = 0.192	0.23	0.72	0.16	0.13	0.27	0.20	0.16	0.29	0.25	0.12	0.05	0.03	0.03	0.02	0.10	0.09	0.25	0.05	0.05	0.48	0.20
% Brook Trout	-	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
% Tolerant	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
% Sculpins	-	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Fish

Cumulative list of fish species (with abundance) collected in High Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Brook Trout	I	41	167	30	23	67	51	36	54	39	19	12	5	6	5	23	26	53	12	13	42	48

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in High Run by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus Bartonii	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in High Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near High Run.

Order(Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Gray tree frog, Northern green frog, Northern spring peeper, Pickerel frog, Wood frog
Caudata (Salamanders and Newts)	Eastern red-backed salamander, Jefferson salamander, Marbled salamander, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander, Red-spotted newt, Spotted salamander
Squamata (Snakes and Lizards)	Northern ring-necked snake, Timber rattlesnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in High Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Branchiobdellida	na	na		1.6	-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	7.4	2.8	17.9	6.8	-	10.6	10.3	6.0	1.9	0.8	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	7.7	0.8	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	0.8	-	0.8	-	0.9	0.9	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Decapoda	Cambaridae	Cambarus	I	0.8	-	-	-	-	-	1.7	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	0.9	-	1.0
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	-	-	-	0.9	-	1.7	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	1.7	-	0.8	2.6	2.6	-	0.8	2.9
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.8	-	2.6	1.7	2.4	-	0.9	3.4	-	2.5	6.8
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	0.8	6.5	4.3	4.2	4.0	16.3	-	0.9	-	-	1.0
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	1.9	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	0.8	-	-	0.9	-	0.9	-	1.0

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	-	-	-	-	-	1.7	-
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	-	-	0.8	-	3.3	0.9	1.7	3.7	-	1.0
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	0.8	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	0.9	1.7	-	-	-	-	-	8.4	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	0.9	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	1.7	0.8	-	-	0.9	-	-	1.0
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	3.7	-	2.5	-	-	22.2	2.6	0.9	6.7	4.9
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	-	-	0.9	0.9	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	0.9	-	-	1.6	-	-	-	0.8	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	-	0.9	0.8	2.4	0.8	-	-	2.8	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.7	0.8	2.4	-	0.9	3.4	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	-	-	-	-	-	-	4.2	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	4.6	1.7	-	-	-	-	-	-	0.8	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	6.6	-	-	-	13.5	7.3	-	1.7	-	1.7	1.9
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	36.9	41.7	22.2	20.3	17.5	23.6	24.8	12.1	18.5	-	17.5
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	-	-	19.8	-	16.8	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	0.8	1.0
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	4.1	-	-	-	-	4.9	6.0	3.4	5.6	2.5	-
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	3.3	7.4	5.1	2.5	15.1	1.6	6.0	5.2	5.6	14.3	2.9
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	13.0	8.5	9.3	-	-	-	4.3	-	11.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	2.5	-	-	-	-	-	-	-	2.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	0.9	-	1.0
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	0.8	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	4.6	-	5.9	6.3	-	6.0	6.0	2.8	2.5	5.8
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	11.5	-	9.4	5.1	0.8	1.6	-	-	0.9	4.2	2.9
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.8	-	-	-	1.6	2.4	1.7	-	0.9	0.8	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	0.8	-	-	0.8	2.4	1.6	0.9	0.9	-	3.4	1.0
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	2.5	3.7	1.7	2.5	4.8	6.5	-	1.7	7.4	-	2.9
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	-	6.5	0.8	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	2.5	-	-	-	-	-	0.9	3.4	4.6	0.8	4.9
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	2.9
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	2.5	-	-	-	2.6	-	-	2.9
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	0.9	-	-	-	-	0.9	-	-	0.8	1.0
Arthropoda	Plecoptera	Perlidae	na	I	-	-	-	0.8	0.8	0.8	0.9	0.9	-	-	1.9
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	-	-	-	-	-	-	-	-	-	-	2.9
Arthropoda	Plecoptera	Perlodidae	na	I	4.1	1.9	4.3	4.2	2.4	4.1	1.7	2.6	2.8	3.4	3.9
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	0.9	-	-	2.4	-	-	-	-	1.0
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	6.6	1.9	5.1	13.6	11.1	5.7	4.3	7.8	16.7	2.5	9.7
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	-	-	7.1	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	2.8	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	2.5	0.9	3.4	0.8	-	0.8	0.9	-	3.7	0.8	8.7
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	0.8	-	-	-	-	1.9	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	0.8	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	-	-	1.0
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	0.9	-	0.8	3.2	-	0.9	0.9	0.9	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	0.9	-	0.8	-	-	1.7	0.9	-	2.5	1.0
Nematomorpha	Gordioidea	Gordiidae	na	M	-	0.9	-	1.7	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Branchiobdellida	na	na		-	-	-	-	-	-	-	-	-	-
Annelida	Haplotaxida	Naididae	na	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Crangonyctidae	Stygobromus	M	-	-	-	-	-	-	-	-	-	0.8
Arthropoda	Coleoptera	Elmidae	na	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	2.6	2.7	0.8	2.6	7.1	1.7	11.4	2.5	3.7	5.7
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	1.7	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Collembola	Isotomidae	na	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	1.7	-	0.8	0.7	0.8
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Chaetocladius	T	-	-	-	0.9	-	-	-	-	-	0.8
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cladotanytarsus	M	-	-	-	-	0.8	-	-	0.8	0.7	0.8
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	2.6	-	3.3	7.0	4.8	7.8	2.6	8.4	-	9.8
Arthropoda	Diptera	Chironomidae	Limnophyes	T	-	0.9	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Micropsectra	I	10.5	0.9	1.7	1.7	4.8	9.6	-	4.2	-	4.1
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	1.7	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	0.9	2.4	-	3.5	0.8	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	0.9	-	-	0.9	-	-	1.6
Arthropoda	Diptera	Chironomidae	Parakiefferiella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	1.8	0.8	0.9	0.8	-	2.6	2.5	0.7	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.9	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Pseudorthocladius	M	-	-	-	-	-	-	0.9	-	0.7	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.9	-	-	-	-	1.8	0.8	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	0.7	0.8
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Sympotthastia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	0.9	0.8	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	0.9	-	-	-	-	-	3.3
Arthropoda	Diptera	Chironomidae	Tvetenia	M	0.9	-	1.7	0.9	0.8	0.9	0.9	2.5	0.7	2.4
Arthropoda	Diptera	Chironomidae	Zavrelimyia	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Dixidae	Dixa	M	-	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	na	T	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Neoplasta		-	-	-	-	0.8	-	-	-	-	0.8
Arthropoda	Diptera	Simuliidae	Prosimulium	I	5.3	6.3	2.5	19.1	0.8	5.2	5.3	6.7	-	2.4
Arthropoda	Diptera	Simuliidae	na	M	-	-	-	-	0.8	-	0.9	-	-	-
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	1.7	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	3.5	-	-	1.7	0.8	0.9	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	0.9	-	0.8	-	1.6	-	0.9	1.7	0.7	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Diptera	Tipulidae	na	M	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.9	2.7	-	-	-	-	-	-	-	0.8
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	2.5	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	1.8	11.7	13.2	0.9	1.6	6.1	-	5.0	12.7	1.6
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	0.9	-	0.7	0.8
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	1.6
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	-	15.3	12.4	8.7	4.8	11.3	9.6	24.4	13.4	12.2
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	6.1	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	-	2.7	8.3	3.5	7.1	-	3.5	-	3.0	8.1
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	17.5	27.9	18.2	20.0	17.5	23.5	7.0	5.0	11.9	10.6
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	0.9	-	-	-	-	0.9	0.8	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	0.9	3.2	0.9	-	-	2.2	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	-	-	-	-	-	0.8	0.7	1.6
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	6.1	6.3	2.5	0.9	10.3	3.5	10.5	6.7	12.7	1.6
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	4.9
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	-	0.9	0.8	-	0.8	-	-	0.8	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Capniidae	na	M	7.0	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	0.9	-	-	-	-	-	-	-	-	0.8
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	0.8	-	0.8	-	-	-	3.7	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	4.4	-	-	1.7	-	0.9	0.9	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.8	3.3	7.0	3.2	1.7	1.8	4.2	7.5	1.6
Arthropoda	Plecoptera	Leuctridae	na	I	0.9	0.9	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	-	0.9	-	-	0.8	0.9	-	-	0.7	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	1.8	-	0.8	-	1.6	1.7	0.9	0.8	0.7	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	0.9	-	-	-	1.6	-	1.8	-	1.5	2.4
Arthropoda	Plecoptera	Perlidae	na	I	0.9	-	0.8	0.9	2.4	-	2.6	0.8	2.2	0.8
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	1.8	4.5	3.3	-	1.6	3.5	-	0.8	4.5	2.4
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.8	0.8	-	-	-	0.9	2.5	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	1.8	-	-	0.9	0.8	-	-	0.8	-	0.8
Arthropoda	Plecoptera	Taeniopterygidae	Oemopteryx	I	4.4	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	1.8	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	0.8	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	8.8	2.7	9.1	8.7	4.8	9.6	14.0	9.2	2.2	1.6
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	2.5	0.9	0.8	1.7	0.9	-	0.7	2.4
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	0.9	1.8	1.7	-	2.4	2.6	-	-	0.7	2.4
Arthropoda	Trichoptera	Limnephilidae	na	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	0.9	-	5.2	2.4
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	0.8	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	1.8	-	0.8	-	0.8	-	-	-	-	-

					2011	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Psychomyiidae	Lype	M	-	-	-	-	-	-	-	-	0.7	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	1.8	-	0.9	-	0.9	2.6	0.8	1.5	1.6
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	3.5	-	1.7	2.6	3.2	-	4.4	1.7	-	2.4
Nematomorpha	Gordioidea	Gordiidae	na	M	-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Mill Run (PRLN-626-S)

Site PRLN-626-S is located on Mill Run in the Highlands region of Maryland. It is in the Lower North Branch Potomac River watershed in Allegany County. This site was sampled from 2000 to 2020.

Mill Run in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	98.56	98.56	97.80	97.80	98.56	98.56	98.56
Urban	1.44	1.44	1.44	1.44	1.44	1.44	1.44
Agriculture	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other	0.00	0.00	0.76	0.76	0.00	0.00	0.00

Water Chemistry

Water chemistry measurements collected at Mill Run (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.283, p = 0.214	7.56	7.67	7.16	7.59	7.46	7.51	7.93	7.64	7.76	7.76	7.95	7.64
Specific Conductance (µS/cm)	R = -0.255, p = 0.265	89.5	100.0	106.6	90.0	100.8	102.7	135.6	104.4	109.5	96.5	135.6	93.3
Acid Neutralizing Capacity (µeq/L)	R = 0.077, p = 0.739	544.9	544.0	489.4	446.6	423.8	529.6	968.2	622.9	691.2	593.5	1027.4	577.2
Dissolved Organic Carbon (mg/L)	R = 0.182, p = 0.429	1.000	0.900	1.600	1.100	0.900	0.940	0.784	0.876	0.960	0.888	0.832	1.070
Chloride (mg/L)	**R = -0.837, p < 0.001**	0.95	1.14	1.38	1.04	1.09	1.15	1.11	0.96	1.09	0.91	0.83	0.81
Sulfate (mg/L)	**R = -0.637, p = 0.002**	13.17	12.19	13.21	13.29	11.48	11.41	10.63	11.84	11.94	12.93	10.45	11.87
Total Nitrogen (mg/L)	R = -0.229, p = 0.319	0.576	0.972	2.049	1.253	2.252	1.506	1.056	1.058	0.906	0.689	0.652	0.727
Nitrate-Nitrogen (mg/L)	R = -0.189, p = 0.411	0.4430	0.8410	1.8880	1.1410	1.9740	1.6512	0.8619	0.9309	0.7685	0.5257	0.4946	0.5959
Nitrite-Nitrogen (mg/L)	R = 0.398, p = 0.074	0.0003 *	0.0022 *	0.0016	0.0004 *	0.0059	0.0019*	0.0019 *	0.0011 *	0.0019 *	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	R = -0.393, p = 0.087	0.0161	0.0115	0.0043	0.0040	0.0077		0.0044	0.0034	0.0095	0.0066	0.0065	0.0031
Total Phosphorus (mg/L)	R = -0.078, p = 0.736	0.0110	0.0190	0.0170	0.0190	0.0190	0.0193	0.0120	0.0144	0.0183	0.0273	0.0243	0.0099
Ortho-phosphate (mg/L)	R = 0.215, p = 0.349	0.0065	0.0098	0.0112	0.0107	0.0141	0.0109	0.0096	0.0092	0.0112	0.0115	0.0063	0.0075
Bromide (mg/L)	**R = 0.840, p = 0.009**												
Magnesium (mg/L)	R = 0.258, p = 0.577										1.848		
Calcium (mg/L)	R = 0.303, p = 0.508										12.629		
Copper (µg/L)	R = -0.732, p = 0.061												
Zinc (µg/L)	R = -0.729, p = 0.063												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.72	7.67	7.65	7.70	7.70	7.55	7.76	7.55	7.68
Specific Conductance (µS/cm)	117.7	91.2	90.1	90.3	90.5	73.5	103.9	94.1	94.8
Acid Neutralizing Capacity (µeq/L)	925.9	582.9	528.7	582.8	536.4	349.2	699.5	569.2	635.8
Dissolved Organic Carbon (mg/L)	0.900	0.611	1.375	2.091	1.095	1.828	1.030	0.775	1.023
Chloride (mg/L)	0.83	0.80	0.78	0.78	0.86	0.76	0.80	0.66	0.74
Sulfate (mg/L)	10.47	12.42	11.65	12.03	12.01	11.32	10.23	9.12	9.87
Total Nitrogen (mg/L)	0.765	0.570	0.782	0.833	0.734	0.911	1.147	1.777	1.006
Nitrate-Nitrogen (mg/L)	0.6100	0.5502	0.7095	0.6824	0.6714	0.7819	1.0191	1.7226	0.9600
Nitrite-Nitrogen (mg/L)	0.0021	0.0011*	0.0016	0.0011*	0.0040*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0062	0.0031	0.0046	0.0036	0.0035	0.0043	0.0035	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0184	0.0109	0.0182	0.0228	0.0183	0.0153	0.0121	0.0173	0.0136
Ortho-phosphate (mg/L)	0.0123	0.0086	0.0099	0.0109	0.0111	0.0077	0.0114	0.0158	0.0112
Bromide (mg/L)		0.0029	0.0021	0.0040*	0.0041	0.0064	0.0047	0.0179*	0.0179*
Magnesium (mg/L)			1.743	1.911	1.856	1.686	2.043	1.950	1.793
Calcium (mg/L)			12.180	13.150	12.020	9.570	15.210	12.760	13.640
Copper (µg/L)			0.572	0.165	0.069	0.166	0.100*	0.046	0.056
Zinc (µg/L)			0.741	1.447	0.502	0.357	0.300*	0.461	0.064*

Physical Habitat

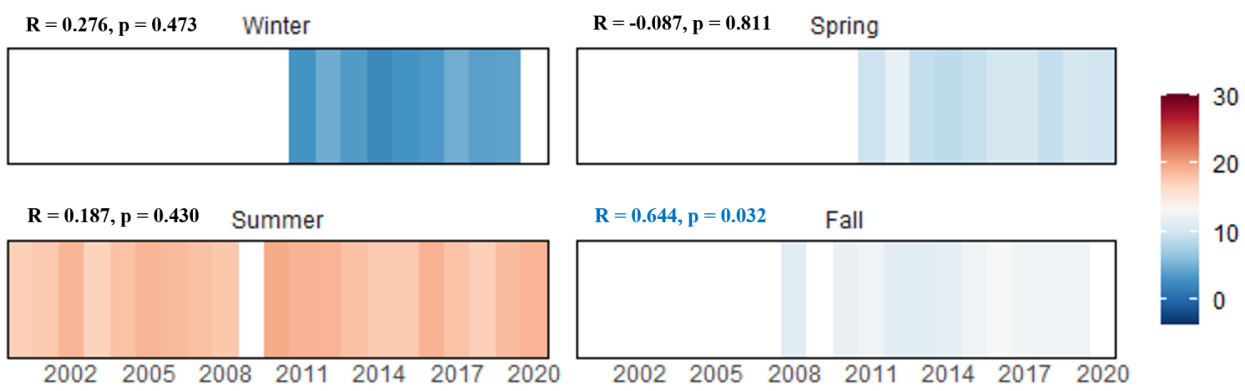
Physical habitat measurements collected at Mill Run (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.652, p = 0.001**	17	18	16	18	16	16	15	18	18	18	12	13	18	14	17	15	11	15	11	13	12
Epifaunal substrate (0-20)	R = 0.191, p = 0.406	17	18	16	14	16	16	12	18	19	19	14	14	19	16	16	19	17	18	16	16	18
Velocity/Depth Diversity (0-20)	R = -0.318, p = 0.160	16	10	10	10	10	10	10	10	10	11	12	13	10	10	10	10	10	10	10	10	10
Pool Quality (0-20)	**R = -0.687, p = 0.001**	16	15	10	12	14	10	10	11	10	13	10	10	10	10	10	10	10	10	9	9	10
Riffle Quality (0-20)	R = -0.324, p = 0.152	17	16	14	16	15	15	15	17	13	15	13	13	15	15	9	17	15	15	11	15	15
Shading (%)	**R = -0.652, p = 0.001**	90	85	94	95	90	95	98	95	90	90	85	80	85	55	75	65	80	75	85	70	80
Embeddedness (%)	**R = -0.434, p = 0.049**	0	15	20	35	35	35	30	20	0	0	0	0	15	25	10	0	0	5	15	0	10
Discharge (cfs)	R = 0.246, p = 0.282	1.47	0.29	0.26	0.73	0.5	0.21	0.23	0.24	0.48	0.89	0.47	0.37	0.42	0.91	0.85	4.28	0.59	1.63	0.6	0.37	0.73
Stream Area (m2)	**R = 0.447, p = 0.042**	180.0	191.3	196.9	262.5	151.9	133.1	148.1	146.3	240.0	202.5	183.8	204.4	189.4	226.9	213.8	219.4	195.0	226.9	219.8	219.8	240.4

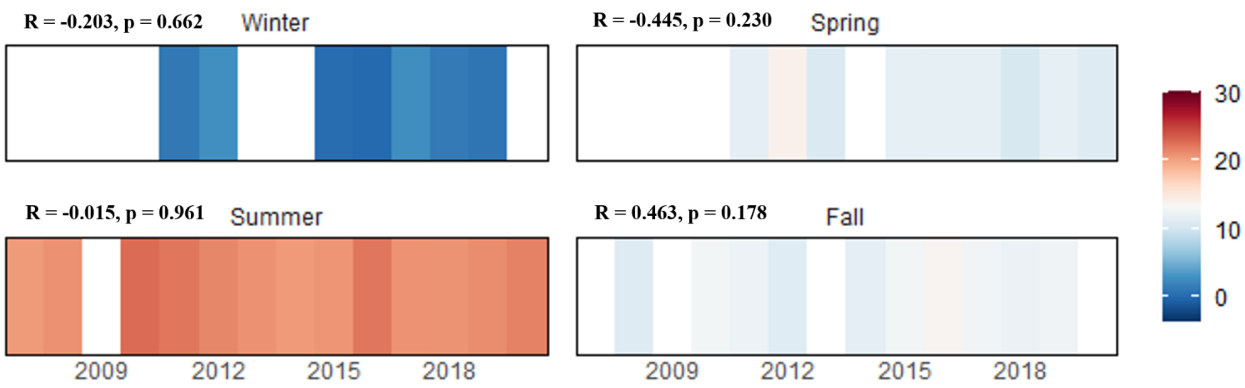
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at Mill Run (only calculated for summers missing no less than 2 weeks of data).

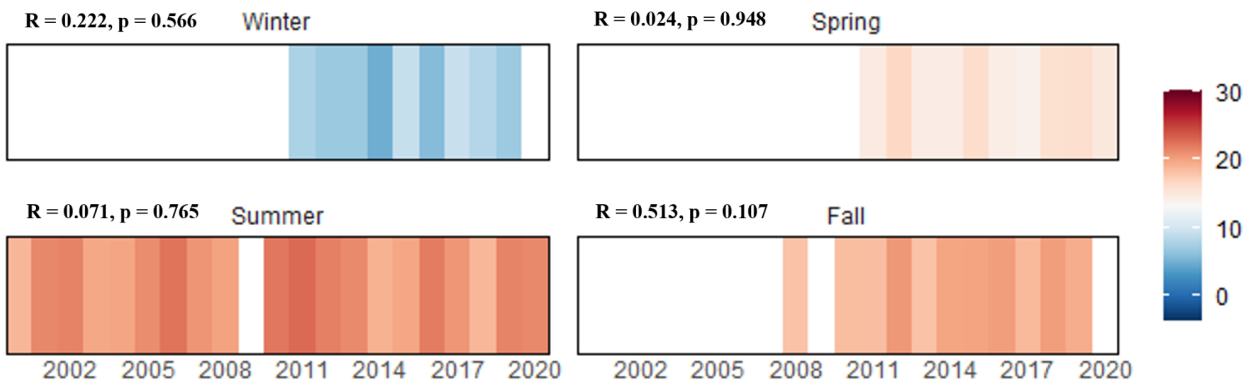
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.147 , p = 0.537	3.2	12.9	35.0	8.7	9.0	29.7	25.9	13.6	9.0	-	44.7	31.4	33.9	14.2	1.8	7.2	40.1	11.6	1.7	24.7	37.9
% above 24°C	R = 0.052, p = 0.829	0	0	0	0	0	0	0.3	0	0	-	0.4	1.1	0	0	0	0	0	0	0	0.2	0



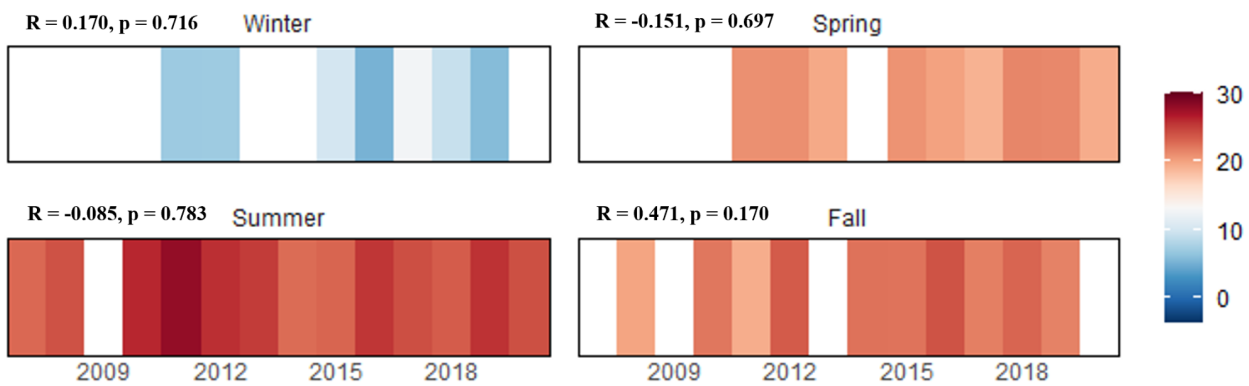
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Mill Run (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = 0.148, p = 0.522	5.00	4.25	4.50	5.00	4.00	4.50	4.00	3.75	4.25	5.00	5.00	4.50	4.75	4.75	4.00	4.75	4.75	4.50	5.00	4.50	4.50
# Taxa	R = 0.209, p = 0.364	24	21	28	29	18	24	23	22	28	32	31	22	24	25	22	28	25	26	32	25	24
# Ephemeroptera Taxa	R = 0.209, p = 0.363	6	5	6	9	4	5	6	5	9	9	8	6	10	5	4	6	6	7	9	7	7
# EPT Taxa	**R = 0.608, p = 0.003**	14	15	16	18	13	15	14	14	18	18	19	17	17	16	15	20	20	20	20	17	17
% Diptera	R = -0.337, p = 0.135	17.8	45.8	35.2	22.7	17.8	20.0	47.8	32.1	27.2	16.4	15.6	15.5	6.5	21.4	31.3	23.8	23.7	11.7	25.0	12.8	28.1
% Intolerant Urban Taxa	R = 0.098, p = 0.673	94.1	92.4	87.6	84.9	82.2	71.2	75.6	100	79.8	81.2	84.4	85.3	95.4	83.9	88.6	96.0	85.6	94.6	85.7	79.2	91.1
% Scrapers	R = 0.112, p = 0.628	20.3	12.7	10.5	20.2	35.6	10.4	17.8	18.9	7.9	21.3	14.8	24.1	40.7	17.9	19.1	21.4	19.5	20.7	17.1	24.8	11.6
% Swimmers	R = -0.349, p = 0.121	31.4	18.6	35.2	21.9	21.2	36.0	12.2	17.0	29.8	19.7	28.9	32.8	31.5	21.4	9.2	11.9	16.1	14.4	18.6	27.2	20.6
% Tanytarsini	R = -0.332, p = 0.141	8.5	6.8	23.8	4.2	2.5	9.6	25.6	0	7.0	8.2	4.4	2.6	1.9	2.7	8.4	12.7	5.9	0.9	7.9	2.4	4.1

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	R = 0.088, p = 0.706	3.50	3.50	3.50	4.00	3.50	3.50	4.00	3.00	4.00	4.00	4.00	4.00	3.00	3.50	3.50	3.50	3.50	3.50	3.50	4.00	4.00
Abundance per m2	**R = -0.709, p < 0.001**	1.01	1.55	1.37	0.80	1.42	0.97	0.70	0.90	0.56	0.40	0.44	0.47	1.00	0.84	0.76	0.51	0.58	0.24	0.47	0.65	0.41
% Brook Trout	R = -0.219, p = 0.340	15.4	12.1	5.9	29.2	44.7	40.3	28.8	9.9	34.8	27.5	20.0	14.4	1.1	1.0	0.6	10.8	4.4	9.1	7.8	32.9	32.7
% Tolerant	R = 0.411, p = 0.064	54.9	41.8	49.6	51.7	36.7	41.1	49.0	68.7	50.4	52.5	58.8	61.9	80.4	75.9	72.8	67.6	75.4	69.1	68.9	46.9	36.7
% Sculpins	R = -0.320, p = 0.157	29.7	46.1	44.4	19.1	18.6	18.6	22.1	21.4	14.8	20.0	21.3	23.7	18.5	23.0	26.5	21.6	20.2	21.8	23.3	20.3	30.6

Fish

Cumulative list of fish species (with abundance) collected in Mill Run by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	100	124	134	108	79	53	51	90	68	42	47	60	152	145	118	75	86	38	71	67	36
Blue Ridge Sculpin	I	54	137	120	40	40	24	23	28	20	16	17	23	35	44	43	24	23	12	24	29	30
Brook Trout	I	28	36	16	61	96	52	30	13	47	22	16	14	2	2	1	12	5	5	8	47	32

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in Mill Run by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	D	D	D	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Mill Run by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near Mill Run.

Order (Common)	*Species*
Anura (Frogs and Toads)	Eastern American toad, Northern green frog , Northern spring peeper, Pickerel frog
Caudata (Salamanders and Newts)	Allegheny mountain dusky, Eastern red-spotted newt, Northern dusky salamander, Northern spring salamander, Northern slimy salamander, Northern two-lined salamander, Seal salamander

Order (Common)	*Species*
Squamata (Snakes and Lizards)	Eastern gartersnake, Eastern ratsnake, Eastern fence lizard, Northern ring-necked snake, Northern watersnake, Timber rattlesnake
Testudines (Turtles)	Box turtle

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in Mill Run by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.8	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	0.8	-	0.8	-	-	-	-	2.2
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	0.8	-	1.9	0.8	-	0.8	-	1.9	-	-	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	0.8	-	-	-	-	-	1.1	1.9	0.9	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-	1.5
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	1.0	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	2.5	0.8	-	-	-	-	4.4	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	1.0	0.8	-	2.4	-	-	2.6	0.8	1.5
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	2.2	0.9	-	-	0.7
Arthropoda	Diptera	Chironomidae	Micropsectra	I	8.5	6.8	21.0	0.8	2.5	9.6	22.2	-	-	1.6	2.2
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	1.9	0.8	-	2.4	1.1	-	-	-	3.0
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	1.0	-	1.7	3.2	4.4	-	6.1	0.8	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	-	-	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Platysmittia	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	-	-	-	0.8	-	-	0.9	-	0.7
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	2.5	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	2.9	-	-	-	-	-	5.3	-	0.7
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	3.4	-	-	3.3	-	-	1.6	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	-	-	-	-	-	-	-	-	1.8	2.5	1.5
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	0.8	-	-	-	-	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	2.5	1.0	0.8	-	-	-	-	1.8	0.8	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	3.4	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	-	4.4	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	3.4	31.4	3.8	13.4	11.9	0.8	3.3	23.6	7.9	0.8	-
Arthropoda	Diptera	Simuliidae	Simulium	M	0.8	-	-	-	-	-	1.1	-	-	0.8	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.8	-	-	-	-	-	-	0.9	0.9	0.8	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.0	-	-	0.8	1.1	4.7	-	-	-
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	0.8	-	-	-	-	-	-	0.9	-	-	1.5
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	0.8	-	-	-	0.9	0.9	1.6	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	13.6	5.9	-	3.4	-	0.8	1.1	4.7	-	2.5	2.2
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	1.7	-	-	1.7	12.7	18.4	4.4	-	-	4.1	1.5
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	11.4	-	-	-	-	-	9.6	1.6	5.2
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	-	-	0.8	-	-	-	-	0.9	3.3	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	2.5	4.2	2.9	5.0	1.7	1.6	3.3	4.7	3.5	4.9	8.9
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	-	-	1.6	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	11.0	-	2.9	5.0	-	-	11.1	-	2.6	4.1	3.0
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	5.9	9.3	3.8	7.6	32.2	2.4	4.4	8.5	2.6	6.6	9.6
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	1.7	-	4.2	-	5.6	1.1	4.7	-	0.8	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	0.8	-	-	-	-	-	-	-	-	-	1.5
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	2.5	-	-	-	-	-	0.8	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	10.5	6.7	-	12.8	3.3	6.6	6.1	1.6	7.4
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	13.6	8.5	9.5	3.4	6.8	0.8	-	-	8.8	3.3	3.7
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	-	-	-	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	0.9	0.8	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	2.2	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.8	0.8	-	-	1.7	0.8	1.1	0.9	1.8	2.5	2.2
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	4.8	1.1	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	3.4	-	1.7	3.4	3.2	1.1	-	-	0.8	-
Arthropoda	Plecoptera	Leuctridae	na	I	1.7	-	-	-	-	11.2	-	-	6.1	4.9	9.6
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	11.0	5.9	6.7	11.8	-	1.6	4.4	16.0	14.0	18.0	8.1
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	na	I	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	-	2.5	-	-	-	-	-	0.9	-	-	0.7
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Plecoptera	Perlidae	na	I	0.8	-	1.9	0.8	1.7	0.8	1.1	4.7	1.8	2.5	2.2
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	5.1	1.7	1.9	1.7	5.9	0.8	4.4	0.9	1.8	-	0.7
Arthropoda	Plecoptera	Perlodidae	na	I	-	1.7	-	-	-	-	-	-	0.9	-	1.5
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	4.2	0.8	1.0	2.5	1.7	1.6	-	3.8	2.6	1.6	-
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	-	-	-	1.6	0.7
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	5.9	3.4	1.9	8.4	6.8	4.8	5.6	2.8	3.5	9.8	9.6
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	-	1.0	1.7	2.5	-	1.1	-	-	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	na		-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	0.8	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	0.8	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	-	-	-	-	-	-	-	-	-	0.7
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	1.0	-	-	-	-	-	-	0.8	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	1.7	-	-	1.7	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	1.7	1.9	1.7	3.4	1.6	-	1.9	-	3.3	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	0.8	-	-	-	0.7	-	-
Arthropoda	Amphipoda	Crangonyctidae	Crangonyx	M	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Amphipoda	Gammaridae	Gammarus	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Coleoptera	Elmidae	Optioservus	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Ectopria	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Decapoda	Cambaridae	Cambarus	I	-	-	-	-	1.6	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Ceratopogon	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Probezzia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	0.9	-	-	-	-	0.7	-	-
Arthropoda	Diptera	Chironomidae	Chironominae	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	0.9	-	0.9	2.3	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	0.8	-	-	-	-	-	0.7
Arthropoda	Diptera	Chironomidae	Micropsectra	I	1.7	0.9	2.7	6.1	12.7	3.4	0.9	4.3	2.4	1.4
Arthropoda	Diptera	Chironomidae	Microtendipes	M	-	-	-	-	-	-	-	-	0.8	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	-	-	0.9	-	-	0.8	0.9	1.4	2.4	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	0.8	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Platysmittia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellina	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	-	-	-	2.3	-	2.5	-	3.6	-	2.7
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	0.9	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	1.4
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	-	-	-	0.8	-	0.9	0.7	-	-
Arthropoda	Diptera	Empididae	Chelifera	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	11.2	0.9	11.6	19.1	7.1	16.1	8.1	12.9	4.0	19.9
Arthropoda	Diptera	Simuliidae	Simulium	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Simuliidae	Stegopterna	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	-	-	0.7	0.8	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	-	1.9	0.9	-	1.6	0.8	0.9	-	-	0.7
Arthropoda	Diptera	Tipulidae	Hexatoma	I	-	-	1.8	-	0.8	-	-	-	1.6	1.4
Arthropoda	Diptera	Tipulidae	Pedicia	M	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Diptera	Tipulidae	Pseudolimnophila	I	-	0.9	-	-	0.8	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	0.9	-	-	-	0.8	0.9	0.7	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	-	-	-	-	-	2.7
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	8.6	1.9	8.0	-	2.4	4.2	0.9	3.6	14.4	4.1
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	1.7	5.6	-	-	1.6	-	3.6	2.1	1.6	2.1
Arthropoda	Ephemeroptera	Baetidae	Heterocloeon	M	-	0.9	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	1.9	0.9	-	-	-	0.9	0.7	0.8	-
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	3.4	5.6	8.9	2.3	4.8	4.2	6.3	5.0	8.0	5.5
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	5.2	5.6	0.9	-	-	-	-	-	-	3.4
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	1.7	7.4	-	-	1.6	-	-	0.7	4.8	4.1

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	17.2	26.9	16.1	13.0	15.1	16.1	18.9	12.1	19.2	4.1
Arthropoda	Ephemeroptera	Heptageniidae	na	I	2.6	-	-	0.8	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	-	-	-	-	2.1
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	0.9	-	-	-	0.8	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Habrophlebia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	9.5	11.1	3.6	6.9	3.2	6.8	2.7	-	3.2	2.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	4.3	-	-	-	-	-	-	7.1	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	3.7	-	-	0.8	-	0.9	-	-	-
Arthropoda	Megaloptera	Sialidae	Sialis	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	na	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	3.1	-	3.4	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Alloperla	I	-	-	-	-	-	-	-	-	-	1.4
Arthropoda	Plecoptera	Chloroperlidae	na	I	0.9	2.8	-	0.8	0.8	0.8	0.9	-	1.6	0.7
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	0.9	-	1.8	-	3.2	1.7	4.5	0.7	13.6	2.1
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	-	-	-	-	0.7	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	6.9	4.6	11.6	6.9	8.7	5.9	25.2	12.9	4.8	19.9
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	na	I	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	1.9	-	-	1.6	2.5	0.9	1.4	0.8	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	0.9	-	1.8	1.5	0.8	1.7	1.8	0.7	-	2.1

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Perlidae	Eccoptura	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	0.9	-	0.9	0.8	3.2	1.7	-	2.9	3.2	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	0.9	1.9	3.6	-	4.0	1.7	3.6	2.9	1.6	2.1
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	-	1.5	-	-	-	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	1.7	-	3.6	3.8	3.2	1.7	-	1.4	1.6	4.1
Arthropoda	Plecoptera	Taeniopterygidae	Taeniopteryx	M	-	-	-	-	-	-	1.8	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Agapetus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Glossosomatidae	Glossosoma	I	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	0.9	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	7.8	6.5	8.9	16.0	9.5	11.9	9.0	10.0	5.6	5.5
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	3.4	-	0.9	2.3	-	1.7	0.9	0.7	0.8	0.7
Arthropoda	Trichoptera	Hydropsychidae	na	M	-	-	0.9	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	-	-	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	na		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Ironoquia	M	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	1.8	-	-	1.7	-	0.7	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	1.5	2.4	1.7	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Wormaldia	I	-	0.9	2.7	-	-	-	0.9	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	1.7	-	0.9	1.5	1.6	2.5	0.9	1.4	0.8	1.4
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	2.6	2.8	0.9	5.3	4.0	2.5	0.9	2.9	-	1.4

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Savage River (SAVA-225-S)

Site SAVA-225-S is located on the Savage River in the Highlands region of Maryland. It is in the Savage River watershed in Garrett County. This site was sampled from 2000 to 2020.

Savage River in spring 2020.

Land Use/ Land Cover

Percent land use/ land cover data (from NLCD) calculated for upstream catchment draining to this site.

Percent Land Type	*2001*	*2004*	*2006*	*2008*	*2011*	*2013*	*2016*
Forest	85.59	85.73	86.16	86.21	85.85	85.95	85.63
Urban	2.93	2.93	2.93	2.93	2.93	2.93	2.93
Agriculture	9.60	9.32	9.37	9.20	8.82	8.78	8.77
Other	1.88	2.02	1.54	1.66	2.40	2.35	2.67

Water Chemistry

Water chemistry measurements collected at the Savage River (2000 to 2020). *Below detection limit

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*
pH	R = 0.247, p = 0.281	7.26	7.22	7.21	7.11	7.40	7.44	7.47	6.93	7.50	7.18	7.57	7.35
Specific Conductance (µS/cm)	R = -0.074, p = 0.748	173.1	139.0	170.6	160.0	103.7	133.4	157.5	196.9	168.2	132.0	155.6	202.8
Acid Neutralizing Capacity (µeq/L)	R = 0.348, p = 0.122	157.6	132.8	135.3	116.7	123.1	233.2	211.8	105.3	211.2	157.0	226.3	160.4
Dissolved Organic Carbon (mg/L)	R = -0.105, p = 0.650	2.400	1.200	2.600	1.900	1.300	1.525	1.186	1.956	1.715	1.160	1.533	2.270
Chloride (mg/L)	R = -0.014, p = 0.951	36.09	23.03	29.69	35.06	16.42	24.74	29.87	40.90	32.84	22.19	27.61	42.63
Sulfate (mg/L)	**R = -0.795, p < 0.001**	11.61	10.40	12.28	11.52	10.09	10.87	10.97	10.78	11.14	10.74	10.28	10.39
Total Nitrogen (mg/L)	R= -0.136, p = 0.558	0.696	1.027	0.948	1.042	1.015	0.673	0.695	0.975	0.636	0.751	0.401	0.833
Nitrate-Nitrogen (mg/L)	R = -0.059, p = 0.799	0.4520	0.9170	0.8710	0.9950	0.7600	0.6214	0.5830	0.8870	0.5180	0.6633	0.3011	0.6244
Nitrite-Nitrogen (mg/L)	**R = 0.611, p = 0.003**	0*	0.0011*	0.0014	0.0004*	0.0020	0.0019*	0.0019*	0.0011*	0.0019*	0.0019*	0.0019*	0.0011*
Ammonia-Nitrogen (mg/L)	**R = 0.634, p = 0.002**	0*	0.0022*	0.0022	0.0020*	0.0039	0.0038	0.0050	0.0019	0.0058	0.0046	0.0023	0.0027
Total Phosphorus (mg/L)	R = 0.040, p = 0.863	0.0040	0.0050*	0.0140	0.0150	0.0070*	0.0067*	0.0106	0.0088	0.0037*	0.0145	0.0064	0.0140
Ortho-phosphate (mg/L)	**R = 0.876, p < 0.001**	0*	0.0007*	0.0007*	0.0007*	0.0007*	0.0007*	0.0007*	0.0011*	0.0011*	0.0011*	0.0011*	0.0011*
Bromide (mg/L)	R = -0.061, p = 0.886												
Magnesium (mg/L)	R= -0.715, p = 0.071										1.866		
Calcium (mg/L)	R = -0.440, p = 0.323										6.112		
Copper (µg/L)	R= -0.659, p = 0.108												
Zinc (µg/L)	R = -0.331, p = 0.469												

Water Chemistry continued

Parameter	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
pH	7.37	7.33	7.22	7.52	7.35	7.47	7.42	7.11	7.41
Specific Conductance (µS/cm)	98.1	374.8	211.2	118.9	146.1	104.9	113.9	143.8	111.6
Acid Neutralizing Capacity (µeq/L)	200.3	184.5	151.7	170.3	184.0	194.4	162.2	177.2	193.7
Dissolved Organic Carbon (mg/L)	1.853	0.192*	1.809	2.344	1.492	1.914	1.640	1.715	1.622
Chloride (mg/L)	16.412	101.245	49.231	21.641	28.187	16.453	19.587	27.540	19.762
Sulfate (mg/L)	9.77	11.29	9.93	9.95	10.04	9.28	9.29	7.66	8.66
Total Nitrogen (mg/L)	0.671	0.807	0.794	0.711	0.701	0.795	0.891	0.905	0.922
Nitrate-Nitrogen (mg/L)	0.5618	0.7538	0.6778	0.5710	0.6638	0.6556	0.6540	0.8987	0.8345
Nitrite-Nitrogen (mg/L)	0.0023	0.0011*	0.0023	0.0015	0.0004*	0.0022*	0.0022*	0.0052*	0.0052*
Ammonia-Nitrogen (mg/L)	0.0052	0.0032	0.0039	0.0047	0.0027	0.0057	0.0028	0.0084*	0.0084*
Total Phosphorus (mg/L)	0.0100	0.0080*	0.0078*	0.0096	0.0030*	0.0080	0.0101	0.0102*	0.0102*
Ortho-phosphate (mg/L)	0.0025	0.0011*	0.0028	0.0030*	0.0030*	0.0049	0.0031*	0.0032*	0.0032*
Bromide (mg/L)		0.0217	0.0138	0.0040*	0.0139	0.0130	0.0015*	0.0179*	0.0179*
Magnesium (mg/L)			2.078	1.971	2.102	1.812	1.557	1.597	1.840
Calcium (mg/L)			6.765	5.840	6.923	5.843	5.340	5.610	6.316
Copper (µg/L)			1.279	0.799	0.259	0.297	0.239	0.261	0.531
Zinc (µg/L)			2.201	6.014	0.996	1.470	0.861	1.557	2.679

Physical Habitat

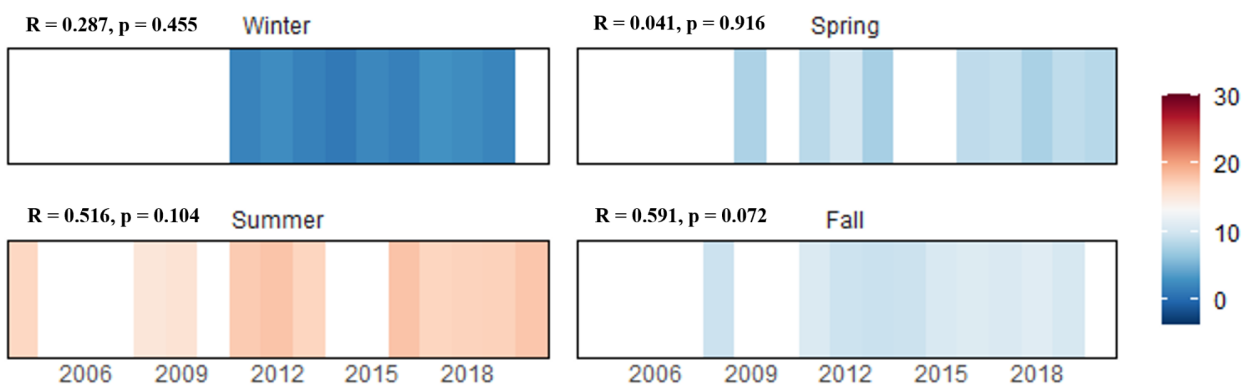
Physical habitat measurements collected at the Savage River (2000 to 2020). Scored parameters are on a 0 (worst) to 20 (best) scale.

Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Instream habitat (0-20)	**R = -0.690, p = 0.001**	19	18	19	19	17	17	19	18	17	17	17	18	16	17	18	17	18	17	16	16	16
Epifaunal substrate (0-20)	R = -0.154, p = 0.506	18	16	17	19	17	17	19	18	18	18	19	19	17	19	17	18	18	19	15	17	16
Velocity/Depth Diversity (0-20)	R= -0.414, p = 0.062	18	16	16	17	15	15	17	16	18	16	16	17	15	15	14	15	15	15	17	16	15
Pool Quality (0-20)	**R = -0.625, p = 0.002**	19	17	17	18	18	17	18	17	16	15	15	15	17	17	15	15	18	16	16	15	15
Riffle Quality (0-20)	R = -0.133, p = 0.564	18	18	20	18	17	18	18	18	17	16	17	17	17	17	18	18	18	19	18	17	18
Shading (%)	**R = -0.557, p = 0.009**	75	75	65	90	85	85	80	91	75	70	75	75	75	50	35	35	50	70	50	75	65
Embeddedness (%)	**R = -0.722, p < 0.001**	15	10	20	25	30	25	25	15	15	15	10	5	15	5	5	5	5	5	5	10	5
Discharge (cfs)	R = 0.231, p = 0.314	4.91	4.84	3.45	4.6	4.95	1.87	7.17	0.18	11.48	3.05	3.1	14.25	3.53	7.18	5.42	3.75	5.54	6.44	7.21	5.59	6.52
Stream Area (m2)	R = 0.280, p = 0.220	783.8	676.9	603.8	485.6	613.1	530.6	682.5	521.3	631.9	489.4	541.9	656.3	579.4	776.3	654.4	755.6	583.1	695.6	666.0	727.5	686.3

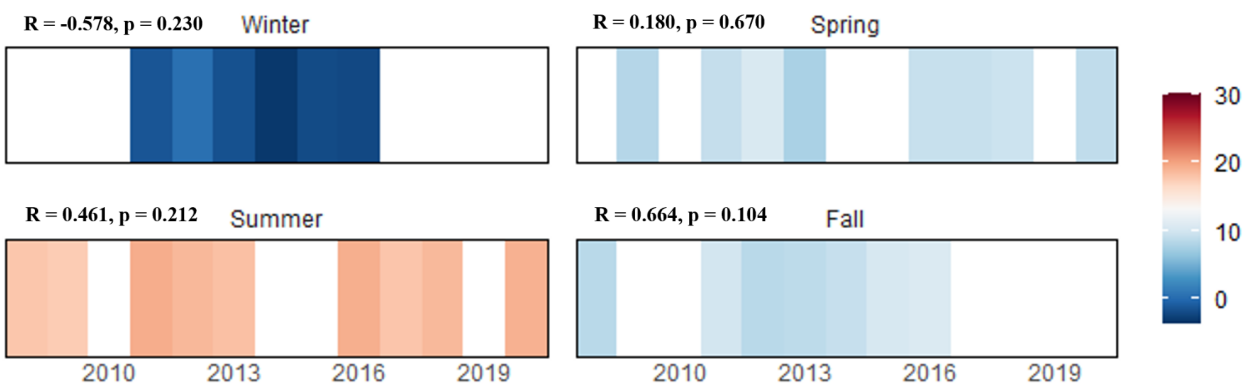
Temperature

Percentage summer water temperature readings falling above 20°C/above 24°C at the Savage River (only calculated for summers missing no less than 2 weeks of data).

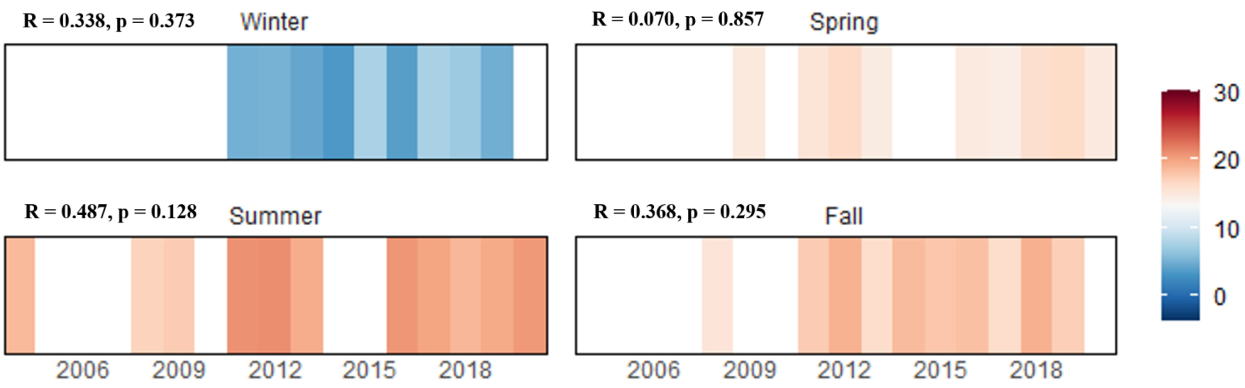
Parameter	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% above 20°C	R = 0.268, p = 0.426	-	-	-	-	0.5	-	-	-	0	0	-	14.8	17.1	0.8	-	-	14.8	3.7	1.5	3.2	12.1
% above 24°C	R = -0.089, p = 0.796	-	-	-	-	0	-	-	-	0	0	-	0	0.08	0	-	-	0	0	0	0	0



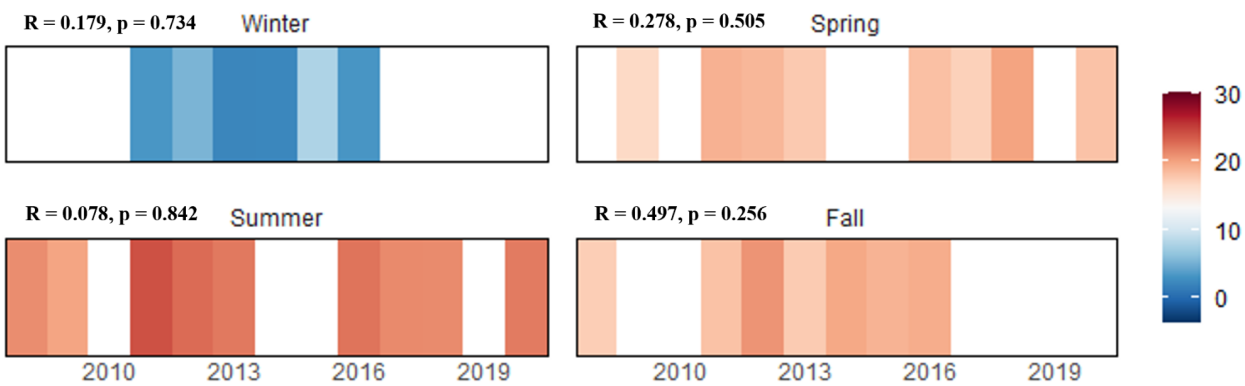
The graph above displays the average daily mean water temperatures (℃) by season calculated using data collected annually at Savage River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) by season calculated using data collected annually at Savage River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean water temperatures (℃) from the warmest week of each season calculated using data collected annually at Savage River (only calculated for seasons missing no less than 2 weeks of data).



The graph above displays the average daily mean air temperatures (℃) from the warmest week of each season calculated using data collected annually at Savage River (only calculated for seasons missing no less than 2 weeks of data).

Biology

Indexes of biotic integrity are scored on a 1 (very poor) to 5 (good) scale.

Benthic Index of Biotic Integrity (BIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
BIBI	R = -0.327, p = 0.148	4.75	3.50	4.25	4.25	4.25	4.75	4.50	4.75	4.50	4.00	4.25	4.50	4.00	4.25	4.25	4.25	4.00	4.25	3.75	4.50	3.50
# Taxa	R = -0.122, p = 0.599	29	19	18	33	25	27	28	31	35	27	21	31	23	31	22	26	21	31	23	27	19
# Ephemeroptera Taxa	R = 0.180, p = 0.434	10	4	8	9	7	9	9	8	10	7	9	8	10	9	8	7	7	11	10	9	7
# EPT Taxa	R = 0.230, p = 0.316	17	9	13	17	15	19	19	17	18	15	18	17	15	22	17	16	15	21	16	18	13
% Diptera	R = -0.049, p = 0.835	17.7	46.3	14.6	25.2	20.0	10.8	22.0	13.3	30.9	20.8	6.2	17.2	31.8	27.1	20.9	11.6	15.0	19.7	31.5	16.5	28.4
% Intolerant Urban Taxa	**R = -0.472, p = 0.031**	81.4	71.1	89.3	75.6	74.0	80.0	87.3	83.8	65.5	68.3	81.4	78.7	74.4	75.4	83.5	67.9	79.7	67.5	72.6	63.7	67.9
% Scrapers	R = -0.019, p = 0.935	14.7	7.4	6.8	5.9	12.0	20.8	13.6	14.3	13.6	9.9	35.4	27.9	26.4	18.6	6.1	8.0	15.9	6.8	8.1	13.2	7.3
% Swimmers	R = 0, p = 1	51.0	38.8	56.3	45.4	41.0	45.8	49.2	34.3	38.2	45.5	34.5	30.3	28.7	33.1	58.3	42.0	46.0	37.6	46.0	57.7	46.8
% Tanytarsini	R= -0.418, p = 0.059	3.9	6.6	10.7	0.8	2.0	1.7	0	1.9	8.2	0	0	3.3	2.3	3.4	2.6	2.7	0	3.4	0.8	0.6	0.9

Fish Index of Biotic Integrity (FIBI) and Influencing Metrics

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
FIBI	**R = -0.509, p = 0.019**	4.67	5.00	5.00	5.00	4.33	5.00	5.00	5.00	5.00	5.00	4.33	4.33	5.00	5.00	4.67	4.33	4.67	5.00	4.33	4.33	4.00
Abundance per m2	R = -0.332, p = 0.141	0.59	0.84	1.06	1.31	0.88	1.93	0.79	1.51	1.05	0.73	1.04	0.3	1.4	1.42	1.1	1.04	0.68	0.84	0.63	0.54	0.29
# Benthic Sp. (Adjusted)	R = -0.369, p = 0.099	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28	1.28
% Tolerant	R = 0.037, p = 0.874	21.2	19.3	24.4	19.1	26.1	16.6	15.9	22.7	26.6	24.7	30.6	22.1	20.2	25.2	30.5	29.3	19.6	21.4	24.9	23.5	10.2

Metric	*Pearson's Correlation Coefficients*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
% Generalists/ Omnivores/ Invertivores	R = 0.162, p = 0.483	52.3	47.5	56.9	55.3	67.4	60.0	55.8	59.0	56.7	60.4	68.7	58.5	53.0	57.0	66.8	69.0	53.9	57.3	61.3	64.0	45.9
% Insectivores	R = -0.149, p = 0.520	47.1	52.6	43.0	44.4	32.4	40.0	43.8	40.4	43.1	38.5	31.0	41.5	47.0	42.8	33.1	31.0	45.9	42.6	38.7	35.7	54.1
% Abundance of Dominant Sp.	R = 0.042, p = 0.856	34.8	37.4	35.2	33.5	24.1	33.9	36.4	29.9	34.0	32.3	29.4	34.4	32.5	32.3	23.5	24.9	38.6	34.7	30.6	29.3	48.0

Fish

Cumulative list of fish species (with abundance) collected in the Savage River by sampling year.

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Blacknose Dace	T	89	88	134	99	130	160	71	163	165	74	148	40	152	239	169	196	68	107	94	77	20
Blue Ridge Sculpin	I	161	213	225	213	127	331	195	235	225	115	139	67	264	356	167	173	154	203	129	115	94
Brook Trout	I	10	30	42	24	33	41	26	28	19	15	11	5	4	41	34	57	30	23	34	63	25
Brown Trout	M	3	-	-	1	1	-	-	1	1	-	-	-	-	-	1	-	1	1	-	1	-
Central Stoneroller	I	-	-	-	-	-	-	-	2	-	4	-	-	-	-	-	-	-	-	-	-	-
Common Shiner	I	-	1	-	-	1	4	5	11	-	-	-	-	-	5	2	2	-	-	-	-	-
Creek Chub	T	2	4	11	3	1	-	2	-	1	3	1	-	4	23	26	18	2	8	2	4	-
Cutlip Minnow	M	24	33	58	61	55	46	24	36	24	14	26	3	11	30	29	29	6	11	10	8	8
Fantail Darter	M	34	56	27	41	24	54	32	68	45	14	18	7	86	85	29	37	22	37	22	10	6
Longnose Dace	M	107	82	90	142	128	347	157	190	141	94	166	60	223	209	158	172	81	132	74	77	36
Northern Hogsucker	I	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Potomac Sculpin	M	23	30	23	28	24	25	8	14	15	8	18	7	32	31	42	34	7	9	12	15	6
Pumpkinseed	T	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-

Species	*Tolerance*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Rainbow Trout	M	-	-	1	1	-	-	2	2	1	-	2	-	-	2	-	-	-	-	-	-	-
River Chub	I	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Rosyside Dace	M	3	12	18	3	6	6	2	19	14	4	12	3	28	65	38	52	20	44	35	11	1
White Sucker	T	7	18	11	19	10	10	12	15	10	11	24	3	8	16	24	16	8	9	9	11	-
Yellow Perch	M	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

I indicates intolerant fish; M are moderately tolerant; and T are tolerant.

Crayfish

Cumulative list of crayfish species (with detected {D}/not detected {N} data) collected in the Savage River by sampling year

Species	*2006*	*2007*	*2008*	*2009*	*2010*	*2011*	*2012*	*2013*	*2014*	*2015*	*2016*	*2017*	*2018*	*2019*	*2020*
Cambarus bartonii	D	D	D	D	D	D	D	D	D	D	N	D	N	N	D
Faxonius obscurus	N	D	D	N	D	N	D	D	D	D	N	N	N	N	D

Mussels

Cumulative list of mussel species (with detected {D}/not detected {N} data) collected in Savage River by sampling year.

Species
None Observed

Herpetofauna

Cumulative list of herpetofauna species collected in or near the Savage River.

Order (Common)	*Species*
Anura (Frogs and Toads)	American toad, Fowler's toad, Northern green frog, Pickerel frog, Wood frog

Order (Common)	*Species*
Caudata (Salamanders and Newts)	Allegheny mountain dusky salamander, Eastern red-backed salamander, Eastern red-spotted newt, Jefferson salamander, Long-tailed salamander, Northern dusky salamander, Northern slimy salamander, Northern two-lined salamander, Spotted salamander
Squamata (Snakes and Lizards)	Eastern gartersnake, Eastern rat snake, Northern ringneck snake, Northern watersnake, Timber rattlesnake

Benthic Macroinvertebrates

Cumulative list of benthic macroinvertebrates collected in the Savage River by sampling year, RA = %Relative Abundance.

					2000	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*	*2007*	*2008*	*2009*	*2010*
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	0.8	-	-	-	1.0	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	1.0	0.8	-	-	-	-	-	1.0	-	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	1.0	-	1.0	-	-	-	-	-	1.8	-	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	-	-	-	1.0	-	-	-	-	1.0	-
Arthropoda	Diptera	Athericidae	Atherix	I	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	-	-	-	-	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	0.8	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	1.0	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	0.8	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	1.7	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	-	-	0.8	4.0	0.8	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	1.0	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	2.0	-	10.7	0.8	2.0	1.7	-	1.0	1.8	-	-
Arthropoda	Diptera	Chironomidae	Microtendipes	M	2.9	-	-	-	-	1.7	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	1.7	-	1.7	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	1.0	-	-	1.7	-	-	-	1.0	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladius	T	-	-	-	-	1.0	-	0.8	1.0	2.7	3.0	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	3.9	1.7	-	3.4	2.0	-	-	1.0	1.8	2.0	0.9
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	-	-	-	3.4	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	2.0	5.8	1.0	3.4	5.0	3.3	0.8	-	7.3	2.0	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	0.8	-	1.7	-	-	-	-	-	1.0	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	0.8	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	1.0	-	-	-	-	-	-	1.0	2.7	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	-	-	-	-	-	-	-	-	0.9	2.0	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	1.0	0.9	2.0	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	6.6	-	-	-	-	-	-	1.8	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	1.0	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	0.8	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	-	-	-	-	-	0.8	0.8	-	0.9	-	-
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	1.0	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	-	4.1	2.9	-	-	0.8	0.8	1.9	3.6	5.0	-
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	-	0.8	0.8	1.0	0.9	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	1.0	23.1	-	3.4	4.0	-	15.3	1.0	-	-	4.4
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-	0.9

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Tipulidae	Antocha	T	-	-	-	-	-	0.8	-	-	0.9	2.0	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	1.0	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.0	-	-	-	-	-	-	-	0.9	-	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	-	-	-	0.8	-	-	0.8	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	1.7	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	2.0	-	-	-	-	-	-	1.0	7.3	1.0	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	5.8	1.7	-	1.7	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	2.0	4.1	-	-	6.0	5.8	4.2	1.0	1.8	-	7.1
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	-	-	-	-	-	-	-	0.9	-	1.8
Arthropoda	Ephemeroptera	Baetidae	Fallceon	I	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	1.0	-	1.9	2.5	1.0	5.8	5.1	7.6	-	-	5.3
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	33.3	31.4	28.2	19.3	23.0	24.2	39.0	21.9	8.2	30.7	14.2
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	-	-	-	1.7	-	-	-	-	-	4.0	7.1
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	1.0	-	-	7.6	-	2.5	3.4	2.9	0.9	3.0	4.4
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	7.8	-	-	-	1.0	9.2	-	5.7	8.2	4.0	18.6
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	2.9	7.4	1.9	3.4	8.0	4.2	3.4	-	2.7	3.0	6.2
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	1.0	-	-	-	5.1	-	-	1.0	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	-	-	-	-	0.8	-	-	0.9	-	3.5
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	-	-	-	-	-	-	-	-	-	-	-

					2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	1.0	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	3.9	-	3.9	0.8	2.0	3.3	-	1.9	1.8	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	-	-	-	7.6	-	0.8	3.4	8.6	10.9	4.0	2.7
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	9.8	3.3	18.4	11.8	10.0	10.0	1.7	-	7.3	5.9	1.8
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	-	-	-	1.0	-	-	-	0.9	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	1.0	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	na	I	1.0	-	-	-	1.0	0.8	-	5.7	-	-	2.7
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	0.8	-	0.9	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	1.0	-	-	0.8	-	-	-	1.9	-	2.0	0.9
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	1.7	1.0	-	8.0	-	-	-	0.9	-	-
Arthropoda	Plecoptera	Leuctridae	na	I	-	-	-	0.8	-	2.5	-	12.4	1.8	-	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	2.9	-	-	1.7	1.0	1.7	0.8	4.8	-	-	1.8
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	2.0	-	-	-	4.0	-	3.4	-	0.9	-	0.9
Arthropoda	Plecoptera	Perlidae	Paragnetina	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	1.0	-	-	-	-	-	-	-	0.9	1.0	0.9
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	3.9	1.7	-	0.8	6.0	7.5	0.8	1.9	3.6	5.9	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	-	2.9	3.4	-	-	0.8	1.0	-	-	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	-	-	-	-	-	0.8	-	-	-	-	0.9

PHYLUM	ORDER	FAMILY	TAXON	TOL	2000 RA	2001 RA	2002 RA	2003 RA	2004 RA	2005 RA	2006 RA	2007 RA	2008 RA	2009 RA	2010 RA
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	3.0	4.4
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	-	-	1.9	-	4.0	0.8	0.8	2.9	3.6	5.9	5.3
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	0.8	-	0.8	2.0	-	-	-	-	1.0	0.9
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	2.0	0.8	2.9	-	1.0	4.2	1.7	-	0.9	1.0	-
Arthropoda	Trichoptera	Hydroptilidae	Stactobiella	I	-	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	-	1.7	11.7	2.5	-	-	0.8	1.0	0.9	1.0	-
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	-	-	-	-	-	-	-	1.0	-	-	0.9
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	-	-	-	-	-	0.8	1.0	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	0.8	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	0.9	-	0.9
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	1.0	-	-	1.7	-	0.8	0.8	1.0	-	-	-
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	1.0	-	-	-	-	0.8	-	-	-	-	-
Mollusca (Gastropoda)	na	na	na		-	-	-	0.8	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).

Benthic Macroinvertebrates Continued

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Annelida	Haplotaxida	Enchytraeidae	na	T	-	-	-	-	-	-	-	-	-	-
Annelida	Lumbriculida	Lumbriculidae	na	M	-	-	-	-	-	-	-	2.4	-	-
Arthropoda	Coleoptera	Elmidae	Oulimnius	I	-	-	0.8	-	-	-	-	1.6	-	-
Arthropoda	Coleoptera	Elmidae	Promoresia	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Coleoptera	Psephenidae	Psephenus	M	-	0.8	0.8	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Athericidae	Atherix	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Blephariceridae	Blepharicera	M	-	3.9	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	Bezzia	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Ceratopogonidae	na	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Brillia	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	na	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Conchapelopia	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Corynoneura	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Cricotopus/Orthocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Diamesa	T	-	0.8	-	-	-	0.9	2.6	0.8	1.6	-
Arthropoda	Diptera	Chironomidae	Diamesinae	T	-	1.6	-	-	-	-	-	3.2	-	-
Arthropoda	Diptera	Chironomidae	Eukiefferiella	M	-	-	-	-	-	-	-	-	-	1.8
Arthropoda	Diptera	Chironomidae	Heleniella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Micropsectra	I	-	2.3	0.8	2.6	1.8	-	0.9	0.8	0.5	0.9
Arthropoda	Diptera	Chironomidae	Microtendipes	M	0.8	-	-	0.9	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Nanocladius	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Orthocladiinae	T	-	-	0.8	-	0.9	-	-	0.8	-	6.4
Arthropoda	Diptera	Chironomidae	Orthocladius	T	0.8	2.3	6.8	-	-	0.9	-	2.4	3.8	-
Arthropoda	Diptera	Chironomidae	Parachaetocladius	M	-	-	-	-	-	0.9	-	-	0.5	0.9
Arthropoda	Diptera	Chironomidae	Parametriocnemus	M	0.8	-	0.8	-	0.9	-	0.9	0.8	1.1	-
Arthropoda	Diptera	Chironomidae	Paraphaenocladius	M	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Polypedilum	M	0.8	-	-	-	1.8	-	1.7	-	3.3	-
Arthropoda	Diptera	Chironomidae	Rheocricotopus	M	-	-	-	-	-	0.9	-	-	-	-
Arthropoda	Diptera	Chironomidae	Rheosmittia	M	-	-	-	-	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Diptera	Chironomidae	Rheotanytarsus	T	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Stempellinella	M	0.8	-	1.7	-	-	-	2.6	-	-	-
Arthropoda	Diptera	Chironomidae	Stilocladius	M	0.8	-	-	-	-	0.9	-	-	1.1	-
Arthropoda	Diptera	Chironomidae	Tanypodinae	T	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsini	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tanytarsus	M	2.5	-	0.8	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemanniella	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Thienemannimyia Group	T	1.6	-	-	-	0.9	-	1.7	-	-	2.8
Arthropoda	Diptera	Chironomidae	Trissopelopia	M	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Diptera	Chironomidae	Tvetenia	M	2.5	-	1.7	2.6	-	-	-	-	3.8	1.8
Arthropoda	Diptera	Empididae	Clinocera	T	-	-	-	-	0.9	-	1.7	-	-	-
Arthropoda	Diptera	Simuliidae	Prosimulium	I	-	17.8	13.6	13.0	1.8	10.6	5.1	22.6	-	13.8
Arthropoda	Diptera	Simuliidae	Simulium	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Antocha	T	0.8	3.1	-	1.7	0.9	-	-	-	-	-
Arthropoda	Diptera	Tipulidae	Dicranota	I	0.8	-	-	-	-	-	1.7	-	-	-
Arthropoda	Diptera	Tipulidae	Hexatoma	I	1.6	-	-	-	-	-	0.9	-	0.5	-
Arthropoda	Diptera	Tipulidae	Tipula	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ameletidae	Ameletus	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acentrella	M	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Acerpenna	I	-	-	0.8	-	-	0.9	0.9	-	1.1	-
Arthropoda	Ephemeroptera	Baetidae	na	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Baetidae	Baetis	M	-	0.8	1.7	8.7	0.9	4.4	1.7	8.1	18.1	10.1
Arthropoda	Ephemeroptera	Baetidae	Diphetor	I	-	0.8	-	-	-	-	-	0.8	0.5	-
Arthropoda	Ephemeroptera	Baetidae	Fallceon	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Drunella	I	-	3.1	-	-	-	-	3.4	0.8	-	-

PHYLUM	ORDER	FAMILY	TAXON	TOL	2011 RA	2012 RA	2013 RA	2014 RA	2015 RA	2016 RA	2017 RA	2018 RA	2019 RA	2020 RA
Arthropoda	Ephemeroptera	Ephemerellidae	Ephemerella	I	10.7	21.7	15.3	33.0	17.0	24.8	24.8	18.5	26.4	32.1
Arthropoda	Ephemeroptera	Ephemerellidae	na	I	5.7	-	1.7	-	3.6	-	-	2.4	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Eurylophella	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Serratella	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Ephemerellidae	Teloganopsis		3.3	0.8	0.8	-	-	-	9.4	2.4	-	1.8
Arthropoda	Ephemeroptera	Ephemeridae	Ephemera	I	-	-	-	0.9	0.9	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Cinygmula	I	17.2	10.9	7.6	2.6	5.4	10.6	1.7	4.0	4.9	1.8
Arthropoda	Ephemeroptera	Heptageniidae	Epeorus	I	9.8	7.0	5.1	1.7	1.8	5.3	0.9	0.8	7.1	5.5
Arthropoda	Ephemeroptera	Heptageniidae	na	I	-	-	-	-	0.9	-	-	0.8	0.5	-
Arthropoda	Ephemeroptera	Heptageniidae	Leucrocuta	I	-	0.8	-	-	-	-	0.9	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Maccaffertium	I	-	-	-	0.9	-	-	-	-	0.5	-
Arthropoda	Ephemeroptera	Heptageniidae	Rhithrogena	I	-	-	-	-	-	-	-	-	-	0.9
Arthropoda	Ephemeroptera	Heptageniidae	Stenacron	I	3.3	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Heptageniidae	Stenonema	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Ephemeroptera	Isonychiidae	Isonychia	I	2.5	1.6	-	3.5	2.7	1.8	0.9	0.8	0.5	-
Arthropoda	Ephemeroptera	Leptophlebiidae	na	I	2.5	3.1	6.8	9.6	16.1	14.2	6.8	15.3	11.0	4.6
Arthropoda	Ephemeroptera	Leptophlebiidae	Neoleptophlebia		-	-	-	-	-	-	-	-	-	2.8
Arthropoda	Ephemeroptera	Leptophlebiidae	Paraleptophlebia	I	8.2	0.8	6.8	3.5	0.9	-	0.9	-	-	-
Arthropoda	Megaloptera	Corydalidae	Nigronia	I	-	0.8	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Aeshnidae	Boyeria	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	na	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Odonata	Gomphidae	Stylogomphus	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Allocapnia	M	-	-	-	-	-	-	-	-	0.5	-
Arthropoda	Plecoptera	Capniidae	na	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Capniidae	Paracapnia	I	-	-	0.8	0.9	-	-	-	-	-	3.7

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Plecoptera	Chloroperlidae	na	I	-	-	-	-	-	-	-	-	1.1	-
Arthropoda	Plecoptera	Chloroperlidae	Haploperla	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Chloroperlidae	Sweltsa	I	-	-	-	0.9	1.8	0.9	-	-	0.5	-
Arthropoda	Plecoptera	Leuctridae	Leuctra	I	-	-	0.8	-	0.9	-	2.6	0.8	-	0.9
Arthropoda	Plecoptera	Leuctridae	na	I	0.8	-	-	-	1.8	-	-	-	2.7	-
Arthropoda	Plecoptera	Nemouridae	Amphinemura	I	3.3	-	-	-	-	-	5.1	0.8	0.5	-
Arthropoda	Plecoptera	Nemouridae	na	I	-	-	0.8	-	-	1.8	-	-	-	-
Arthropoda	Plecoptera	Peltoperlidae	Tallaperla	I	0.8	-	-	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	Acroneuria	I	1.6	-	1.7	0.9	-	1.8	-	0.8	0.5	0.9
Arthropoda	Plecoptera	Perlidae	Paragnetina	I	-	-	-	-	1.8	-	-	-	-	-
Arthropoda	Plecoptera	Perlidae	na	I	-	-	1.7	-	2.7	-	1.7	-	0.5	-
Arthropoda	Plecoptera	Perlodidae	Diploperla	I	-	-	-	-	0.9	-	-	-	-	-
Arthropoda	Plecoptera	Perlodidae	Isoperla	I	4.9	0.8	4.2	7.0	0.9	4.4	1.7	-	2.7	-
Arthropoda	Plecoptera	Perlodidae	na	I	-	0.8	-	-	-	-	-	-	0.5	-
Arthropoda	Plecoptera	Pteronarcyidae	Pteronarcys	I	0.8	-	-	-	-	-	0.9	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Strophopteryx	M	-	-	0.8	-	-	-	-	-	-	-
Arthropoda	Plecoptera	Taeniopterygidae	Taenionema	I	-	-	0.8	0.9	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Ceratopsyche		-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Cheumatopsyche	M	3.3	6.2	5.9	1.7	17.9	6.2	6.0	3.2	1.1	-
Arthropoda	Trichoptera	Hydropsychidae	Diplectrona	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Hydropsychidae	Hydropsyche	T	-	5.4	-	0.9	5.4	5.3	2.6	3.2	1.1	3.7
Arthropoda	Trichoptera	Hydroptilidae	Stactobiella	I	-	-	-	-	-	-	1.7	-	-	-
Arthropoda	Trichoptera	Lepidostomatidae	Lepidostoma	I	2.5	-	0.8	0.9	0.9	1.8	0.9	-	-	0.9
Arthropoda	Trichoptera	Limnephilidae	Pycnopsyche	M	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Odontoceridae	Psilotreta	I	0.8	-	0.8	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Philopotamidae	Dolophilodes	I	-	1.6	0.8	0.9	-	-	-	-	-	-

					2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
PHYLUM	*ORDER*	*FAMILY*	*TAXON*	*TOL*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*	*RA*
Arthropoda	Trichoptera	Polycentropodidae	na	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Polycentropodidae	Polycentropus	I	-	-	-	-	-	-	-	-	-	-
Arthropoda	Trichoptera	Rhyacophilidae	Rhyacophila	I	-	0.8	0.8	-	0.9	0.9	3.4	0.8	0.5	1.8
Arthropoda	Trichoptera	Uenoidae	Neophylax	I	-	-	1.7	-	-	-	-	-	-	-
Mollusca (Gastropoda)	na	na	na		-	-	-	-	-	-	-	-	-	-

I families are intolerant (family tolerance values from 0 to 3); M are moderately tolerant (family tolerance values from 3.1 to 6.9); and T are tolerant (family tolerance values from 7 to 10).