

RESULTS OF THE
AQUATIC MONITORING PROGRAM
IN BIG DRY CREEK, 2018

Results Presented in December 2019

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Prepared for:

Big Dry Creek Watershed Association
c/o City and County of Broomfield,
Cities of Northglenn and Westminster,
Adams and Weld Counties
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INTRODUCTION

The Big Dry Creek biological monitoring program was initiated in 1997 for the Big Dry Creek Watershed Association (BDCWA), which was founded in 1997 by the City and County of Broomfield, the Cities of Northglenn and Westminster (the Cities) and the Rocky Flats Environmental Technology Site (RFETS). The purpose of this program is to document changes in the abundance and distribution of fish and benthic macroinvertebrate populations and to monitor physical habitat conditions at established study sites in Big Dry Creek (BDC). Objectives of this program have been to establish a biological data base that can be used to support appropriate water quality standards for Segment 1 of Big Dry Creek and to document the effects that changes in water quality and habitat conditions have on the aquatic community.

This report is a technical memo that presents the key findings of the 2018 biological monitoring event with historical comparisons made as appropriate. The 2018 results will be discussed in more detail in the forthcoming comprehensive report for the 2022 monitoring year which will include pertinent 2018 and 2020 data as appropriate. Detailed results of biological monitoring efforts conducted from 1997 through 2016 are available in separate reports with the references provided in the 2019 report (Aquatics Associates, Inc. (AAI) 2019).

The project study area in Big Dry Creek currently extends from approximately 1.5 miles downstream from the Standley Lake dam to site bdc5.0 immediately downstream from the Yoxall Ditch at Weld County Road 4, which is 8.2 miles downstream from site bdc3.0 and in agricultural land. The total length of the study area is currently ~17 miles including the six sites (bdc0.5 through bdc5.0), with three sites upstream and downstream from the WWTPs. The project study area and locations of study sites and WWTPs are depicted in Figure 1. Locations of the study sites on Big Dry Creek with distances between the sites and cumulative distances downstream (from Standley Lake dam to the lowest site) are provided in Table 1. Sampling at the six sites occurred in the fall with the types of samples collected presented in Table 2. The 2018 monitoring program and sampling methodologies for fish, macroinvertebrates and habitat were consistent with previous years with methods described in detail in the 2019 report (AAI 2019).

Physical habitat, fish populations, and macroinvertebrate results are presented in separate sections below. Fish and macroinvertebrate community data are provided in their respective Tables and Figures Section. Detailed data are provided in the following appendices: Appendix A – streamflow and photographic documentation; Appendix B – fish population data; and Appendices C and D – macroinvertebrate data.

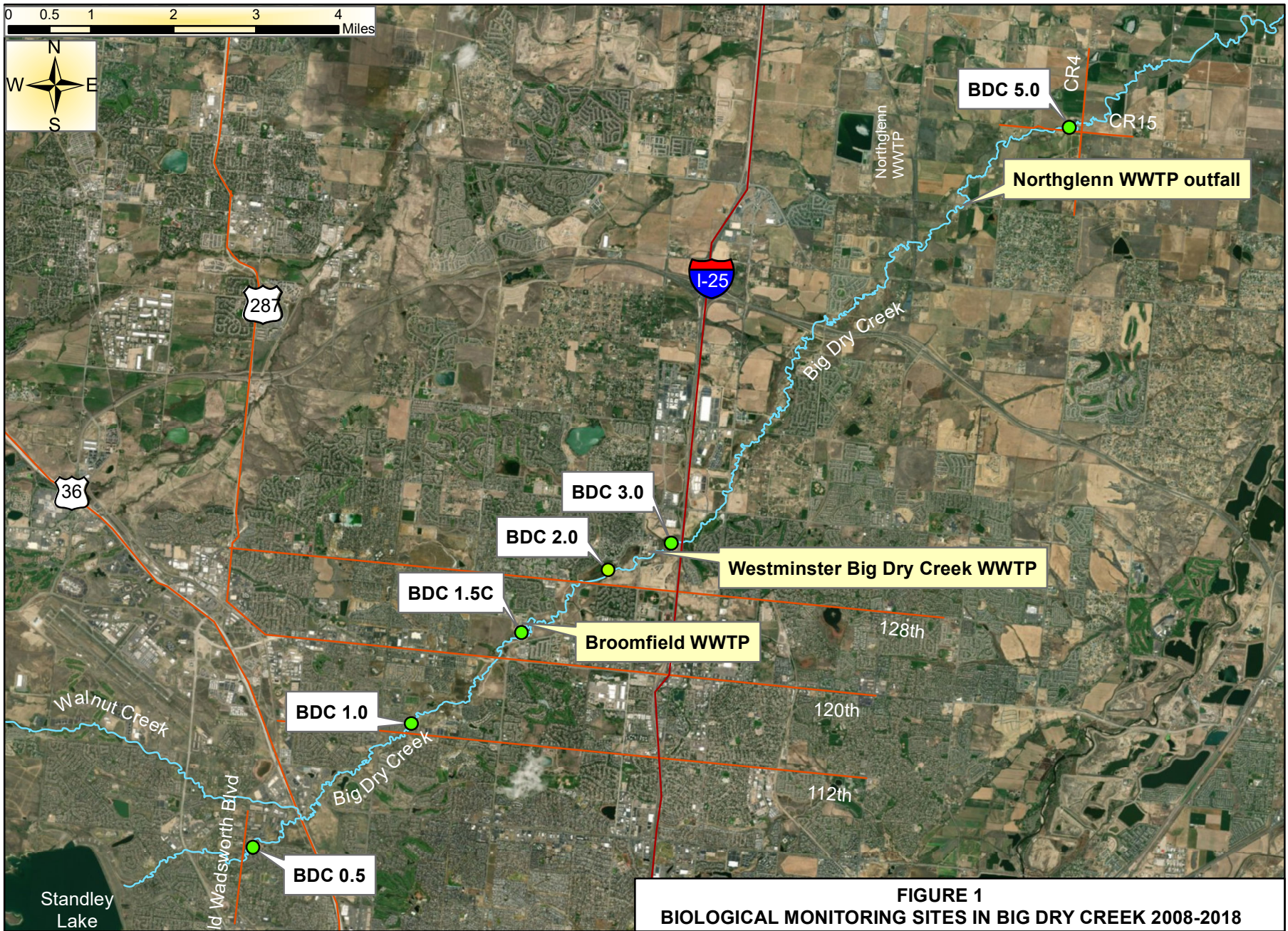


FIGURE 1
BIOLOGICAL MONITORING SITES IN BIG DRY CREEK 2008-2018

TABLE 1
 BIOLOGICAL MONITORING SITES
 IN BIG DRY CREEK, FALL 2008-2018 1/

<u>Study Site</u>	<u>Location</u>	<u>Distance Between Sites</u>	<u>Cumulative Distance</u>
BIG DRY CREEK			
UPSTREAM FROM TREATMENT PLANTS			
<i>Distance from Standley Lake dam</i>			
bdc0.5	Church Ranch Open Space, downstream from Old Wadsworth Boulevard	1.5 mi.	1.5 mi.
bdc1.0	Downstream from 112 th Avenue	2.8 mi.	4.3 mi.
bdc1.5C	Immediately upstream from Broomfield WWTP 2/	0.4 mi.	6.2 mi.
DOWNSTREAM FROM TREATMENT PLANTS			
bdc2.0	Upstream from 128 th Avenue, downstream from Broomfield WWTP	1.5 mi.	7.7 mi.
bdc3.0	At Interstate-25, downstream from Westminster Big Dry Creek WWTP	1.0 mi.	8.7 mi.
bdc5.0	Downstream from Weld County Road 4	8.2 mi.	16.9 mi.

1/ Sites bdc1.5 and bdc6.0 were eliminated in 2008.

2/ Site bdc1.5C was added to the program in the spring 2000.

TABLE 2
 SAMPLING DATES AND TYPES OF SAMPLES COLLECTED AT
 BIG DRY CREEK MONITORING SITES, FALL 2018 1/

<u>Study Site</u>	<u>2018 Fall</u>
BIG DRY CREEK	
<u>Upstream from WWTPs</u>	
bdc0.5	<i>F, M, H</i>
bdc1.0	<i>F, M, H</i>
bdc1.5C	<i>F, M, H</i>
<u>Downstream from WWTPs</u>	
bdc2.0	<i>F, M, H</i>
bdc3.0	<i>F, M, H</i>
bdc5.0	<i>F, M, H</i>

1/ Fish, macroinvertebrate, and habitat sampling are denoted by *F*, *M*, and *H*, respectively.

PHYSICAL HABITAT

Photographs taken during the fall 2018 sampling event are provided in Appendix A and show the notable physical habitat features at each site and document any observed changes, particularly those that may affect the fish and macroinvertebrate populations. The streamflows were low at the time of sampling 2018. Streamflow graphs for 2013 through 2018 are presented in Appendix A. Year 2012 was a record drought year while 2013 was also dry until the record flood event in September. Since then, in 2014-2018 flow conditions were more normal with generally wetter summer months and the typical low flows in the fall. Substrate conditions at the BDC sites improved notably since the 2013 flood event which resulted in scouring away of soft sediments (silt and mud), exposing more gravel and cobble substrates, creating a cleaner and more uniform stream bottom at all sites (AAI 2016). These improved conditions were first evident during the 2014 sampling event with substrate conditions remaining generally the same in 2016. A slight degradation was noted at some sites in the fall 2018, as evidenced at sites bdc2.0 and bdc3.0 with slight increases in silt and some organic muck deposited in slow and backwater areas. The improved habitat conditions observed are reflected in the improved macroinvertebrate and fish populations collected in 2014, 2016 and 2018.

FISH POPULATIONS

Fish populations were sampled at the six study sites on October 1-3, 2018, with assistance provided by the Cities. Fish data are presented in Tables 3-5, Figures 2-5, and Appendix B.

The 2018 fish populations continued to be healthy and abundant with the typical year-to-year variability. As in past sampling years, the predominant fish collected were longnose dace (LND), creek chubs (CRC), fathead minnows (FMW), sand shiners (SAH), and white suckers (WHS), all of which are native species in the South Platte River drainage. Non-native fishes such as common carp (CPP) and mosquitofish (MSQ) were present, but generally fewer in numbers. Fathead minnows are the most abundant species system-wide with LND predominant at sites bdc0.5, 1.0 and 3.0, while SAH are most abundant at site bdc5.0 and somewhat fewer at sites bdc1.0 and 3.0. Creek chubs were initially most abundant at the upper sites but in the last five sampling years have also been collected at the downstream sites.

Total fish numbers collected in 2018 were high with >1,000 individuals collected at four of the six sites. The highest numbers (2,260) were collected at site bdc0.5, while the lowest numbers (318) were at site bdc1.5C which is typical for this site. Notably, the number of fish collected at site bdc2.0 was 1,615 individuals and represents the highest number collected at this site for the entire study period indicating full recovery from the effects of the high ammonia concentrations present from 2002 to 2004. Somewhat fewer fish were collected at site bdc5.0, which often has the highest number of fish. Interestingly, a total of 43 large common carp were collected at this site, most of which were over 10 lbs. with most of the carp being collected from the large deep pool at the top of this reach that was created during the 2013 flood.

Johnny darters were notably more numerous in 2018 than in any past year, especially at sites bdc1.0 and 1.5C where 63 and 60 were collected, respectively. In comparison, only 9 and 4 individuals, respectively, were collected at these sites in 2016. In contrast, at site bdc0.5 in 2018, where they have historically been most numerous, only one individual was collected. Also interesting was the collection of 19 individuals at site bdc2.0 in 2018, whereas only one was collected in 2016 and none since 2001. At site bdc5.0, 11 individuals were found in 2016 but only one in 2018. The johnny darter is a sensitive species and they have been collected at all sites since 2016 indicating that their range has been expanded to include the entire BDC study area. This is likely due to the recently improved habitat and water quality conditions. Habitat improvements were especially noticeable at sites bdc1.5C and 2.0 where anoxic sediments were scoured away by the 2013 flood.

Over the study period, fish IBIs have not been very discriminatory between and among the study sites. IBIs were relatively similar among the sites in 2018 and were highest at sites bdc1.0 and 5.0 and lowest at

sites bdc2.0 and 1.5C. Overall, mean IBIs for the last six years were nearly the same for the upstream vs. downstream sites indicating the fish population is generally healthy throughout the BDC study area.

Fish “black spot” disease rates were generally low as indicated by the overall disease rates of 0.9% and 0.4% for the upstream and downstream sites, respectively. The percent of heavily infected fish however, increased at the three upstream sites from 2016 to 2018. Increases at site bdc0.5 were 0.5% to 1.2%, at site bdc1.0 (where disease rates have historically been the highest) were 1.8% to 2.8%, and at site bdc1.5C were 0% to 2.4%, respectively.

MACROINVERTEBRATES

The fall macroinvertebrate sampling was performed on October 29, 2018. Macroinvertebrate data are presented in Tables 6-8, Figures 6-8, and Appendices C and D.

In 2018 the macroinvertebrate data indicated that the population though relatively healthy was slightly stressed from organic inputs at all sites while site bdc5.0 was additionally stressed by agricultural runoff, irrigation diversion and return flows. Organic-related stress was most notable at sites bdc2.0 and bdc3.0 which are downstream from the WWTPs although in recent years (post-flood 2013), water quality and substrate improvements appear to have favored an increase in the numbers of mayflies. Notably in 2018 at site bdc2.0, mayflies comprised 22.9% of the macroinvertebrate population as they also did in 2016, and 17.3% in 2014. These abundances are considerably higher than in 2012 when their relative abundance was 4.5% (AAI 2016, 2019).

As in past years, the macroinvertebrates in 2018 were dominated by dipterans (true flies) most of which were midges followed by (in order of abundance) mayflies (ephemeropterans), aquatic worms (oligochaetes), scuds (amphipods), and caddisflies (trichopterans). Other groups were present but in fewer numbers including flatworms, nematodes, leaches, damselflies, dragonflies, true bugs, springtails, snails and clams. Overall, 14 orders of macroinvertebrates were collected comprising a total of 68 taxa.

Predominant species in 2018 were similar to past years with slight variations as usual. Dipterans, as in past years, were collected at all sites and dominated by midges (family: Chironomidae) with the two predominant species the same as in 2016 which were moderately-tolerant *Stictochironomus sp.* (t= 6) and *Cricotopus sp.* (t=7). These two species were present at every site with *Stictochironomus sp.*, as in 2014 and 2016, more abundant at the upstream sites than the downstream sites (13.1 vs 5.1%). *Cricotopus sp.* on the other hand, showed no preference for either the upstream or downstream sites in 2016, but in 2018 was notably more abundant at the downstream sites (2.5 vs 17.9%).

Mayflies were also collected at all sites. As in past years, sites bdc0.5 and 1.0 had the highest abundances at 47.4 and 37.6%, respectively, while the lowest numbers were at sites bdc1.5C and 3.0 (16.8 and 18.0%, respectively). In 2018, mayflies were comprised mainly by two species: *Tricorythodes sp.* and *Fallceon quilleri* whereas in 2016, these two species plus the common *Baetis tricaudatus* was also abundant. In 2018 however, *B. tricaudatus* comprised less than 1% of the mayflies.

Interestingly, oligochaete abundances for 2018 shifted from the predominance of naidids in 2016 to tubificids in 2018, especially at the upstream sites (17.7 vs 2.3%, respectively) while abundances were nearly equal at the downstream sites.

For the other commonly collected species, caddisflies and amphipods, numbers were low as in past years. Caddisfly abundance, however, was unusually high at site bdc3.0 with a density of 3,969/m² with the species *Cheumatopsyche sp.* predominant. Amphipod abundance was less than 10% at all sites with *Crangonyx sp.* the dominant species.

Macroinvertebrate densities were high in 2018 with >15,000 organisms/m² collected at all sites except bdc1.5C. The lowest density was at site bdc1.5C (11,674 organisms/m²) which is typical for this site. The highest density was at bdc3.0 (112,756 organisms/m²) mainly due to the high numbers of midges and oligochaetes which collectively accounted for 68.4% of the population. Density at site bdc2.0 was higher (28,224 organisms/m²) due to the high numbers of worms, dipterans and mayflies. Taxa richness continued to be relatively robust in 2018, ranging from 30 to 40 total taxa with the most collected at site bdc3.0 and the fewest at sites bdc5.0 and bdc1.5C (30 and 31 taxa).

For the key metrics, the HBI and ICI indices have indicated that the downstream sites are generally more degraded than the upstream sites. However in 2018, only slight differences in scores were noted. The mean HBI score was slightly lower (better) at the upstream sites than the downstream sites (6.46 vs 6.93) while the mean ICIs were almost the same and slightly higher (better) at the downstream sites at 26.7 vs 27.3. Mean species diversities were also nearly the same for the upstream vs downstream sites (3.71 vs 3.68). Species diversity values were above 3.00 at each site in 2018 and ranged from 3.44 at site bdc1.5C to 4.1 at site bdc1.0. Values above 3.00 are indicative of a diverse macroinvertebrate community.

The MMI analysis has been performed on the macroinvertebrate datasets for the last five sampling years (2010-2018) in accordance with the State's Policy 10-1 (CWQCC 2017). MMI data for 2018 indicated that all sites met use-attainment thresholds (MMI \geq 29) and ranged from 39.3 at site bdc3.0 to 55.9 at site bdc1.0 (Table 8). Sites bdc0.5 and bdc1.0 scores were 55.2 and 55.9 respectively, and in the High Scoring Waters (HSW) category (MMI >51). For the four sampling years (2012 to 2018), only site bdc5.0 in 2016 failed to meet use-attainment for *biotype 3* streams.

REFERENCES

- Aquatics Associates, Inc. 2016. Results of the Aquatic Monitoring Program in Big Dry Creek, 2014. December 2016. Prepared for the Big Dry Creek Watershed Association, Colorado.
- Aquatics Associates, Inc. 2019. Results of the Aquatic Monitoring Program in Big Dry Creek, 2016. March 2019. Prepared for the Big Dry Creek Watershed Association, Colorado.
- Colorado Water Quality Control Commission. 2017. Policy Statement 10-1, Appendices A-F. Aquatic Life Use Attainment, Methodology to Determine Use Attainment for Rivers and Streams. Approved August 7, 2017, Expires December 31, 2020. Colorado Department of Public Health and Environment, Colorado Water Quality Control Commission, Denver, CO.

FISH

TABLES AND FIGURES

TABLE 3
 PERCENT ABUNDANCE OF FISH SPECIES, TOTAL NUMBER COLLECTED,
 NUMBER OF NATIVE SPECIES, AND INDEX OF BIOTIC INTEGRITY (IBI) SCORES
 AT BIG DRY CREEK SITES, FALL 2018

SPECIES	STUDY SITES					
	bdc0.5	bdc1.0	bdc1.5C	bdc2.0	bdc3.0	bdc5.0
Longnose dace <i>Rhinichthys cataractae</i>	11.4	27.9	1.6	1.3	67.2	1.0
Creek chub <i>Semotilus atromaculatus</i>	54.4	38.4	23.9	20.0	1.1	15.5
Fathead minnow <i>Pimephales promelas</i>	19.7	4.4	17.9	40.0	9.6	15.2
Sand shiner <i>Notropis stramineus</i>	--	7.3	0.3	--	5.3	45.4
White sucker <i>Catostomus commersoni</i>	11.4	17.8	30.8	34.4	8.8	13.6
Longnose sucker <i>Catostomus catostomus</i>	3.1	--	--	0.1	--	--
Johnny darter <i>Etheostoma nigrum</i>	0.04	4.1	18.9	1.2	--	0.1
Green sunfish <i>Lepomis cyanellus</i>	--	--	6.6	3.0	6.5	0.2
Mosquitofish <i>Gambusia affinis</i>	--	--	--	--	0.1	1.2
Largemouth bass <i>Micropterus salmoides</i>	--	--	--	--	--	2.4
Common carp <i>Cyprinus carpio</i>	--	--	--	0.1	0.4	3.5
Black Crappie <i>Ameiurus melas</i>	--	--	--	--	0.2	--
Bluegill <i>Pomoxis nigromaculatus</i>	--	--	--	--	0.8	0.9
Black bullhead <i>Ameiurus melas</i>	--	--	--	--	--	1.0
Brook stickleback <i>Culaea inconstans</i>	--	--	--	--	--	0.2
TOTAL COLLECTED	2260	1,525	318	1615	936	1,235
TOTAL SPECIES	6	6	7	8	10	13
NATIVE SPECIES	6	6	7	7	6	9
IBI SCORE	35	37	33	31	39	41

* Bold indicates native to South Platte River.

TABLE 4
 COMPARISONS OF PERCENT DISEASE BY SITE AND UPSTREAM VS. DOWNSTREAM
 AT SITES IN BIG DRY CREEK, 2000-2018

Percent Disease by site	Big Dry Creek							
	upstream sites				downstream sites			
	<u>bdc0.5</u>	<u>bdc1.0</u>	<u>bdc1.5</u>	<u>bdc1.5C</u>	<u>bdc2.0</u>	<u>bdc3.0</u>	<u>bdc5.0</u>	<u>bdc6.0</u>
2000	7.8	6.4	1.8	6.2	19.6	5.3	2.1	6.4
2001	69.4	90.3	79.0	26.8	46.4	70.4	6.8	28.2
2002	95.2	85.6	57.6	68.0	71.2	56.8	3.8	13.1
2003	66.6	75.6	76.5	94.4	66.7	50.0	5.2	37.2
2004	85.8	91.0	84.3	91.7	92.1	38.8	31.5	20.3
2006	99.8	65.4	80.6	81.5	92.9	57.4	7.5	21.1
2008	59.2	75.7	ns	70.9	39.4	63.0	8.0	ns
2010	50.0	48.6	ns	44.7	48.8	83.0	14.8	ns
2012	45.5	80.3	ns	71.9	41.0	28.1	3.6	ns
2014	80.9	76.0	ns	32.9	49.0	29.2	29.9	ns
2016	66.4	89.0	ns	74.2	67.6	57.1	6.0	ns
2018	86.1	86.4	ns	70.8	83.6	79.6	31.8	ns
11-yr Mean 2001-2018	73.2	78.5		66.2	63.5	55.8	13.5	

Annual Mean Percent Disease	<u>all sites</u>	<u>upstream sites</u>	<u>downstream sites</u>
2000	7.0	5.6	8.4
2001	52.2	66.4	38.0
2002	56.4	76.6	36.2
2003	59.0	78.3	39.8
2004	66.9	88.2	45.7
2006	63.3	81.8	44.7
2008	52.7	68.6	36.8
2010	48.3	47.8	48.9
2012	45.1	65.9	24.2
2014	49.7	63.3	36.0
2016	60.1	76.5	43.6
2018	73.1	81.1	65.0
11-yr Mean 2001-2018	58.4	72.6	44.3

59.6 for d/s sites when bdc2.0 & bdc3.0 only

* ns indicates not sampled.

TABLE 5
 MEAN DISEASE RATINGS AND PERCENT OF HEAVY INFECTED FISH COLLECTED
 AT BIG DRY CREEK SITES, FALL 2008-2018

<u>Year Sampled</u>	Big Dry Creek							
	<u>bdc0.5</u>	<u>upstream sites</u>			<u>downstream sites</u>			
		<u>bdc1.0</u>	<u>bdc1.5</u>	<u>bdc1.5C</u>	<u>bdc2.0</u>	<u>bdc3.0</u>	<u>bdc5.0</u>	<u>bdc6.0</u>
Fall 2008								
Mean Disease Rating	0.8	1.1	ns	0.8	0.4	0.6	0.1	ns
upstream sites	0.9							
downstream sites	0.4							
Percent Heavy	1.2	2.8	ns	2.4	0.0	0.0	0.0	ns
upstream sites	2.1							
downstream sites	0.0							
Fall 2010								
Mean Disease Rating	0.5	0.5	ns	0.5	0.5	0.6	0.1	ns
upstream sites	0.5							
downstream sites	0.4							
Percent Heavy	0.0	0.0	ns	0.6	0.0	0.0	0.0	ns
upstream sites	0.2							
downstream sites	0.0							
Fall 2012								
Mean Disease Rating	0.5	1.1	ns	0.7	0.6	0.3	0.05	ns
upstream sites	0.8							
downstream sites	0.3							
Percent Heavy	0.4	9.3	ns	0.7	0.4	0.0	0.0	ns
upstream sites	3.5							
downstream sites	0.1							
Fall 2014								
Mean Disease Rating	0.8	0.8	ns	0.3	0.4	0.4	0.3	ns
upstream sites	0.6							
downstream sites	0.4							
Percent Heavy	1.2	2.1	ns	0.0	0.0	0.0	0.0	ns
upstream sites	1.1							
downstream sites	0.0							
Fall 2016								
Mean Disease Rating	0.7	1.0	ns	0.7	0.6	0.6	0.04	ns
upstream sites	0.8							
downstream sites	0.4							
Percent Heavy	0.5	1.8	ns	0.0	0.0	0.0	0.0	ns
upstream sites	0.8							
downstream sites	0.0							
Fall 2018								
Mean Disease Rating	0.8	1.1	ns	0.8	0.4	0.6	0.1	ns
upstream sites	0.9							
downstream sites	0.4							
Percent Heavy	1.2	2.8	ns	2.4	0.0	0.0	0.0	ns
upstream sites	2.1							
downstream sites	0.0							

1/ Mean disease rating is the level of disease for the entire population sampled at each site on scale of 0-3, with ratings of 0, 1, 2, or 3 denoting either no, slight, moderate, or heavy level of disease for individuals collected.

2/ Percent of diseased fish that were rated as heavily infected.

FIGURE 2

PERCENT RELATIVE ABUNDANCE OF NUMERICALLY DOMINANT AND IMPORTANT NATIVE FISH SPECIES COLLECTED AT BIG DRY CREEK SITES, FALL 2008-2018

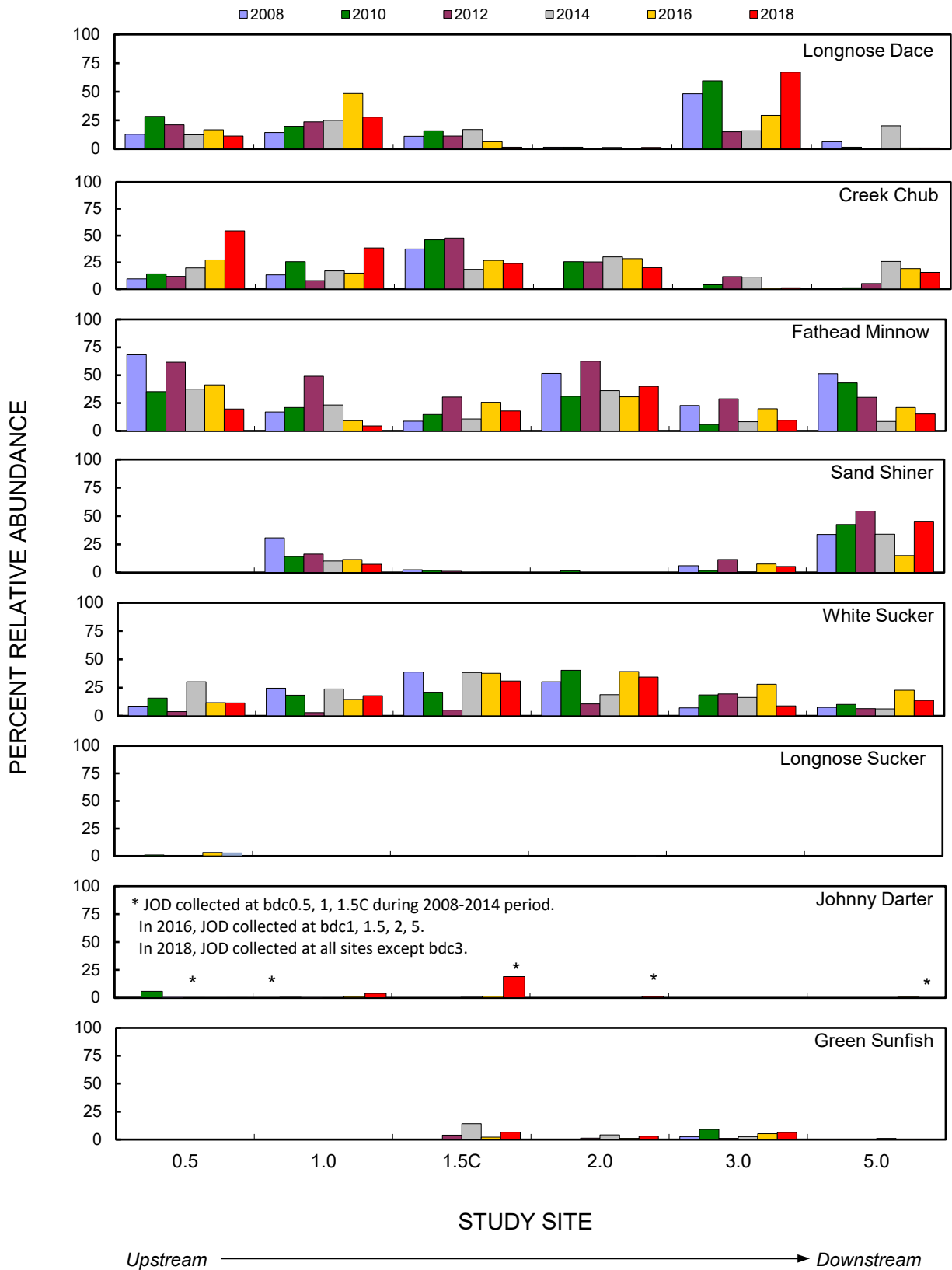


FIGURE 3
COMPARISONS OF NUMBERS OF FISH AND SPECIES COLLECTED AT
BIG DRY CREEK SITES, 2008-2018

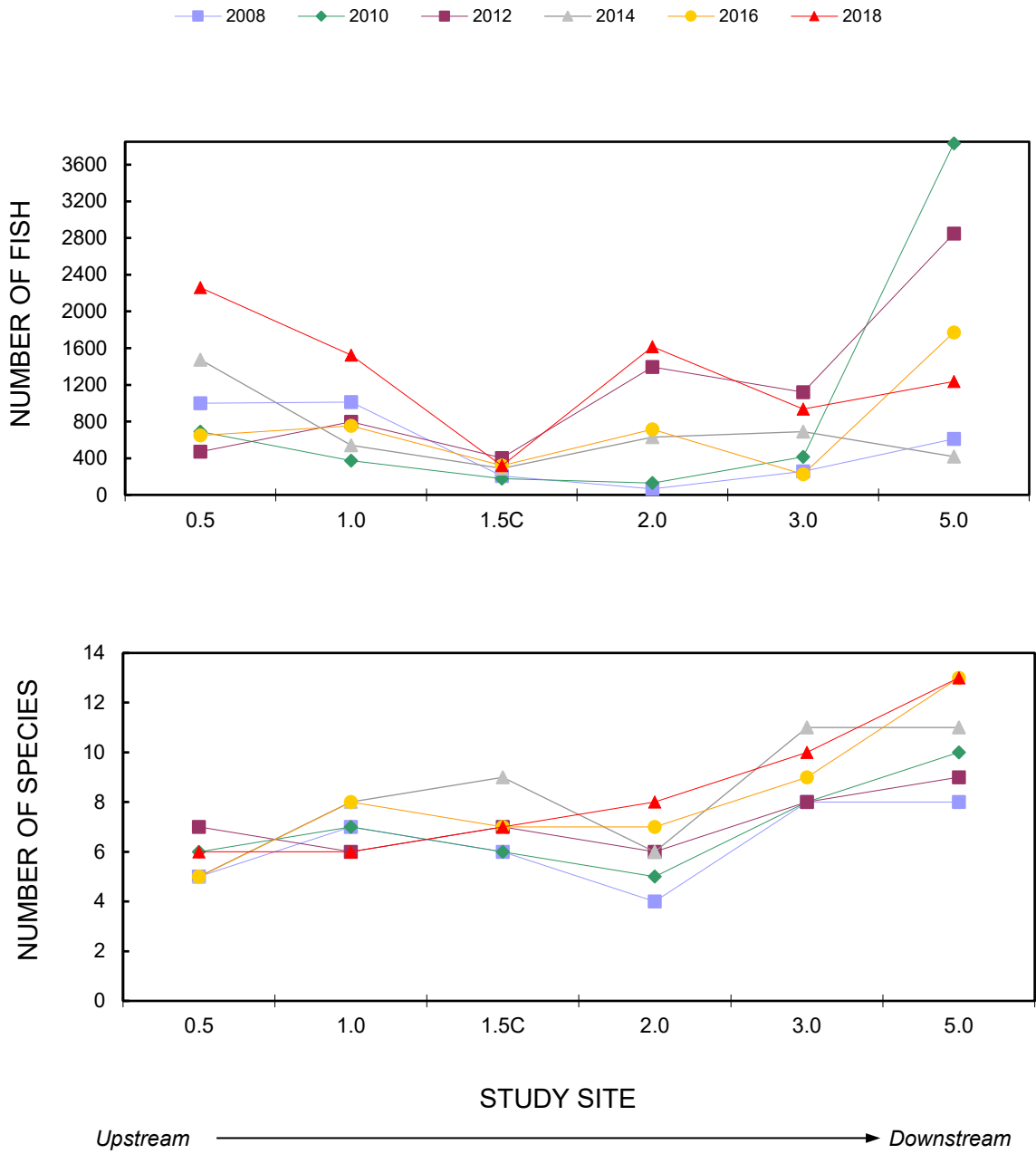


FIGURE 4
COMPARISONS OF FISH INDEX OF BIOTIC INTEGRITY (IBI) SCORES
FOR BIG DRY CREEK, 2008-2018

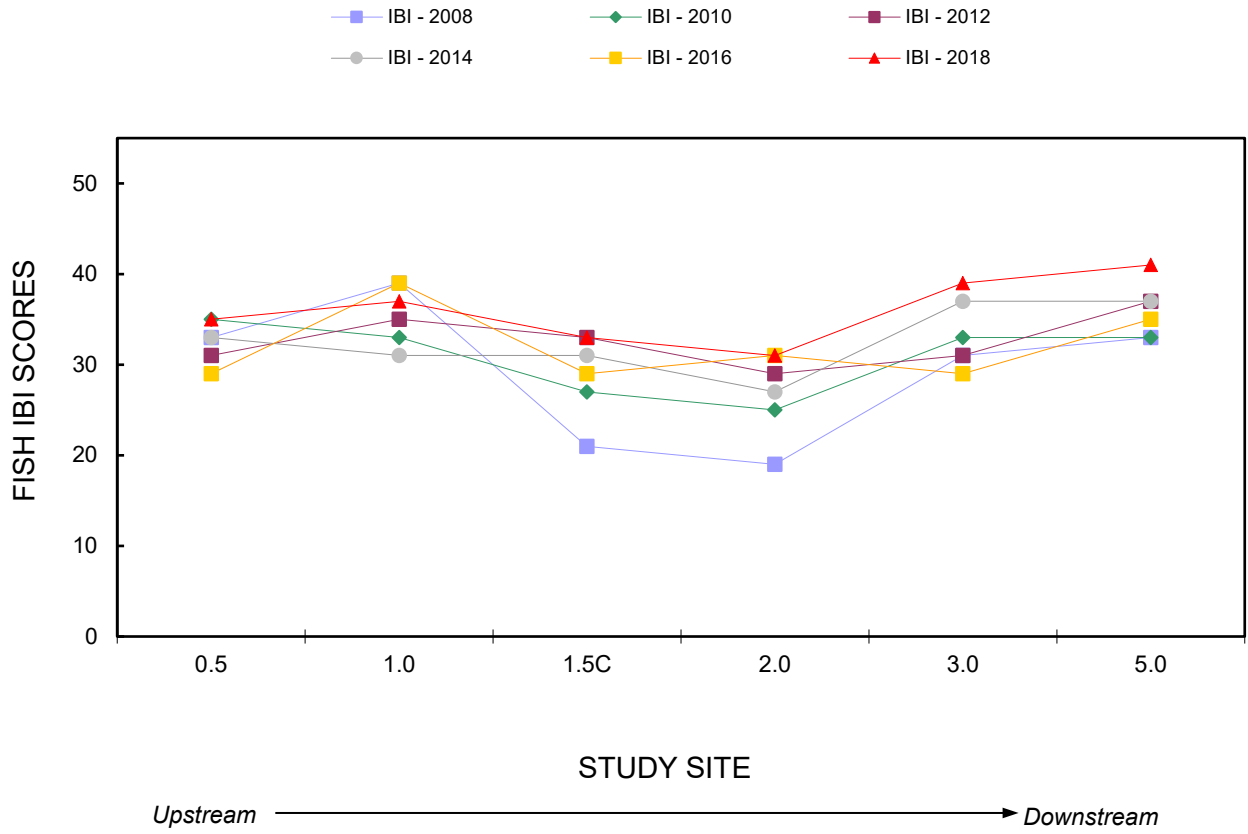
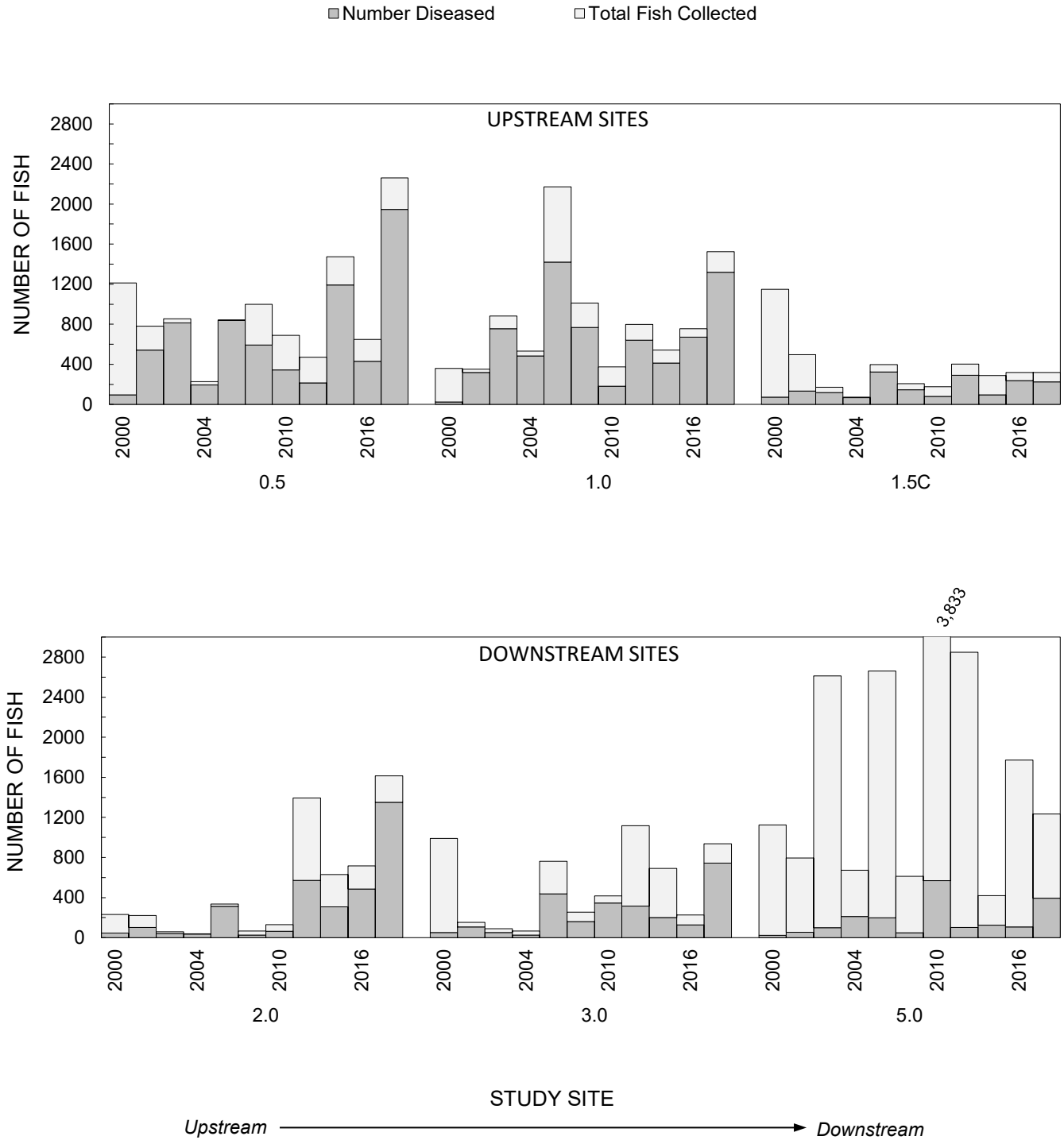


FIGURE 5
FISH DISEASE OCCURRENCE AT
BIG DRY CREEK SITES, 2000-2018



MACROINVERTEBRATES

TABLES AND FIGURES

TABLE 6

MEAN PERCENT RELATIVE ABUNDANCE FOR PREDOMINANT AND IMPORTANT
MACROINVERTEBRATE SPECIES COLLECTED AT BIG DRY CREEK SITES
UPSTREAM AND DOWSTREAM FROM WWTPs, FALL 2018 VS. 2012-2016 1/

Taxa	2012		2014		2016		2018	
	Up	Down	Up	Down	Up	Down	Up	Down
TURBELLARIA (flatworms)								
<i>Dugesia sp.</i>	0.4	0.1	1.3	1.2	0.1	0.5	0.6	0.5
OLIGOCHAETA (aquatic worms)								
<i>Nais spp.</i>	1.9	14.1	1.0	3.7	5.0	31.5	2.3	15.8
Tubificidae	10.1	16.8	11.6	10.5	9.5	18.2	17.7	14.0
AMPHIPODS (scuds)								
<i>Crangonyx sp.</i>	6.2	1.2	1.7	1.2	4.2	4.4	2.8	2.0
<i>Hyaella azteca</i>	3.8	2.3	3.5	4.0	1.2	2.6	2.7	1.6
EPHEMEROPTERA (mayflies)								
<i>Acentrella insignificans</i>	0.2	0.7	nc 2/	5.8	nc	0.2	1.1	4.3
<i>Baetis tricaudatus</i>	1.1	0.0	15.5	4.3	7.0	0.6	0.8	0.1
<i>Fallceon quilleri</i>	10	4.4	4.2	7.8	7.8	3.4	8.7	3.5
<i>Tricorythodes explicatus</i>	8.1	2.8	11.9	4.6	12.2	7.5	22.8	13.7
TRICHOPTERA (caddisflies)								
<i>Cheumatopsyche sp.</i>	3.2	0.5	3.6	0.8	1.4	0.4	1.3	1.9
<i>Hydropsyche sp.</i>	0.2	0.1	0.1	nc	0.6	0.2	0.1	1.1
<i>Hydroptila sp.</i>	1.2	1	0.5	0.3	0.4	0.3	nc	0.3
DIPTERA								
Chironomidae (midges)								
<i>Chironomus sp.</i>	0.2	1	0.6	0.3	2.2	3.0	1.2	0.8
<i>Cladotanytarsus sp.</i>	0.1	0.6	0.5	1.9	0.2	1.3	nc	1.1
<i>Cricotopus sp.</i>	4.0	10.2	6.3	15.9	12.2	11.9	2.5	17.0
<i>Cryptochironomus sp.</i>	2.2	1.3	1.4	0.5	2.9	0.5	1.4	0.6
<i>Eukiefferiella sp.</i>	0.5	0	0.1	0.2	0.1	0.2	0.4	0.4
<i>Hydrobaenus sp.</i>	5.6	1.4	4.5	2.1	0.6	0.1	4.4	0.5
<i>Micropsectra sp.</i>	0.7	4.7	0.1	3.1	1.6	3.1	2.6	3.4
<i>Parakiefferiella sp.</i>	0.2	0.6	1.8	1.4	1.2	0.4	0.2	0.2
<i>Paratanytarsus sp.</i>	1.3	0	0.8	nc	2.1	0.1	0.2	nc
<i>Polypedilum sp.</i>	0.3	0.4	1.5	0.5	1.1	0.3	1.1	0.3
<i>Rheotanytarsus sp.</i>	0.4	nc	0.3	nc	7.5	0.1	1.3	nc
<i>Saetheria tylus</i>	0.1	nc	0.3	2.9	1.0	0.2	0.1	0.3
<i>Stictochironomus sp.</i>	26.1	17.4	17.2	3.9	10.0	2.0	13.1	5.1
<i>Thienemanniella sp.</i>	1.5	6.7	0.9	0.6	nc	0.5	0.6	0.5
<i>Thienemannimyia</i> group	1.5	0.8	0.8	0.3	1.0	0.2	0.4	0.1
Simuliidae (black flies)								
<i>Simulium vittatum</i> complex	0.6	3.6	2.7	16.8	1.1	3.4	1.4	3.9
GASTROPODA (snails)								
<i>Ferrissia sp.</i>	0.5	0.1	0.4	0.2	1.6	0.1	1.6	0.1
Physidae	0.1	0	0.4	0.1	0.1	nc	0.1	nc

1/ Upstream sites include bdc0.5, 1.0, and 1.5C; downstream sites include bdc2.0, 3.0, and 5.0.

2/ nc indicates species not collected.

TABLE 7

SUMMARY OF KEY COMMUNITY PARAMETERS AND INDICES
BIG DRY CREEK SITES, FALL 2018 VS. 2012-2016

Site	Total Taxa	EPT Taxa	<u>Metric</u> <u>Species</u> Diversity	ICI	HBI	% Chironomidae
Fall 2012						
<u>Upstream Sites</u>						
bdc0.5	41	5	4.18	38	6.04	23.2
bdc1.0	34	8	3.82	32	6.52	37.9
bdc1.5C	31	7	2.99	26	6.84	63.2
Mean	35	7	3.66	32.0	6.47	41.4
<u>Downstream Sites</u>						
bdc2.0	25	5	2.84	16	7.16	48.3
bdc3.0	41	8	3.54	32	8.22	27.6
bdc5.0	33	5	3.76	26	6.60	31.0
Mean	33	6	3.38	24.7	7.33	35.6
Fall 2014						
<u>Upstream Sites</u>						
bdc0.5	35	5	3.58	32	5.75	21.9
bdc1.0	36	6	3.69	34	6.20	31.1
bdc1.5C	34	6	3.83	24	6.90	63.3
Mean	35	6	3.70	30.0	6.28	38.8
<u>Downstream Sites</u>						
bdc2.0	35	6	3.75	26	6.47	34.7
bdc3.0	42	7	4.11	28	7.25	38.2
bdc5.0	27	8	3.30	36	5.73	31.8
Mean	35	7	3.72	30.0	6.48	34.9
Fall 2016						
<u>Upstream Sites</u>						
bdc0.5	46	6	3.76	42	6.21	40.2
bdc1.0	33	7	4.11	34	6.17	43.4
bdc1.5C	30	6	3.71	26	6.75	53.6
Mean	36	6	3.86	34.0	6.38	45.7
<u>Downstream Sites</u>						
bdc2.0	29	6	3.62	26	6.74	37.5
bdc3.0	36	6	3.13	24	8.10	17.2
bdc5.0	24	4	2.27	12	8.47	19.2
Mean	30	5	3.01	20.7	7.77	24.6
Fall 2018						
<u>Upstream Sites</u>						
bdc0.5	39	6	3.58	34	6.02	15.1
bdc1.0	38	5	4.10	26	6.21	27.4
bdc1.5C	31	5	3.44	20	7.14	48.6
Mean	36	5	3.71	26.7	6.46	30.4
<u>Downstream Sites</u>						
bdc2.0	34	6	3.74	24	7.07	31.5
bdc3.0	40	8	3.73	34	7.20	26.6
bdc5.0	30	5	3.56	24	6.52	38.6
Mean	35	6	3.68	27.3	6.93	32.2

FIGURE 6
 PERCENT RELATIVE ABUNDANCE OF MACROINVERTEBRATE TAXONOMIC GROUPS
 COLLECTED IN KICK SAMPLES FROM BIG DRY CREEK, FALL 2012- 2018

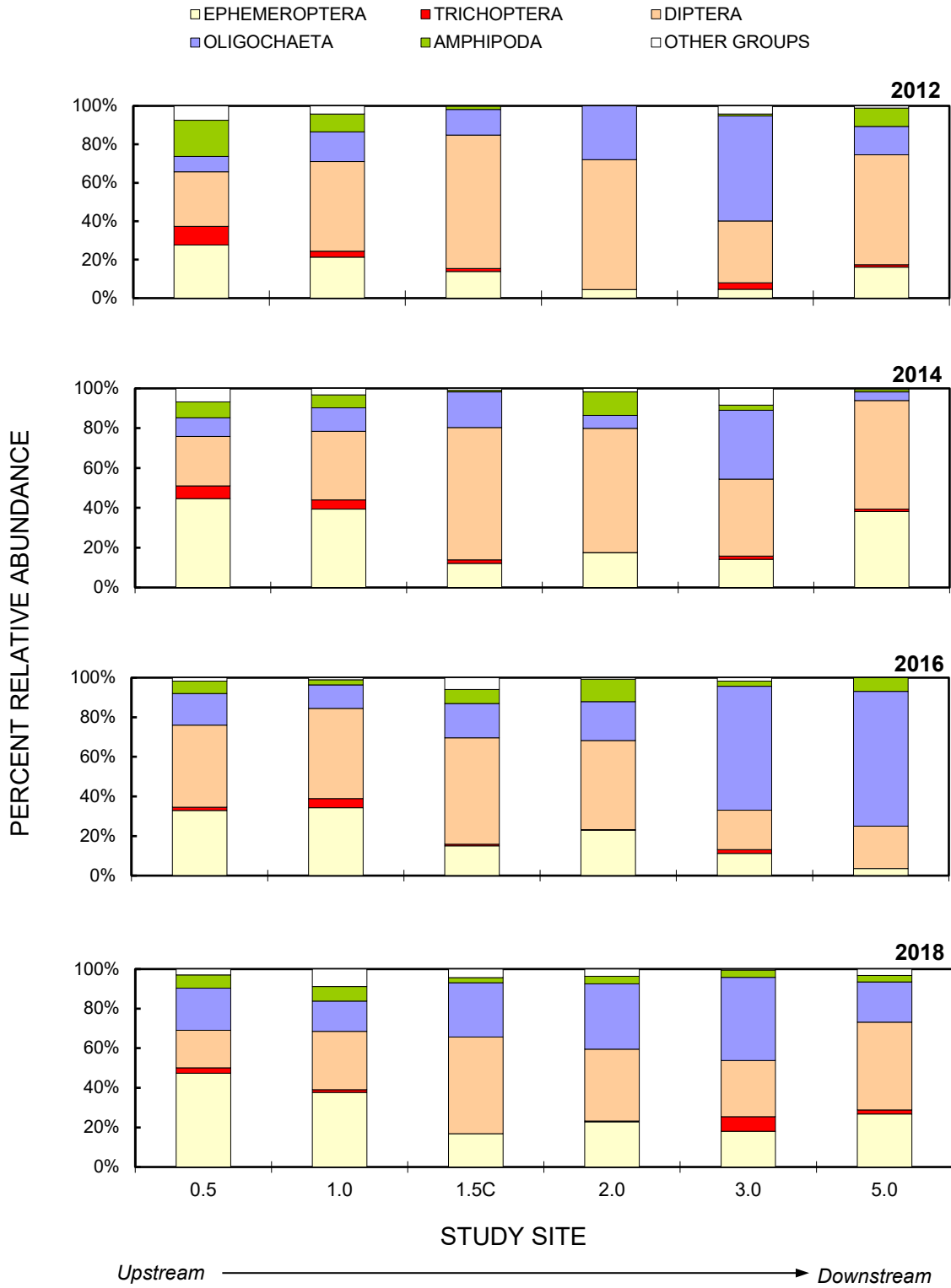


TABLE 8
MMI SCORES FOR BIG DRY CREEK SITES, FALL 2012, 2014, 2016 AND 2018

MMI Sores							
Site	Location	Biotype	2012	2014	2016	2018	4-yr mean
BDC 0.5	d/s from Old Wadsworth Ave., at Church Ranch Open Space	3	60.2	50.9	52.9	55.2	54.8
BDC 1.0	u/s from 112th Ave.	3	47.5	50.0	41.4	55.9	48.7
BDC 1.5C	d/s from 120th Ave., immediately u/s Broomfield WWTP	3	59.5	58.3	43.4	46.3	51.9
BDC 2.0	u/s from 128th Ave., d/s from Broomfield WWTP	3	37.2	52.4	46.7	44.8	45.3
BDC 3.0	at I-25, d/s from Westminster WWTP	3	45.5	41.7	42.0	39.3	42.1
BDC 5.0	d/s from Weld County Rd. 4	3	58.2	41.1	24.9	43.8	42.0
Annual Mean			51.4	49.1	41.9	47.6	

MMIs per EDAS v4 and Policy Statement 10-1 (CWQCC 2017).

Bold indicates High Scoring Water (MMI >51 for Biotype 3).

MMI Impairment threshold for Class 2 streams is <29.

impaired

All analyses performed by Aquatics Associates, Inc.

Comments for 2018

MMI values for 2018 met use attainment all six sites on Big Dry Creek (MMIs >29 threshold for Class 2 streams).

Sites bdc0.5 and bdc1.0 were High Scoring waters.

Lowest score in 2018 was at site bdc3.0.

FIGURE 7
 MACROINVERTEBRATE DENSITY AND TOTAL NUMBER OF TAXA COLLECTED IN KICK
 SAMPLES FROM BIG DRY CREEK, FALL 2012- 2018

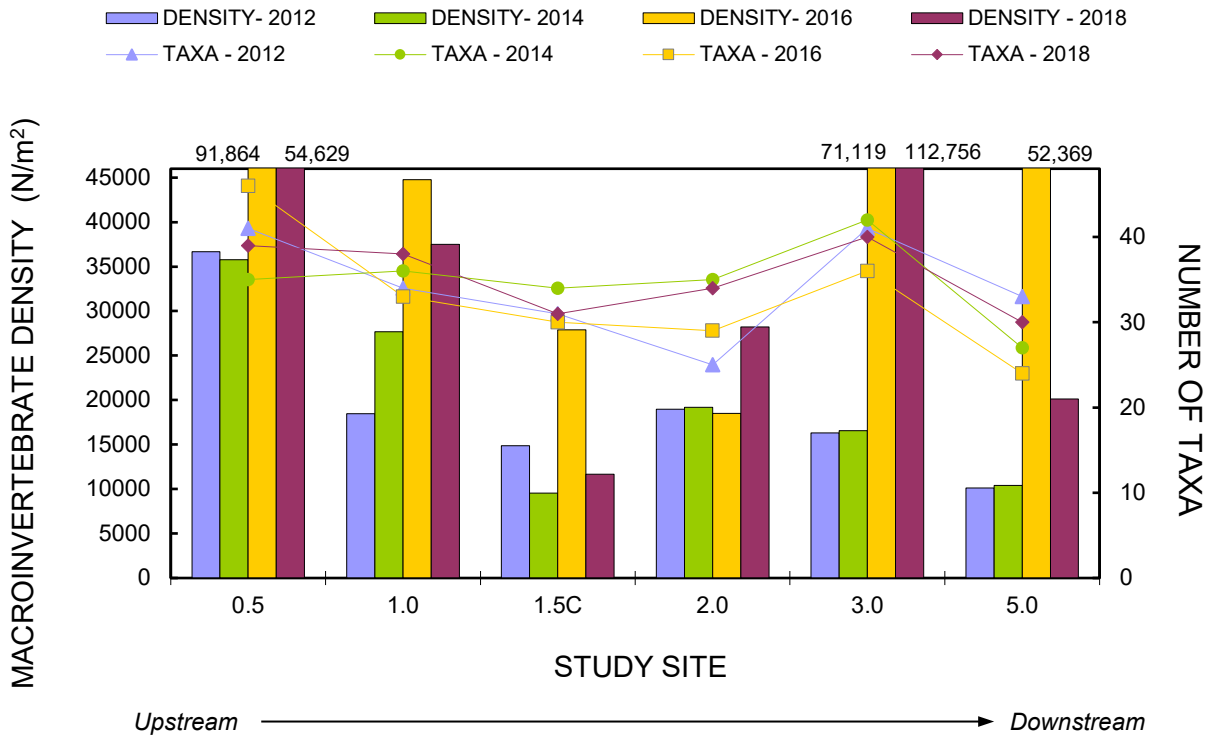
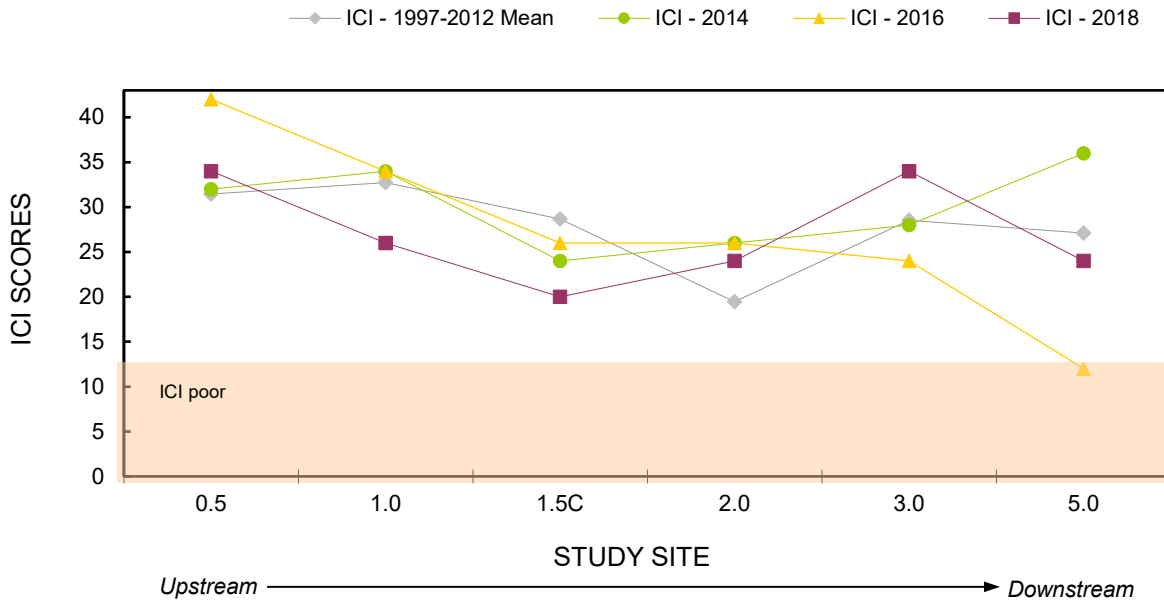
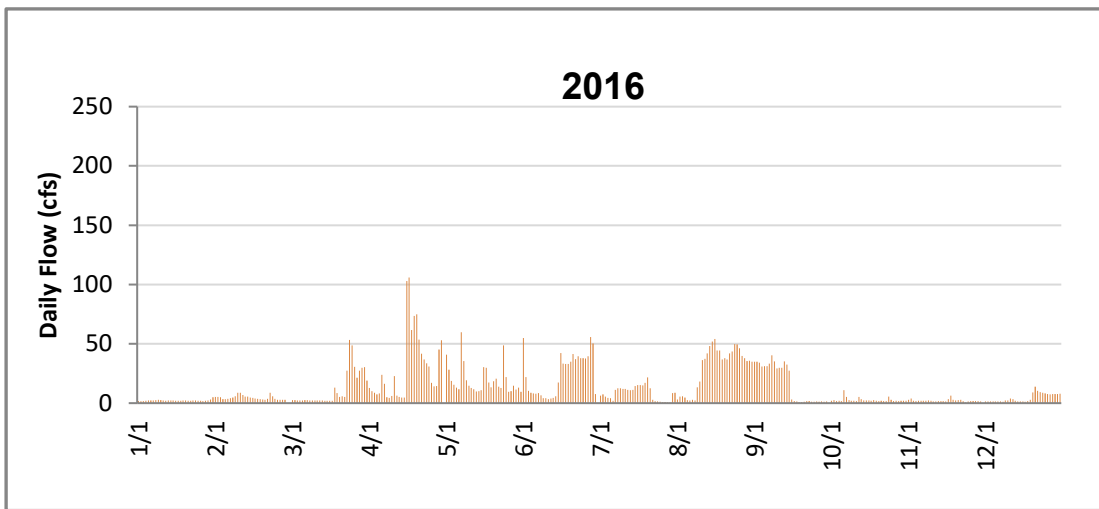
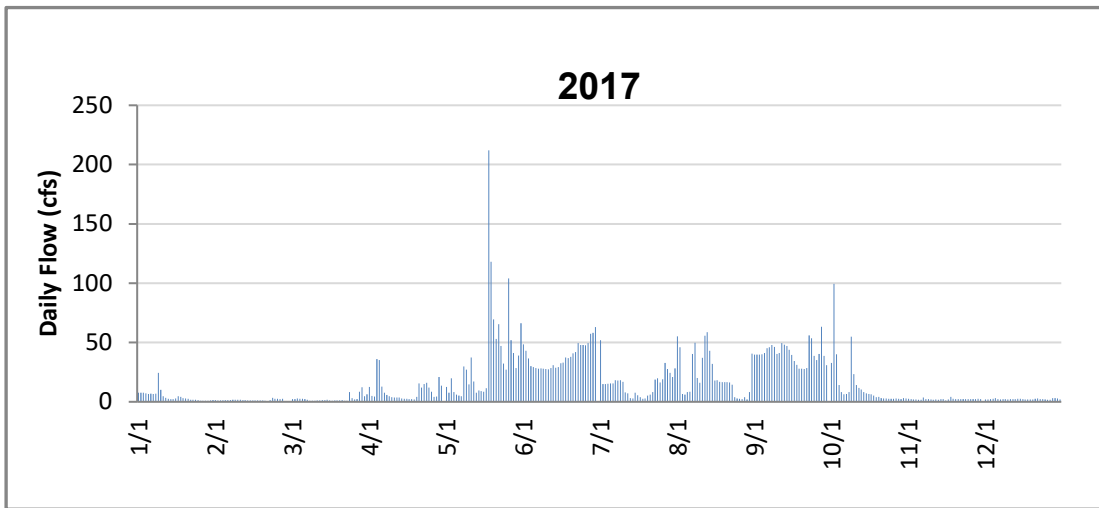
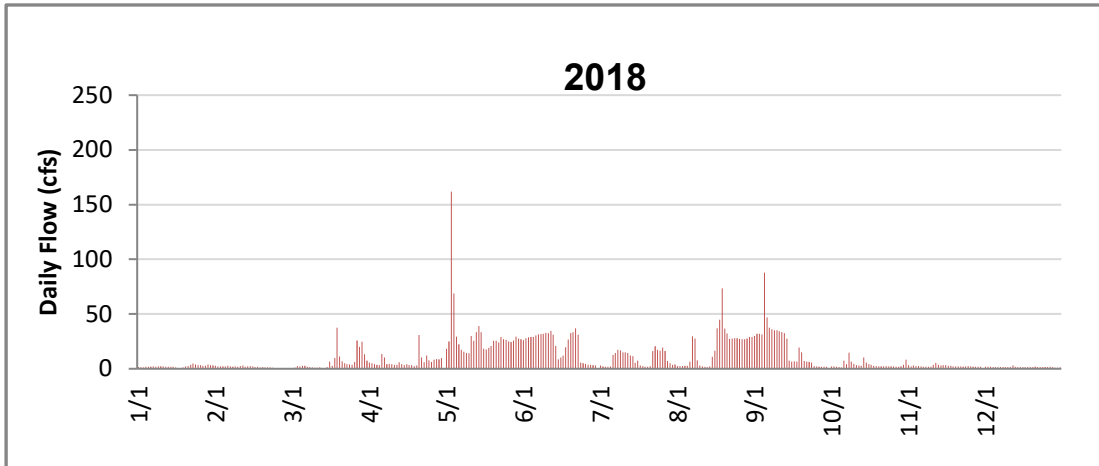


FIGURE 8
COMPARISON OF INVERTEBRATE COMMUNITY INDEX (ICI) SCORES
FOR BIG DRY CREEK SITES IN FALL,
1997-2012 MEAN VS. 2014, 2016 AND 2018



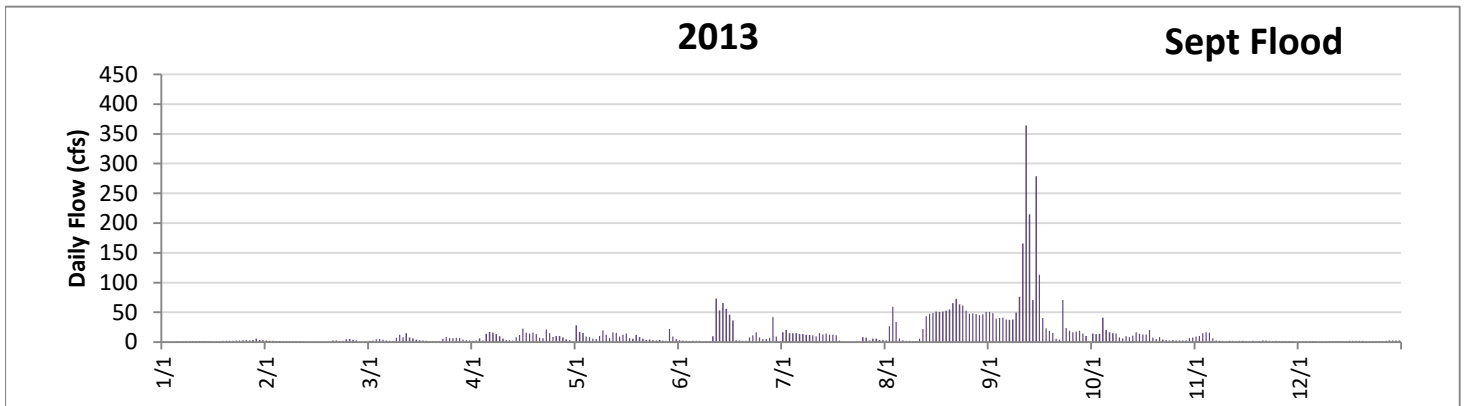
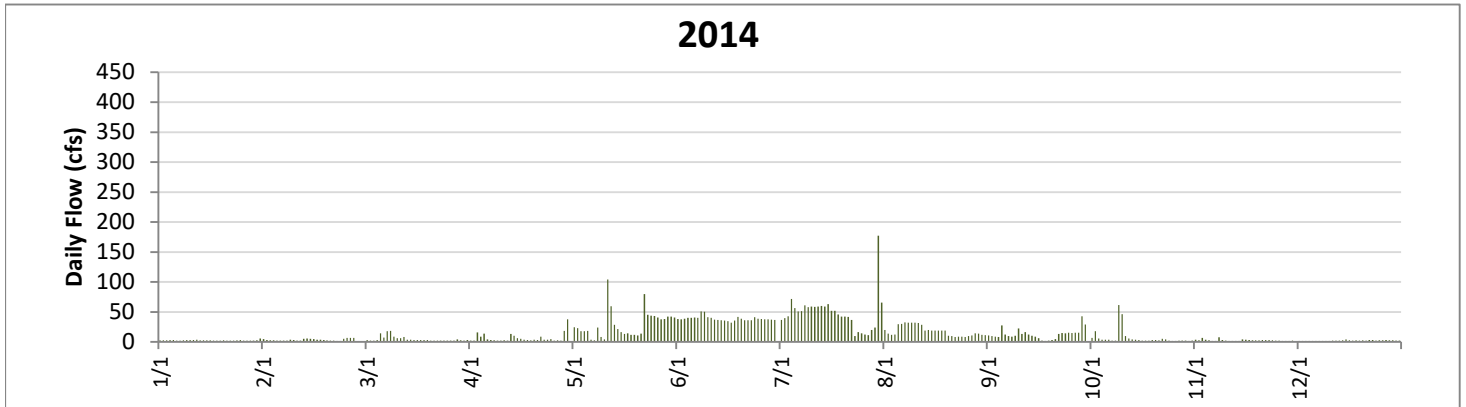
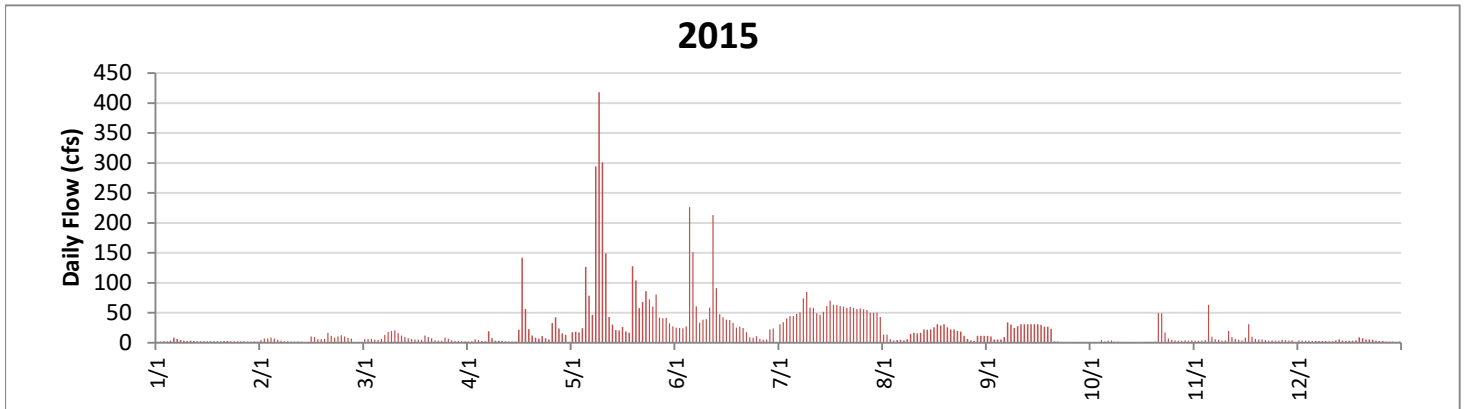
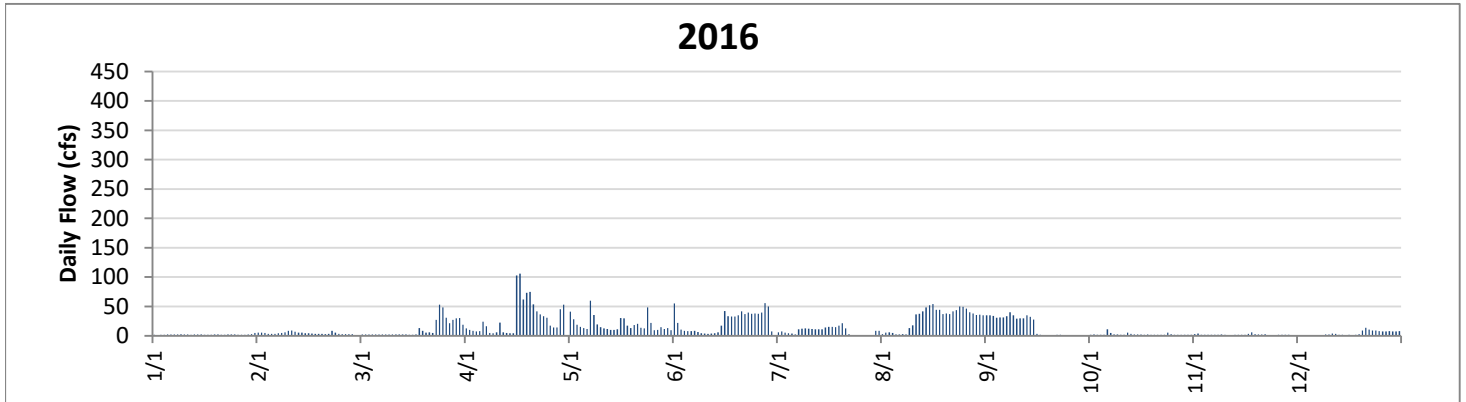
APPENDIX A
STREAMFLOW DATA AND
PHOTOGRAPHIC DOCUMENTATION

Big Dry Creek Streamflow Data, 2016-2018



Source: USGS Streamflow data for gage 06720820 Big Dry Creek at Westminster, CO 2016-2018.
U.S. Department of Interior, U.S. Geological Survey.

Big Dry Creek Streamflow Data, 2013-2016



Source: USGS Streamflow data for gage 06720820 Big Dry Creek at Westminster, CO 2012-2014. U.S. Dept. of Interior, U.S. Geological Survey.

BDC 0.5



Low flow and dense algae and aquatic weed growth in Oct 2018



Low flow restricting stream area available for fish in Oct 2018

Exposed mud

BDC 1.0



Overhanging riparian vegetation

Abundant cobble substrate preferred by longnose dace



Trees along channel no longer present by Oct 2018

Eroded bank

Pool and run habitats providing good fish cover even at low flow conditions

BDC 1.5C

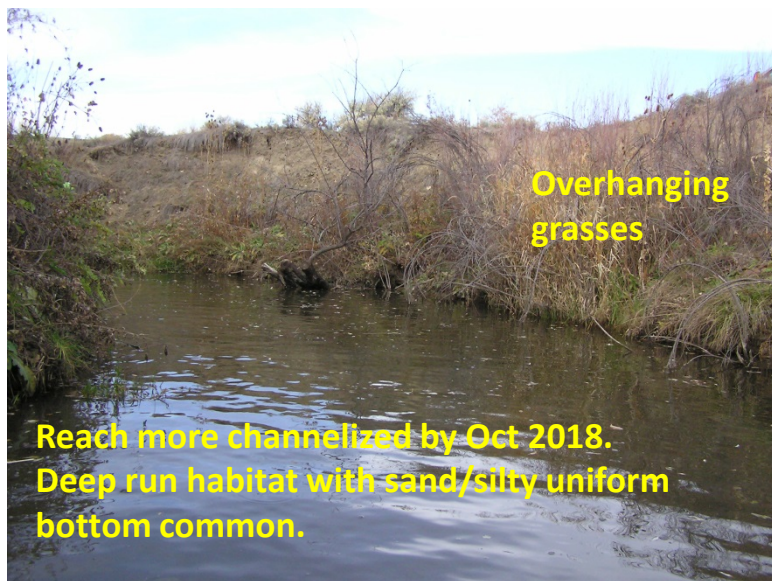


Abundant trees shade most of the stream reach



Overhanging vegetation providing fish cover

Small riffle washed out by Oct 2018.
Only few areas with small cobble substrate.



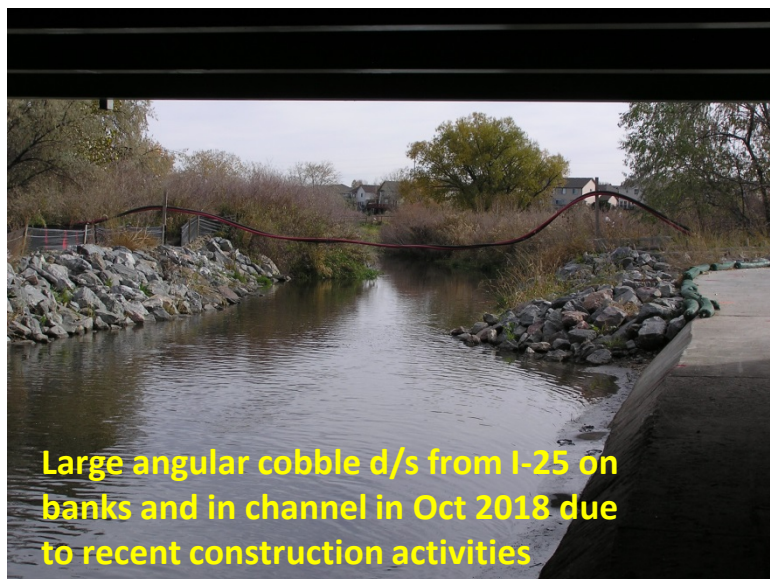
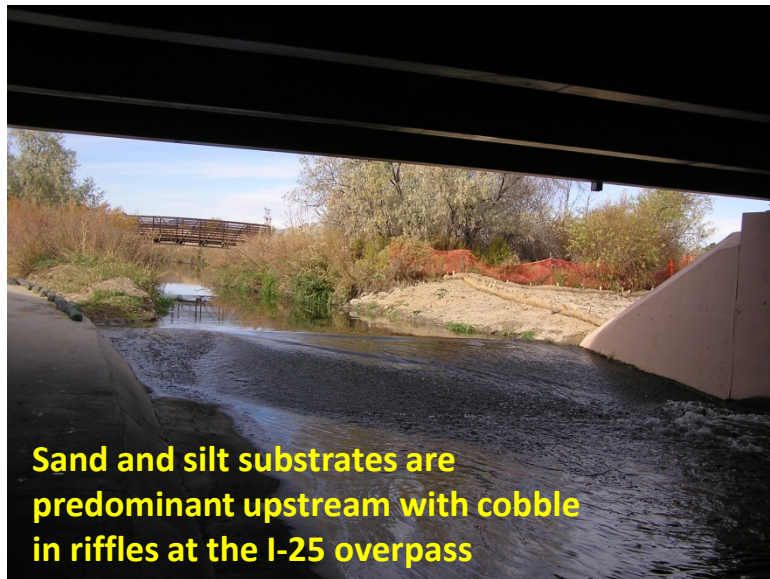
Overhanging grasses

Reach more channelized by Oct 2018.
Deep run habitat with sand/silty uniform bottom common.

BDC 2.0



BDC 3.0



BDC 5.0



Upper pool, which was deepened by Sept 2013 flood event, continues to provide good fish habitat



Banks well-vegetated with overhanging grasses in Oct 2018

Good flow conditions for fish and macroinvertebrate sampling in the stream reach in Oct 2018

BDC Sampling



BDC Fish Sampling



Fish processing set up and species sorting at bdc2.0



Fish measurements

BDC Fish Sampling



Measuring big common carp
at bdc5.0 in Oct 2018



Fish measurements

BDC Important Native Fish Species



Johnny Darter presence is important species for water quality regulations in BDC Segment 1



Longnose Dace is the only intolerant species in the BDC system for Fish IBIs

BLACK SPOT DISEASE



BDC Reg 38 - Relevant Fish Species Collected



APPENDIX B
FISH POPULATION DATA

FISH POPULATION DATA SUMMARY FALL 2018
BIG DRY CREEK

RELATIVE ABUNDANCE

	0.5	1.0	1.5C	2.0	3.0	5.0
Longnose Dace	11.4	27.9	1.6	1.3	67.2	1.0
Creek Chub	54.4	38.4	23.9	20.0	1.1	15.5
Fathead Minnow	19.7	4.4	17.9	40.0	9.6	15.2
Sand Shiner	-	7.3	0.3	-	5.3	45.4
White Sucker	11.4	17.8	30.8	34.4	8.8	13.6
Longnose Sucker	3.1	-	-	0.1	-	-
Johnny Darter	0.04	4.1	18.9	1.2	-	0.1
Green Sunfish	-	-	6.6	3.0	6.5	0.2
Mosquitofish	-	-	-	-	0.1	1.2
Largemouth Bass	-	-	-	-	-	2.4
Common Carp	-	-	-	0.1	0.4	3.5
Black Crappie	-	-	-	-	0.2	-
Bluegill	-	-	-	-	0.8	0.9
Black Bullhead	-	-	-	-	-	1.0
Brook Stickleback	-	-	-	-	-	0.2

NUMBER COLLECTED

	0.5	1.0	1.5C	2.0	3.0	5.0	overall- all sites	
							N	%
Longnose Dace	258	425	5	21	629	12	1350	17.1
Creek Chub	1229	586	76	323	10	191	2415	30.6
Fathead Minnow	444	67	57	646	90	188	1492	18.9
Sand Shiner	-	112	1	-	50	561	724	9.2
White Sucker	258	272	98	556	82	168	1434	18.2
Longnose Sucker	70	-	-	1	-	-	-	-
Johnny Darter	1	63	60	19	-	1	-	-
Green Sunfish	-	-	21	48	61	2	-	-
Mosquitofish	-	-	-	-	1.0	15	-	-
Largemouth Bass	-	-	-	-	-	29	-	-
Common Carp	-	-	-	1	4	43	-	-
Black Crappie	-	-	-	-	2	-	-	-
Bluegill	-	-	-	-	7	11	-	-
Black Bullhead	-	-	-	-	-	12	-	-
Brook Stickleback	-	-	-	-	-	2	-	-
Total Collected	2260	1525	318	1615	936	1235	7889	
Total Species Collected	6	6	7	8	10	13	15	
Native Species	6	6	7	7	6	9	10	

Bold indicates native to South Platte River.

FISH SUMMARY DATA
BIG DRY CREEK 1999-2018
Comparison of Fish Numbers

Years	Numbers of Fish Collected							
	0.5	1.0	1.5	1.5C	2.0	3.0	5.0	6.0
1999	1892	144	226	ns	967	940	1464	329
2000	1212	360	1141	1149	230	990	1125	156
2001	780	351	290	496	222	152	794	266
2002	854	883	382	172	59	88	2612	206
2003	856	831	226	196	9	68	1762	156
2004	226	531	198	72	38	67	674	148
2006	841	2171	164	398	336	762	2660	223
2008	999	1012	ns	206	66	255	611	ns
2010	688	374	ns	176	129	416	3833	ns
2012	470	797	ns	403	1394	1118	2849	ns
2014	1474	541	ns	289	629	691	419	ns
2016	648	754	ns	319	716	225	1772	ns
2018	2260	1525	ns	318	1615	936	1235	ns

ns indicates not sampled.

Bold indicates low fish numbers due to elevated ammonia and/or above normal flows.

JOHNNY DARTER COLLECTIONS
BIG DRY CREEK 1997-2018

Dates Sampled *	Numbers Collected							
	0.5	1.0	1.5	1.5C	2.0	3.0	5.0	6.0
1997 spring	10	5	0	ns	2	0	0	0
1997 fall	28	13	0	ns	0	0	0	0
1998	20	6	0	ns	4	0	0	0
1999	27	0	1	ns	0	0	0	0
2000	11	2	0	0	2	0	0	0
2001	15	0	0	0	1	0	0	0
2002	0	1	0	0	0	0	0	0
2003	0	0	0	0	0	0	0	0
2004	0	0	0	0	0	0	0	0
2006	0	0	0	0	0	0	0	0
2008	5	1	ns	0	0	0	0	ns
2010	40	2	ns	0	0	0	0	ns
2012	3	1	ns	0	0	0	0	ns
2014	2	0	ns	1	0	0	0	ns
2016	0	9	ns	4	1	0	11	ns
2018	1	63	ns	60	19	0	1	ns
No. of Years Collected 1997-2018	10	9	1	3	6	nc	2	nc
Total Individuals (when collected)	1-40	1-63	1	1-60	1-19		1-11	

* Fish sampling includes only Fall collections for 1998-2018 period.

ns = not sampled

nc = not collected

FISH IBI SCORES
BIG DRY CREEK 1999-2018

IBI Score	0.5	1.0	1.5	1.5C	2.0	3.0	5.0	6.0
1999	41	31	29		35	41	41	35
2000	41	37	35	35	31	33	39	31
2001	39	35	27	29	21	29	39	33
2002	33	37	29	27	25	25	39	27
2003	37	37	31	33	21	29	35	33
2004	29	33	33	27	17	31	33	31
2006	33	37	29	31	27	35	41	29
2008	33	39		21	19	31	33	
2010	35	33		27	25	33	33	
2012	31	35		33	29	31	37	
2014	33	31		31	27	37	37	
2016	29	39		29	31	29	35	
2018	35	37		33	31	39	41	
13-yr Mean IBI 1999-2018	34.5	35.5	30.4	29.7	26.1	32.5	37.2	31.3
mean up/down	32.5 upstream sites				31.8 downstream sites			

Condition Category	Score Range
Excellent	53 - 55
Good	44 - 52
Fair	37 - 43
Poor	29 - 36
Very Poor	11 - 28

FISH IBI SCORES
BIG DRY CREEK 2008-2018

IBI Score	0.5	1.0	1.5C	2.0	3.0	5.0
2008	33	39	21	19	31	33
2010	35	33	27	25	33	33
2012	31	35	33	29	31	37
2014	33	31	31	27	37	37
2016	29	39	29	31	29	35
2018	35	37	33	31	39	41
				min		max
6-yr Mean IBI 2008-2018	32.7	35.7	29.0	27.0	33.3	36.0
mean up/down	32.4 upstream sites			32.1 downstream sites		

Condition Category	Score Range
Excellent	53 - 55
Good	44 - 52
Fair	37 - 43
Poor	29 - 36
Very Poor	11 - 28

BDC Snail Population 1999-2018

year	season	Numbers Collected					
		0.5	1.0	1.5C	2.0	3.0	5.0
1999	spring	2	0	ns	0	0	0
2000	spring	36	0	0	0	0	0
	fall	73	0	0	0	0	0
2001	spring	254	0	0	0	73	0
	fall	98	73	0	0	254	36
2002	spring	83	28	28	0	0	0
	fall	4774	388	413	167	358	248
2003	spring	559	0	0	0	0	0
	fall	551	413	55	0	110	55
2004	spring	78	78	39	0	0	0
	fall	496	55	110	0	96	0
2006	spring	0	138	28	0	28	0
	fall	78	248	83	0	55	18
2008	fall	0	0	0	0	2	0
2010	fall	83	469	165	0	55	717
2012	fall	165	276	0	0	28	28
2014	fall	386	33	0	110	55	0
2016	fall	331	0	1323	55	0	0
2018	fall	0	1544	303	165	224	0

APPENDIX C

MACROINVERTEBRATE COMMUNITY SUMMARIES AND METRICS

MACROINVERTEBRATE DATA SUMMARY - METRICS COMPARISONS
BIG DRY CREEK FALL 2012-2018

FALL 2012

metric	upstream sites				downstream sites			
	0.5	1.0	1.5C	Means	2.0	3.0	5.0	Means
diversity	4.18	3.82	2.99	3.66	2.84	3.54	3.76	3.38
HBI	6.04	6.52	6.84	6.47	7.16	8.22	6.60	7.33
ICI	38	32	26	32.0	16	32	26	24.7
EPT taxa	5	8	7	7	5	8	5	6
total taxa	41	34	31	35	25	41	33	33
density	36658	18467	14862	23329	18963	16291	10126	15127

FALL 2014

metric	upstream sites				downstream sites			
	0.5	1.0	1.5C	Means	2.0	3.0	5.0	Means
diversity	3.58	3.69	3.83	3.70	3.75	4.11	3.30	3.72
HBI	5.75	6.20	6.90	6.28	6.47	7.25	5.73	6.48
ICI	32	34	24	30.0	26	28	36	30.0
EPT taxa	5	6	6	6	6	7	8	7
total taxa	35	36	34	35	35	42	27	35
density	35765	27673	9537	24325	19037	16389	10222	15216

FALL 2016

metric	upstream sites				downstream sites			
	0.5	1.0	1.5C	Means	2.0	3.0	5.0	Means
diversity	3.76	4.11	3.71	3.86	3.62	3.13	2.27	3.01
HBI	6.21	6.17	6.75	6.38	6.74	8.10	8.47	7.77
ICI	42	34	26	34.0	26	24	12	20.7
EPT taxa	6	7	6	6	6	6	4	5
total taxa	46	33	30	36	29	36	24	30
density	91864	44762	27893	54840	18511	71119	52369	47333

FALL 2018

metric	upstream sites				downstream sites			
	0.5	1.0	1.5C	Means	2.0	3.0	5.0	Means
diversity	3.58	4.10	3.44	3.71	3.74	3.73	3.56	3.68
HBI	6.02	6.21	7.14	6.46	7.07	7.20	6.52	6.93
ICI	34	26	20	26.7	24	34	24	27.3
EPT taxa	6	5	5	5	6	8	5	6
total taxa	39	38	31	36	34	40	30	35
density	54629	37492	11674	34598	28224	112756	20121	53700

BIG DRY CREEK

MACROINVERTEBRATE DATA SUMMARY - DENSITY & TAXA
BIG DRY CREEK FALL 2012-2018

	STUDY SITE						Annual Mean
	0.5	1.0	1.5C	2.0	3.0	5.0	
DENSITY (N/m²)							
2012	36,658	18,467	14,862	18,963	16,291	10,126	19,228
2014	35,765	27,673	9,537	19,190	16,574	10,401	19,857
2016	91,864	44,762	27,893	18,511	71,119	52,369	51,086
2018	54,629	37,492	11,674	28,224	112,756	20,121	44,149
4-yr Mean 2012-2018	54,729	32,098	15,991	21,222	54,185	23,254	33,580
TAXA							
2012	41	34	31	25	41	33	34
2014	35	36	34	35	42	27	35
2016	46	33	30	29	36	24	33
2018	39	38	31	34	40	30	35
4-yr Mean 2012-2018	40	35	32	31	40	29	34

**MACROINVERTEBRATE DATA SUMMARY - ICI METRIC
FALL 2000-2018**

Annual ICI Results	STUDY SITE					
	0.5	1.0	1.5C	2.0	3.0	5.0
2000	38	36	30	30	36	14
2001	30	38	38	14	32	32
2002	24	22	28	16	22	28
2003	24	36	34	14	22	22
2004	36	20	28	20	30	36
2006	28	22	28	10	30	28
2008	22	34	16	20	22	32
2010	36	42	30	20	28	24
2012	38	32	26	16	32	26
2014	32	34	24	26	28	36
2016	42	34	26	26	24	12
2018	34	26	20	24	34	24
12-yr mean ICI - 2000-2018	32.0	31.3	27.3	19.7	28.3	26.2
4-yr mean ICI - 2012-2018	36.5	31.5	24	23	29.5	24.5

**MACROINVERTEBRATE DATA SUMMARY
FALL 2018**

**DENSITY
KICK SAMPLES**

Density by Order	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
TURBELLARIA	662	221	0	0	221	55
NEMATODA	441	551	83	276	0	221
OLIGOCHAETA	11620	5733	3197	9316	47408	4079
HIRUDINEA	110	110	0	0	0	55
ISOPODA	0	0	0	0	0	0
AMPHIPODA	3638	2756	303	1047	4190	662
DECAPODA	0	0	11	0	26	0
ACARI	0	0	0	0	0	0
COLLEMBOLA	0	772	83	276	0	331
EPHEMEROPTERA	25909	14112	1957	6450	20286	5402
ODONATA	110	4	4	55	0	0
HEMIPTERA	331	4	28	0	0	0
TRICHOPTERA	1433	551	0	110	8379	386
COLEOPTERA	0	0	0	0	0	0
DIPTERA	10375	11025	5705	10253	31973	8930
GASTROPODA	0	1544	303	165	224	0
BIVALVIA	0	110	0	276	51	0
Total	54629	37492	11674	28224	112756	20121

**RELATIVE ABUNDANCE
KICK SAMPLES**

Relative Abundance by Order	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
TURBELLARIA	1.21	0.59	0.00	0.00	0.20	0.27
NEMATODA	0.81	1.47	0.71	0.98	0.00	1.10
OLIGOCHAETA	21.27	15.29	27.39	33.01	42.04	20.27
HIRUDINEA	0.20	0.29	0.00	0.00	0.00	0.27
ISOPODA	0	0	0	0	0	0
AMPHIPODA	6.66	7.35	2.60	3.71	3.72	3.29
DECAPODA	0.00	0.00	0.09	0.00	0.02	0.00
ACARI	0	0	0	0	0	0
COLLEMBOLA	0	2	1	1	0	2
EPHEMEROPTERA	47.43	37.64	16.76	22.85	17.99	26.85
ODONATA	0.20	0.01	0.03	0.20	0.00	0.00
HEMIPTERA	0.61	0.01	0.24	0.00	0.00	0.00
TRICHOPTERA	2.62	1.47	0.00	0.39	7.43	1.92
COLEOPTERA	0.00	0.00	0.00	0.00	0.00	0.00
DIPTERA	18.99	29.41	48.87	36.33	28.36	44.38
GASTROPODA	0.00	4.12	2.60	0.59	0.20	0.00
BIVALVIA	0.00	0.29	0.00	0.98	0.05	0.00
Total	100.00	100.00	100.00	100.00	100.00	100.00

*Isopoda, Acari and Coleoptera not collected in 2018.

MACROINVERTEBRATE SUMMARY DATA
COMMUNITY PARAMETERS - FALL 2012-2018

FALL 2012
KICK SAMPLES

Community Parameters	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
Taxa Richness	41	34	31	25	41	33
Total Density (N/m2)	36658	18467	14862	18963	16291	10126
Diversity (d)	4.18	3.82	2.99	2.84	3.54	3.76
% Dominant Taxon	17.59	27.31	42.28	40.99	27.75	19.87
EPT Index	5	8	7	5	8	5
EPT abundance	13671.00	4520.25	2287.69	854.44	1295.44	1764.00
Chironomid abundance	8875.13	8351.44	10143.00	11052.56	5154.19	5347.13
Scraper abundance	1598.63	441.00	2563.31	826.88	468.56	137.81
Filterer abundance	2866.50	716.63	248.06	1708.88	248.06	248.06
Shredder abundance	330.75	1378.13	744.19	1571.06	551.25	2094.75
HBI	6.04	6.52	6.84	7.16	8.22	6.60
ICI	38	32	26	16	32	26

FALL 2014
KICK SAMPLES

Community Parameters	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
Taxa Richness	35	36	34	35	42	27
Total Density (N/m2)	35765	27673	9537	22888	20948	22712
Diversity (d)	3.58	3.69	3.83	3.75	4.11	3.30
% Dominant Taxon	27.28	29.88	23.70	27.70	21.05	22.82
EPT Index	5	6	6	6	7	8
EPT abundance	18246.38	12182.63	1323.00	4024.13	3307.50	8930.25
Chironomid abundance	7827.75	8599.50	6036.19	7938.00	7993.13	7221.38
Scraper abundance	716.63	1047.38	1378.13	1543.50	385.88	385.88
Filterer abundance	3197.25	2149.88	413.44	6394.50	551.25	5292.00
Shredder abundance	606.38	2425.50	1350.56	2039.63	3748.50	5181.75
HBI	5.75	6.20	6.90	6.47	7.25	5.73
ICI	32	34	24	26	28	36

MACROINVERTEBRATE SUMMARY DATA
COMMUNITY PARAMETERS - FALL 2012-2018

FALL 2016
KICK SAMPLES

Community Parameters	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
Taxa Richness	46	33	30	29	36	24
Total Density (N/m ²)	91864	44762	27893	18511	71119	52369
Diversity (d)	3.76	4.11	3.71	3.62	3.13	2.27
% Dominant Taxon	23.64	14.29	20.95	22.04	30.23	64.00
EPT Index	6	7	6	6	6	4
EPT abundance	31752.00	17419.50	4410.00	4299.75	9371.25	1874.25
Chironomid abundance	36933.75	19404.00	14938.88	6945.75	12237.75	10032.75
Scraper abundance	1543.50	882.00	1874.25	275.63	441.00	992.25
Filterer abundance	22711.50	3307.50	275.63	1400.18	3087.00	110.25
Shredder abundance	2212.35	7166.25	6118.88	4354.88	6174.00	3087.00
HBI	6.21	6.17	6.75	6.74	8.10	8.47
ICI	42	34	26	26	24	12

FALL 2018
KICK SAMPLES

Community Parameters	BDC-0.5	BDC-1.0	BDC-1.5C	BDC-2.0	BDC-3.0	BDC-5.0
Taxa Richness	39	38	31	34	40	30
Total Density (N/m ²)	54629	37492	11674	28224	112756	20121
Diversity (d)	3.58	4.10	3.44	3.74	3.73	3.56
% Dominant Taxon	32.69	20.88	28.81	24.02	24.25	29.04
EPT Index	6	5	5	6	8	5
EPT abundance	27342.00	14663.25	1956.94	6559.88	28665.00	5788.13
Chironomid abundance	8268.75	10253.25	5677.88	8875.13	29988.00	7772.63
Scraper abundance	0.61	4.41	3.31	1.76	1.96	1.37
Filterer abundance	9.49	2.94	0.47	5.86	8.65	7.12
Shredder abundance	1102.72	1434.43	249.95	3308.09	11686.89	5843.25
HBI	6.02	6.21	7.14	7.07	7.20	6.52
ICI	34	26	20	24	34	24

APPENDIX D
MACROINVERTEBRATE DATA

BDC-0.5

Sample Date: 29 October 2018

Taxon	Kick Sample		Relative
	n	N/m ²	Abundance (%)
TURBELLARIA			
Dugesia sp.	180	661.50	1.21
NEMATODA			
	120	441.00	0.81
OLIGOCHAETA			
Dero nivea			
Enchytraeidae	420	1543.50	2.83
Lumbricidae	12	44.10	0.08
Nais spp.	90	330.75	0.61
Pristina leidyi			
Pristinella jenkiniae	30	110.25	0.20
Tubificidae with hair chaetae	330	1212.75	2.22
Tubificidae w/o hair chaetae	2280	8379.00	15.34
HIRUDINEA			
Erpobdellidae	30	110.25	0.20
AMPHIPODA			
Crangonyx sp.	450	1653.75	3.03
Hyaella azteca	540	1984.50	3.63
DECAPODA			
Orconectes immunis			
Orconectes sp.			
COLLEMBOLA			
EPHEMEROPTERA			
Acentrella insignificans	30	110.25	0.20
Baetis tricaudatus	180	661.50	1.21
Callibaetis sp.			
Fallceon quilleri	1980	7276.50	13.32
Heptagenia elegantula			
Paracloeodes minutus			
Tricorythodes explicatus	4860	17860.50	32.69
ODONATA			
Argia sp.	30	110.25	0.20
Coenagrionidae			
Hetaerina americana			
Ophiogomphus severus			
HEMIPTERA			
Corixidae	30	110.25	0.20
Microvelia sp.	60	220.50	0.40
Sigara grossolineata			
TRICHOPTERA			
Cheumatopsyche sp.	360	1323.00	2.42
Hydropsyche sp.	30	110.25	0.20
Hydroptila sp.			

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.			
Ceratopogonidae			
Chironomus sp.	30	110.25	0.20
Cladotanytarsus sp.			
Cricotopus sp.	300	1102.50	2.02
Cryptochironomus sp.	120	441.00	0.81
Dicrotendipes sp.			
Eukiefferiella sp.	150	551.25	1.01
Hemerodromia sp.	90	330.75	0.61
Hydrobaenus sp.	120	441.00	0.81
Micropsectra sp.	60	220.50	0.40
Microtendipes sp.			
Nanocladius sp.			
Neoplasta sp.			
Odontomesa sp.			
Orthocladius sp.			
Parakiefferiella sp.	30	110.25	0.20
Parametriocnemus sp.	30	110.25	0.20
Paraphaenocladius sp.			
Paratanytarsus sp.	90	330.75	0.61
Paratendipes sp.			
Phaenopsectra sp.	90	330.75	0.61
Polypedilum sp.	30	110.25	0.20
Pseudochironomus sp.			
Rheocricotopus sp.			
Rheotanytarsus sp.	540	1984.50	3.63
Saetheria tylus	30	110.25	0.20
Simulium vittatum complex	480	1764.00	3.23
Stictochironomus sp.	450	1653.75	3.03
Thienemanniella sp.	60	220.50	0.40
Thienemannimyia group	120	441.00	0.81
Tipula sp.	3	11.03	0.02
GASTROPODA			
Ferrissia sp.			
Physidae			
BIVALVIA			
Corbicula sp.			
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Totals:	14865	54628.88	100.00
Total Density (N/m ²)		54629	
Total Number of Taxa		39	
Diversity (d)		3.58	

BDC-0.5

Community Parameters	Kick Sample
Total Density (N/m ²)	54629
Diversity (d)	3.58
Total Number of Taxa	39
% Dominant Taxon	32.69
EPT Richness 4/0/2	6
EPT (abundance)	27342.00
Chiron (abundance)	8268.75
EPT/Chironomid ratio	3.31
Scraper (abundance)	0.61
Filterer (abundance)	9.49
SC/F ratio	0.06
Shredder (abundance)	1102.72
SH/Total ratio	0.02
HBI	6.02
ICI	34 fair

Relative Abundance by Order

TURBELLARIA	1.21
NEMATODA	0.81
OLIGOCHAETA	21.27
HIRUDINEA	0.20
ISOPODA	0
AMPHIPODA	6.66
DECAPODA	0.00
ACARI	0
COLLEMBOLA	0.00
EPHEMEROPTERA	47.43
ODONATA	0.20
HEMIPTERA	0.61
TRICHOPTERA	2.62
COLEOPTERA	0
DIPTERA	18.99
GASTROPODA	0.00
BIVALVIA	0.00
Totals:	100.00

Density by Order

TURBELLARIA	662
NEMATODA	441
OLIGOCHAETA	11620
HIRUDINEA	110
ISOPODA	0
AMPHIPODA	3638
DECAPODA	0
ACARI	0
COLLEMBOLA	0
EPHEMEROPTERA	25909
ODONATA	110
HEMIPTERA	331
TRICHOPTERA	1433
COLEOPTERA	0
DIPTERA	10375
GASTROPODA	0
BIVALVIA	0
Totals:	54629

BDC-1.0

Sample Date: 29 October 2018

Taxon	Kick Sample		Relative
	n	N/m ²	Abundance (%)
TURBELLARIA			
Dugesia sp.	60	220.50	0.59
NEMATODA			
	150	551.25	1.47
OLIGOCHAETA			
Dero nivea	60	220.50	0.59
Enchytraeidae			
Lumbricidae			
Nais spp.	270	992.25	2.65
Pristina leidyi	30	110.25	0.29
Pristinella jenkiniae			
Tubificidae with hair chaetae	150	551.25	1.47
Tubificidae w/o hair chaetae	1050	3858.75	10.29
HIRUDINEA			
Erpobdellidae	30	110.25	0.29
AMPHIPODA			
Crangonyx sp.	390	1433.25	3.82
Hyaella azteca	360	1323.00	3.53
DECAPODA			
Orconectes immunis			
Orconectes sp.			
COLLEMBOLA	210	771.75	2.06
EPHEMEROPTERA			
Acentrella insignificans	330	1212.75	3.23
Baetis tricaudatus	120	441.00	1.18
Callibaetis sp.			
Fallceon quilleri	1260	4630.50	12.35
Heptagenia elegantula			
Paracloeodes minutus			
Tricorythodes explicatus	2130	7827.75	20.88
ODONATA			
Argia sp.			
Coenagrionidae	1	3.68	0.01
Hetaerina americana			
Ophiogomphus severus			
HEMIPTERA			
Corixidae			
Microvelia sp.			
Sigara grossolineata	1	3.68	0.01
TRICHOPTERA			
Cheumatopsyche sp.	150	551.25	1.47
Hydropsyche sp.			
Hydroptila sp.			

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.	30	110.25	0.29
Ceratopogonidae	60	220.50	0.59
Chironomus sp.	30	110.25	0.29
Cladotanytarsus sp.			
Cricotopus sp.	360	1323.00	3.53
Cryptochironomus sp.	150	551.25	1.47
Dicrotendipes sp.			
Eukiefferiella sp.	30	110.25	0.29
Hemerodromia sp.	60	220.50	0.59
Hydrobaenus sp.	630	2315.25	6.18
Micropsectra sp.	480	1764.00	4.70
Microtendipes sp.			
Nanocladius sp.			
Neoplasta sp.			
Odontomesa sp.			
Orthocladius sp.	30	110.25	0.29
Parakiefferiella sp.	30	110.25	0.29
Parametriocnemus sp.	30	110.25	0.29
Paraphaenocladius sp.			
Paratanytarsus sp.			
Paratendipes sp.			
Phaenopsectra sp.	30	110.25	0.29
Polypedilum sp.	120	441.00	1.18
Pseudochironomus sp.			
Rheocricotopus sp.			
Rheotanytarsus sp.	30	110.25	0.29
Saetheria tylus			
Simulium vittatum complex	90	330.75	0.88
Stictochironomus sp.	750	2756.25	7.35
Thienemanniella sp.	60	220.50	0.59
Thienemannimyia group			
Tipula sp.			
GASTROPODA			
Ferrissia sp.	420	1543.50	4.12
Physidae			
BIVALVIA			
Corbicula sp.	30	110.25	0.29
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Totals:	10202	37492.35	100.00
Total Density (N/m ²)		37492	
Total Number of Taxa		38	
Diversity (d)		4.10	

BDC-1.0

Community Parameters	Kick Sample
Total Density (N/m ²)	37492
Diversity (d)	4.10
Total Number of Taxa	38
% Dominant Taxon	20.88
EPT Richness 4/0/1	5
EPT (abundance)	14663.25
Chiron (abundance)	10253.25
EPT/Chironomid ratio	1.43
Scraper (abundance)	4.41
Filterer (abundance)	2.94
SC/F ratio	1.50
Shredder (abundance)	1434.43
SH/Total ratio	0.04
HBI	6.21
ICI	26 fair

Relative Abundance by Order

TURBELLARIA	0.59
NEMATODA	1.47
OLIGOCHAETA	15.29
HIRUDINEA	0.29
ISOPODA	0
AMPHIPODA	7.35
DECAPODA	0.00
ACARI	0
COLLEMBOLA	2.06
EPHEMEROPTERA	37.64
ODONATA	0.01
HEMIPTERA	0.01
TRICHOPTERA	1.47
COLEOPTERA	0
DIPTERA	29.41
GASTROPODA	4.12
BIVALVIA	0.29
Totals:	100.00

Density by Order

TURBELLARIA	221
NEMATODA	551
OLIGOCHAETA	5733
HIRUDINEA	110
ISOPODA	0
AMPHIPODA	2756
DECAPODA	0
ACARI	0
COLLEMBOLA	772
EPHEMEROPTERA	14112
ODONATA	4
HEMIPTERA	4
TRICHOPTERA	551
COLEOPTERA	0
DIPTERA	11025
GASTROPODA	1544
BIVALVIA	110
Totals:	37492

BDC-1.5C

Sample Date: 29 October 2018

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
TURBELLARIA			
Dugesia sp.			
NEMATODA	22.5	82.69	0.71
OLIGOCHAETA			
Dero nivea			
Enchytraeidae			
Lumbricidae			
Nais spp.	112.5	413.44	3.54
Pristina leidyi			
Pristinella jenkiniae			
Tubificidae with hair chaetae	210	771.75	6.61
Tubificidae w/o hair chaetae	547.5	2012.06	17.24
HIRUDINEA			
Erpobdellidae			
AMPHIPODA			
Crangonyx sp.	52.5	192.94	1.65
Hyaella azteca	30	110.25	0.94
DECAPODA			
Orconectes immunis			
Orconectes sp.	3	11.03	0.09
COLLEMBOLA	22.5	82.69	0.71
EPHEMEROPTERA			
Acentrella insignificans			
Baetis tricaudatus			
Callibaetis sp.	22.5	82.69	0.71
Fallceon quilleri	15	55.13	0.47
Heptagenia elegantula	15	55.13	0.47
Paracloeodes minutus	7.5	27.56	0.24
Tricorythodes explicatus	472.5	1736.44	14.87
ODONATA			
Argia sp.			
Coenagrionidae			
Hetaerina americana			
Ophiogomphus severus	1	3.68	0.03
HEMIPTERA			
Corixidae			
Microvelia sp.	7.5	27.56	0.24
Sigara grossolineata			
TRICHOPTERA			
Cheumatopsyche sp.			
Hydropsyche sp.			
Hydroptila sp.			

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.	7.5	27.56	0.24
Ceratopogonidae	7.5	27.56	0.24
Chironomus sp.	97.5	358.31	3.07
Cladotanytarsus sp.			
Cricotopus sp.	60	220.50	1.89
Cryptochironomus sp.	60	220.50	1.89
Dicrotendipes sp.			
Eukiefferiella sp.			
Hemerodromia sp.			
Hydrobaenus sp.	195	716.63	6.14
Micropsectra sp.	82.5	303.19	2.60
Microtendipes sp.	15	55.13	0.47
Nanocladius sp.			
Neoplasta sp.			
Odontomesa sp.			
Orthocladius sp.			
Parakiefferiella sp.	7.5	27.56	0.24
Parametriochnemus sp.			
Paraphaenocladius sp.	7.5	27.56	0.24
Paratanytarsus sp.			
Paratendipes sp.	7.5	27.56	0.24
Phaenopsectra sp.			
Polypedilum sp.	60	220.50	1.89
Pseudochironomus sp.			
Rheocricotopus sp.			
Rheotanytarsus sp.			
Saetheria tylus			
Simulium vittatum complex			
Stictochironomus sp.	915	3362.63	28.81
Thienemanniella sp.	22.5	82.69	0.71
Thienemannimyia group	7.5	27.56	0.24
Tipula sp.			
GASTROPODA			
Ferrissia sp.	82.5	303.19	2.60
Physidae			
BIVALVIA			
Corbicula sp.			
<hr/>			
Totals:	3177	11673.64	100.00
Total Density (N/m ²)		11674	
Total Number of Taxa		31	
Diversity (d)		3.44	

BDC-1.5C

Community Parameters	Kick Sample
Total Density (N/m ²)	11674
Diversity (d)	3.44
Total Number of Taxa	31
% Dominant Taxon	28.81
EPT Richness 5/0/0	5
EPT (abundance)	1956.94
Chiron (abundance)	5677.88
EPT/Chironomid ratio	0.34
Scraper (abundance)	3.31
Filterer (abundance)	0.47
SC/F ratio	7.00
Shredder (abundance)	249.95
SH/Total ratio	0.02
HBI	7.14
ICI	20 fair

Relative Abundance by Order

TURBELLARIA	0.00
NEMATODA	0.71
OLIGOCHAETA	27.39
HIRUDINEA	0.00
ISOPODA	0
AMPHIPODA	2.60
DECAPODA	0.09
ACARI	0
COLLEMBOLA	0.71
EPHEMEROPTERA	16.76
ODONATA	0.03
HEMIPTERA	0.24
TRICHOPTERA	0.00
COLEOPTERA	0
DIPTERA	48.87
GASTROPODA	2.60
BIVALVIA	0.00
Totals:	100.00

Density by Order

TURBELLARIA	0
NEMATODA	83
OLIGOCHAETA	3197
HIRUDINEA	0
ISOPODA	0
AMPHIPODA	303
DECAPODA	11
ACARI	0
COLLEMBOLA	83
EPHEMEROPTERA	1957
ODONATA	4
HEMIPTERA	28
TRICHOPTERA	0
COLEOPTERA	0
DIPTERA	5705
GASTROPODA	303
BIVALVIA	0
Totals:	11674

BDC-2.0

Sample Date: 29 October 2018

Taxon	Kick Sample		Relative
	n	N/m ²	Abundance (%)
TURBELLARIA			
Dugesia sp.			
NEMATODA	75	275.63	0.98
OLIGOCHAETA			
Dero nivea	30	110.25	0.39
Enchytraeidae			
Lumbricidae			
Nais spp.	645	2370.38	8.40
Pristina leidyi			
Pristinella jenkiniae			
Tubificidae with hair chaetae	15	55.13	0.20
Tubificidae w/o hair chaetae	1845	6780.38	24.02
HIRUDINEA			
Erpobdellidae			
AMPHIPODA			
Crangonyx sp.	195	716.63	2.54
Hyaella azteca	90	330.75	1.17
DECAPODA			
Orconectes immunis			
Orconectes sp.			
COLLEMBOLA	75	275.63	0.98
EPHEMEROPTERA			
Acentrella insignificans	225	826.88	2.93
Baetis tricaudatus			
Callibaetis sp.			
Fallceon quilleri	270	992.25	3.52
Heptagenia elegantula	75	275.63	0.98
Paracloeodes minutus			
Tricorythodes explicatus	1185	4354.88	15.43
ODONATA			
Argia sp.			
Coenagrionidae			
Hetaerina americana	15	55.13	0.20
Ophiogomphus severus			
HEMIPTERA			
Corixidae			
Microvelia sp.			
Sigara grossolineata			
TRICHOPTERA			
Cheumatopsyche sp.	15	55.13	0.20
Hydropsyche sp.			
Hydroptila sp.	15	55.13	0.20

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.			
Ceratopogonidae	15	55.13	0.20
Chironomus sp.	60	220.50	0.78
Cladotanytarsus sp.	165	606.38	2.15
Cricotopus sp.	900	3307.50	11.72
Cryptochironomus sp.	75	275.63	0.98
Dicrotendipes sp.			
Eukiefferiella sp.	30	110.25	0.39
Hemerodromia sp.			
Hydrobaenus sp.	105	385.88	1.37
Micropsectra sp.	150	551.25	1.95
Microtendipes sp.			
Nanocladius sp.			
Neoplasta sp.			
Odontomesa sp.			
Orthocladius sp.			
Parakiefferiella sp.	30	110.25	0.39
Parametriocnemus sp.	15	55.13	0.20
Paraphaenocladius sp.	15	55.13	0.20
Paratanytarsus sp.			
Paratendipes sp.			
Phaenopsectra sp.			
Polypedilum sp.	45	165.38	0.59
Pseudochironomus sp.			
Rheocricotopus sp.			
Rheotanytarsus sp.			
Saetheria tylus	75	275.63	0.98
Simulium vittatum complex	360	1323.00	4.69
Stictochironomus sp.	705	2590.88	9.18
Thienemanniella sp.	30	110.25	0.39
Thienemannimyia group	15	55.13	0.20
Tipula sp.			
GASTROPODA			
Ferrissia sp.	45	165.38	0.59
Physidae			
BIVALVIA			
Corbicula sp.	75	275.63	0.98
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Totals:	7680	28224.00	100.00
Total Density (N/m ²)		28224	
Total Number of Taxa		34	
Diversity (d)		3.74	

BDC-2.0

Community Parameters	Kick Sample
Total Density (N/m ²)	28224
Diversity (d)	3.74
Total Number of Taxa	34
% Dominant Taxon	24.02
EPT Richness 4/0/2	6
EPT (abundance)	6559.88
Chiron (abundance)	8875.13
EPT/Chironomid ratio	0.74
Scraper (abundance)	1.76
Filterer (abundance)	5.86
SC/F ratio	0.30
Shredder (abundance)	3308.09
SH/Total ratio	0.12
HBI	7.07
ICI	24 fair

Relative Abundance by Order

TURBELLARIA	0.00
NEMATODA	0.98
OLIGOCHAETA	33.01
HIRUDINEA	0.00
ISOPODA	0
AMPHIPODA	3.71
DECAPODA	0.00
ACARI	0
COLLEMBOLA	0.98
EPHEMEROPTERA	22.85
ODONATA	0.20
HEMIPTERA	0.00
TRICHOPTERA	0.39
COLEOPTERA	0
DIPTERA	36.33
GASTROPODA	0.59
BIVALVIA	0.98
Totals:	100.00

Density by Order

TURBELLARIA	0
NEMATODA	276
OLIGOCHAETA	9316
HIRUDINEA	0
ISOPODA	0
AMPHIPODA	1047
DECAPODA	0
ACARI	0
COLLEMBOLA	276
EPHEMEROPTERA	6450
ODONATA	55
HEMIPTERA	0
TRICHOPTERA	110
COLEOPTERA	0
DIPTERA	10253
GASTROPODA	165
BIVALVIA	276
Totals:	28224

BDC-3.0

Sample Date: 29 October 2018

Taxon	Kick Sample		Relative
	n	N/m ²	Abundance (%)
TURBELLARIA			
Dugesia sp.	60	220.50	0.20
NEMATODA			
OLIGOCHAETA			
Dero nivea	180	661.50	0.59
Enchytraeidae			
Lumbricidae			
Nais spp.	7440	27342.00	24.25
Pristina leidyi	180	661.50	0.59
Pristinella jenkiniae	120	441.00	0.39
Tubificidae with hair chaetae	60	220.50	0.20
Tubificidae w/o hair chaetae	4920	18081.00	16.04
HIRUDINEA			
Erpobdellidae			
AMPHIPODA			
Crangonyx sp.	1020	3748.50	3.32
Hyaella azteca	120	441.00	0.39
DECAPODA			
Orconectes immunis	1	3.68	0.00
Orconectes sp.	6	22.05	0.02
COLLEMBOLA			
EPHEMEROPTERA			
Acentrella insignificans	480	1764.00	1.56
Baetis tricaudatus	120	441.00	0.39
Callibaetis sp.			
Fallceon quilleri	1260	4630.50	4.11
Heptagenia elegantula	180	661.50	0.59
Paracloeodes minutus			
Tricorythodes explicatus	3480	12789.00	11.34
ODONATA			
Argia sp.			
Coenagrionidae			
Hetaerina americana			
Ophiogomphus severus			
HEMIPTERA			
Corixidae			
Microvelia sp.			
Sigara grossolineata			
TRICHOPTERA			
Cheumatopsyche sp.	1080	3969.00	3.52
Hydropsyche sp.	1020	3748.50	3.32
Hydroptila sp.	180	661.50	0.59

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.	60	220.50	0.20
Ceratopogonidae			
Chironomus sp.	360	1323.00	1.17
Cladotanytarsus sp.	360	1323.00	1.17
Cricotopus sp.	3120	11466.00	10.17
Cryptochironomus sp.			
Dicrotendipes sp.	60	220.50	0.20
Eukiefferiella sp.	120	441.00	0.39
Hemerodromia sp.			
Hydrobaenus sp.			
Micropsectra sp.	1980	7276.50	6.45
Microtendipes sp.			
Nanocladius sp.	60	220.50	0.20
Neoplasta sp.			
Odontomesa sp.	60	220.50	0.20
Orthocladius sp.			
Parakiefferiella sp.			
Parametriochnemus sp.			
Paraphaenocladius sp.	300	1102.50	0.98
Paratanytarsus sp.			
Paratendipes sp.			
Phaenopsectra sp.	180	661.50	0.59
Polypedilum sp.	120	441.00	0.39
Pseudochironomus sp.	60	220.50	0.20
Rheocricotopus sp.	180	661.50	0.59
Rheotanytarsus sp.			
Saetheria tylus			
Simulium vittatum complex	540	1984.50	1.76
Stictochironomus sp.	1020	3748.50	3.32
Thienemanniella sp.	60	220.50	0.20
Thienemannimyia group	60	220.50	0.20
Tipula sp.			
GASTROPODA			
Ferrissia sp.	60	220.50	0.20
Physidae	1	3.68	0.00
BIVALVIA			
Corbicula sp.	14	51.45	0.05
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Totals:	30682	112756.35	100.00
Total Density (N/m ²)		112756	
Total Number of Taxa		40	
Diversity (d)		3.73	

BDC-3.0

Community Parameters	Kick Sample
Total Density (N/m ²)	112756
Diversity (d)	3.73
Total Number of Taxa	40
% Dominant Taxon	24.25
EPT Richness 5/0/3	8
EPT (abundance)	28665.00
Chiron (abundance)	29988.00
EPT/Chironomid ratio	0.96
Scraper (abundance)	1.96
Filterer (abundance)	8.65
SC/F ratio	0.23
Shredder (abundance)	11686.89
SH/Total ratio	0.10
HBI	7.20
ICI	34 fair

Relative Abundance by Order

TURBELLARIA	0.20
NEMATODA	0.00
OLIGOCHAETA	42.04
HIRUDINEA	0.00
ISOPODA	0
AMPHIPODA	3.72
DECAPODA	0.02
ACARI	0
COLLEMBOLA	0.00
EPHEMEROPTERA	17.99
ODONATA	0.00
HEMIPTERA	0.00
TRICHOPTERA	7.43
COLEOPTERA	0
DIPTERA	28.36
GASTROPODA	0.20
BIVALVIA	0.05
Totals:	100.00

Density by Order

TURBELLARIA	221
NEMATODA	0
OLIGOCHAETA	47408
HIRUDINEA	0
ISOPODA	0
AMPHIPODA	4190
DECAPODA	26
ACARI	0
COLLEMBOLA	0
EPHEMEROPTERA	20286
ODONATA	0
HEMIPTERA	0
TRICHOPTERA	8379
COLEOPTERA	0
DIPTERA	31973
GASTROPODA	224
BIVALVIA	51
Totals:	112756

BDC-5.0

Sample Date: 29 October 2018

Taxon	Kick Sample		Relative
	n	N/m ²	Abundance (%)
TURBELLARIA			
Dugesia sp.	15	55.13	0.27
NEMATODA			
	60	220.50	1.10
OLIGOCHAETA			
Dero nivea	15	55.13	0.27
Enchytraeidae	30	110.25	0.55
Lumbricidae			
Nais spp.	810	2976.75	14.79
Pristina leidyi	45	165.38	0.82
Pristinella jenkiniae	120	441.00	2.19
Tubificidae with hair chaetae	15	55.13	0.27
Tubificidae w/o hair chaetae	75	275.63	1.37
HIRUDINEA			
Erpobdellidae	15	55.13	0.27
AMPHIPODA			
Crangonyx sp.			
Hyalella azteca	180	661.50	3.29
DECAPODA			
Orconectes immunis			
Orconectes sp.			
COLLEMBOLA	90	330.75	1.64
EPHEMEROPTERA			
Acentrella insignificans	465	1708.88	8.49
Baetis tricaudatus			
Callibaetis sp.			
Fallceon quilleri	150	551.25	2.74
Heptagenia elegantula	75	275.63	1.37
Paracloeodes minutus			
Tricorythodes explicatus	780	2866.50	14.25
ODONATA			
Argia sp.			
Coenagrionidae			
Hetaerina americana			
Ophiogomphus severus			
HEMIPTERA			
Corixidae			
Microvelia sp.			
Sigara grossolineata			
TRICHOPTERA			
Cheumatopsyche sp.	105	385.88	1.92
Hydropsyche sp.			
Hydroptila sp.			

Taxon	Kick Sample n	N/m ²	Relative Abundance (%)
DIPTERA			
Brillia sp.			
Ceratopogonidae	15	55.13	0.27
Chironomus sp.	30	110.25	0.55
Cladotanytarsus sp.			
Cricotopus sp.	1590	5843.25	29.04
Cryptochironomus sp.	45	165.38	0.82
Dicrotendipes sp.			
Eukiefferiella sp.	30	110.25	0.55
Hemerodromia sp.			
Hydrobaenus sp.			
Micropsectra sp.	105	385.88	1.92
Microtendipes sp.			
Nanocladius sp.			
Neoplasta sp.	15	55.13	0.27
Odontomesa sp.			
Orthocladius sp.	30	110.25	0.55
Parakiefferiella sp.	15	55.13	0.27
Parametriochnemus sp.			
Paraphaenocladius sp.	75	275.63	1.37
Paratanytarsus sp.			
Paratendipes sp.			
Phaenopsectra sp.			
Polypedilum sp.			
Pseudochironomus sp.			
Rheocricotopus sp.			
Rheotanytarsus sp.			
Saetheria tylus			
Simulium vittatum complex	285	1047.38	5.21
Stictochironomus sp.	150	551.25	2.74
Thienemanniella sp.	45	165.38	0.82
Thienemannimyia group			
Tipula sp.			
GASTROPODA			
Ferrissia sp.			
Physidae			
BIVALVIA			
Corbicula sp.			
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Totals:	5475	20120.63	100.00
Total Density (N/m ²)		20121	
Total Number of Taxa		30	
Diversity (d)		3.56	

BDC-5.0

Community Parameters	Kick Sample
Total Density (N/m ²)	20121
Diversity (d)	3.56
Total Number of Taxa	30
% Dominant Taxon	29.04
EPT Richness 4/0/1	5
EPT (abundance)	5788.13
Chiron (abundance)	7772.63
EPT/Chironomid ratio	0.74
Scraper (abundance)	1.37
Filterer (abundance)	7.12
SC/F ratio	0.19
Shredder (abundance)	5843.25
SH/Total ratio	0.29
HBI	6.52
ICI	24 fair

Relative Abundance by Order

TURBELLARIA	0.27
NEMATODA	1.10
OLIGOCHAETA	20.27
HIRUDINEA	0.27
ISOPODA	0
AMPHIPODA	3.29
DECAPODA	0.00
ACARI	0
COLLEMBOLA	1.64
EPHEMEROPTERA	26.85
ODONATA	0.00
HEMIPTERA	0.00
TRICHOPTERA	1.92
COLEOPTERA	0
DIPTERA	44.38
GASTROPODA	0.00
BIVALVIA	0.00
Totals:	100.00

Density by Order

TURBELLARIA	55
NEMATODA	221
OLIGOCHAETA	4079
HIRUDINEA	55
ISOPODA	0
AMPHIPODA	662
DECAPODA	0
ACARI	0
COLLEMBOLA	331
EPHEMEROPTERA	5402
ODONATA	0
HEMIPTERA	0
TRICHOPTERA	386
COLEOPTERA	0
DIPTERA	8930
GASTROPODA	0
BIVALVIA	0
Totals:	20121