

Bioassessment of Deep Creek Lake Tributaries
Garrett Co., Maryland

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Executive Summary

In early July 2025, a team from Penn West University - California conducted a synoptic ecological reassessment of 30 perennial Deep Creek Lake tributaries selected by the Deep Creek Watershed Foundation. Most stream-sampling stations were established as close to the lake confluence as accessible. The team obtained water samples, conducted a stream habitat assessment, and assessed both fish and macroinvertebrate communities. One station was dry at the time of sampling and nearly 20 stations exhibited high enough flows to permit either fish and/or macroinvertebrate sampling. Three stations were accessed by boat. Overall our results were similar to those obtained in 2022, with many sites exhibiting coolwater fish communities with measurable total alkalinity and in general good chemical water quality. One site yielded slightly acidic pH levels. Poor habitat, including siltation and embedded stream bottoms resulted in low macroinvertebrate and fish abundance in many stations. This study affirms that tributaries play an integral role in the sustainability of fish populations and that their water quality should continue to be a focus as development continues around the lake.

Description of Study Area

The Deep Creek Watershed, located in Garrett County MD is impounded over 9% of its drainage area by a hydroelectric dam creating a 3,900-acre lake which is seasonally raised and lowered according to energy production and recreational uses (Maryland Department of the Environment 2010). The lake is fed by a high proportion of first order streams because higher

order tributaries are submerged by the impoundment (Maryland Department of the Environment 2010). Cultural impacts, including residential, commercial, and recreational development (Fig. 1) exacerbate the stream morphology of these low order streams. Bog and wetland conditions are also present in several sub-watersheds here (Fig. 2). Moreover, the flat topography

Image credit: Dakota Knott

Figure 1 – Map depicting land use/land cover around the watershed. Tributaries are highlighted in blue (refer to Table 1 for stream names). Red indicates developed and residential areas, Dark green indicates forest, and light green and yellow indicates agriculture (either livestock grazing or crops).

(a)

(a)

(b)

(b)

Figure 2 – Images depicting bog-type habitat present on Red Run (a) and Mountain Meadow Run (b).

adjacent to Deep Creek Lake produces low gradients and streams with few riffle areas which are the preferred habitats of macroinvertebrates (stream insects).

The two largest tributaries, Cherry Creek and Mountain Meadow Run, continue to exhibit strong perennial flows. The former, Cherry Creek, has a long history of coal mining and subsequently acid mine drainage (AMD) has formed. This is being mitigated by several passive treatment systems and a limestone doser (Fig. 3). All remediation structures were installed between 1998 and 2001 and by all accounts are functioning as designed. Perhaps the greater and more prevailing threat to water quality throughout the lake basin is sedimentation, which was noted by Maryland Department of the Environment (MDE 2010) and Argent and Kimmel (2022).

Figure 3 – Image of limestone doser located on Cherry Creek, upstream of its confluence with Deep Creek Lake.

This survey is a re-assessment of water quality, habitat, macroinvertebrate, and fish communities in selected Deep Creek Lake tributaries (Fig. 4). A prior evaluation performed by Argent and Kimmel (2022) concluded that many of the tributaries are compromised to varying degrees, that sedimentation was a major basin-wide issue, that many tributaries experienced periods of low to no flow, and that streams supported low abundances of macroinvertebrates and fish. This survey is being performed to determine if any changes in tributary condition have occurred.

Methods

At nearly every station a water sample was collected, permitting temperature ($^{\circ}\text{C}$), pH, TDS (total dissolved solids; ppm) and specific conductance ($\mu\text{S}/\text{cm}$) to be measured on-site (Table 1). Another water sample was collected and later analyzed for total alkalinity (mg/l as CaCO_3). The US Environmental Protection Agencies Rapid Bioassessment habitat form (Barbour et al. 1999) was completed for 28 of the 30 stations. The large majority of sites were evaluated with the low gradient form; while three others were evaluated with the high gradient form (see Barbour et al. 1999). We summed each category score to provide a table against which

each stream could be qualitatively classified.

Macroinvertebrate sampling was conducted at 24 of the 30 stations using either a D-frame kick net or a 500 µm kick-net (Barbour et al. 1999; Table 1). All organisms were preserved in 50% isopropyl alcohol and processed (removed from debris) within a week of collection. Collected specimens were identified to the lowest practicable taxonomic level using Merritt and Cummins (2008), Peckarsky et al. (1990), and Voshell (2002) and enumerated.

Fish were sampled from 21 stations (Table 1) over an approximately 100-m reach by back-pack electrofishing using methods described by Barbour et al. (1999). All collected

Figure 4 – Map depicting stream sampling stations around Deep Creek Lake, Maryland. Numbers correspond to those found in Table 1. Base map acquired from Maryland Department of the Environment (2010). Three stations that are bolded were accessed using a boat.

Table 1 – Sampling stations established on Deep Creek Lake tributaries. Three stations that are bolded were accessed using a boat. UNT = unnamed tributary

Stream No.	Stream Name	Fish	Macro	Water	Habitat	Latitude	Longitude
1	North Glade R	X	X	X	X	39.50692	-79.25082
2	Poland R	X	X	X	X	39.48635	-79.27678
3	Green Glade R	X	X	X	X	39.48291	-79.24597
4	UNT - 1 Green Glade R	X	X	X	X	39.47621	-79.25317
5	UNT - 2 Green Glade R	X	X	X	X	39.47100	-79.26404
6	UNT - 3 Green Glade R	X	X	X	X	39.46639	-79.27179
7a	Pawn R -1	X	X	X	X	39.47490	-79.33199
7b	Pawn R -2			X		39.47014	-79.32214
8	Bull's Arm R			X	X	39.47583	-79.30975
9	Red R	X	X	X	X	39.49357	-79.36624
10	Smith R	X	X	X	X	39.51824	-79.34944
11	Murray Swamp R		X	X	X	39.52129	-79.38280
12	Brushy Hollow	X	X	X	X	39.51890	-79.37291
13	Shingle Camp			X	X	39.52804	-79.35825
14	Gravelly R	X	X	X	X	39.53808	-79.34421
15	UNT - 3 McHenry			X	X	39.56072	-79.35204
16	UNT - 2 McHenry			X	X	39.55973	-79.35776

17	UNT - 1 McHenry	X	X	X	X	39.56071	-79.36232
18	Hoop Pole R	X	X	X	X	39.48469	-79.32574
19	UNT - 21 DC	X	X	X	X	39.45435	-79.29457
20	Meadow Mountain R	X	X	X	X	39.52232	-79.26929
21	UNT - 22 DC	X	X	X	X	39.52786	-79.31738
22	UNT - 23 DC (Chatterton R)	X	X	X	X	39.44815	-79.30307
23	UNT - 24 DC		X	X	X	39.46166	-79.33103
24	Cherry Creek	X	X	X	X	39.53755	-79.31573
25	Deep Creek	X	X	X	X	39.44824	-79.31214
26	UNT - 25 DC	X	X	X	X	39.45359	-79.30949
27	UNT - 24a Pawn R		X	X	X	39.46530	-79.31642
28	UNT - 26 DC			Dry		39.45723	-79.27853
29	Arrowhead R	X	X	X	X	39.50270	-79.32660

individuals were identified to species, enumerated, and released. Several specimens were photographed to document their capture.

Results and Discussion

Water quality

Five water quality parameters were measured among 29 of the 30 streams listed in Table 1. At the time of sampling one stream was dry preventing sample collection. Despite the heavy rains in late June, several tributaries were very low. Overall, water temperatures suggest that streams feeding Deep Creek Lake can best be described as coolwater (streams whose temperature ranges from 15 to 26°C) (PFBC 2000; Table 2). Values of pH were mostly circumneutral with one stream being slightly acidic, UNT - 22 DC at 5.7 (Table 2). In 2022, Argent and Kimmel (2022) documented this tributary to have a pH of 7.0. Values of TDS fall well below the limit of 1000 ppm established by the US EPA (Environmental Protection Agency Chapter 70) as harmful to humans. Conductivity and alkalinity values were much lower than those reported by Argent and Kimmel (2022) - a likely reflection of markedly increased flows compared with those of 2022.

Habitat

The US EPA's Habitat evaluation form (Barbour et al. 1999) was used to assess each sampled tributary. Three streams (Smith Run, UNT – 22 DC, and Cherry Creek) were recognized as high gradient, while the rest were identified as low gradient. Many streams had relatively high sediment loads (silt and clay categories combined), while others e.g., Smith Run and Cherry Creek contained more cobble, gravel, and boulder substrates (Table 3; Figs. 5 and 6). Among low

gradient streams, habitat evaluation scores ranged from 89 to 128. Mountain Meadow received
Table 2 – Summary of water quality parameters from tributaries to Deep Creek Lake, MD. UNT
= unnamed tributary

Stream Name	Temperature	pH	Conductivity (uS/cm)	TDS (ppm)	Alkalinity (mg/L as CaCo3)
North Glade R	23.0	7.1	110	76	16
Poland R	20.5	7.2	59	42	20
Green Glade	21.2	7.0	60	42	12
UNT - 1 Green Glade	22.0	7.3	135	96	16
UNT - 2 Green Glade	23.0	7.6	36	25	12
UNT - 3 Green Glade	19.6	7.5	30	21	16
Pawn R -1	19.1	7.2	84	60	26
Pawn R -2	23.7	6.8	89	64	22
Bull's Arm R	22.7	7.0	79	56	24
Red R	22.3	7.1	96	68	30
Smith R	19.9	7.2	29	20	16
Murray Swamp R	18.9	6.7	20	15	4
Brushy Hollow	18.3	7.0	50	35	14
Shingle Camp	19.4	7.3	90	64	10
Gravelly R	20.3	7.2	66	47	26
UNT - 3 McHenry	21.3	6.6	161	116	36
UNT - 2 McHenry	22.7	7.4	134	88	26
UNT - 1 McHenry	22.8	7.5	132	94	40
Hoop Pole R	22.8	7.2	103	68	36
UNT - 21 DC	24.0	7.1	95	65	38
Meadow Mountain R	22.8	6.7	51	37	12
UNT - 22 DC	15.8	5.7	19	13	2
UNT - 23 DC (Chatterton R)	21.7	7.5	125	89	28
UNT - 24 DC	22.0	7.0	84	60	36
Cherry Creek	21.8	7.1	73	52	16
Deep Creek	24.7	6.8	56	40	14
UNT - 25 DC	25.1	6.9	65	46	16
UNT - 24a Pawn R	24.8	7.0	65	46	18
UNT - 26 DC			Dry		
Arrowhead R	23.1	7.7	198	141	52

Table 3 – Summary of substrate composition of Deep Creek Lake tributaries. High gradient streams are expressed in bold type. UNT = unnamed tributary

	Rock Type (size, mm)						
Stream Name	Bedrock	Boulder	Cobble	Gravel	Sand	Silt	Clay
North Glade R	0	0	15	50	15	10	10
Poland R	0	0	0	20	30	40	10
Green Glade	0	0	0	10	25	35	30
UNT - 1 Green Glade	0	0	15	25	30	20	10
UNT - 2 Green Glade	0	0	35	20	10	15	20
UNT - 3 Green Glade	0	0	0	45	25	15	15
Pawn R -1	0	0	10	20	35	25	10
Pawn R -2	No habitat evaluation, water sample only						
Bull's Arm R	0	0	15	35	20	20	10
Red R	0	0	5	60	20	10	5
Smith R	0	0	25	35	30	10	0
Murray Swamp R	0	0	15	20	35	15	15
Brushy Hollow	0	0	10	30	25	25	10
Shingle Camp	0	0	20	30	20	15	15
Gravelly R	0	5	15	20	25	25	10
UNT - 3 McHenry	0	0	20	25	30	15	10
UNT - 2 McHenry	0	0	0	0	0	80	20
UNT - 1 McHenry	0	0	5	60	15	10	10
Hoop Pole R	0	0	15	20	20	40	5
UNT - 21 DC	0	0	15	10	25	25	25

Meadow Mountain R	0	0	15	25	20	20	20
UNT - 22 DC	0	5	10	15	25	25	20
UNT - 23 DC (Chatterton R)	0	0	25	25	25	15	10
UNT - 24 DC	0	0	10	15	20	50	5
Cherry Creek	0	50	20	10	10	5	5
Deep Creek	0	0	10	20	30	35	5
UNT - 25 DC	0	0	10	25	20	25	20
UNT - 24a Pawn R	0	0	5	15	35	40	5
UNT - 26 DC	Dry						
Arrowhead R	60	0	10	10	10	5	5

(b)

(b)

(a)

(a)

Figure 5 – Images of Smith Run depicting woody debris (a), and suitable spawning gravels (b) within the riparian corridor.

Figure 6 – Image of Cherry Creek depicting its substrate and riparian cover.

the highest score, 128. With its relatively remote location and minimal riparian disturbance this stream continues to yield a diversity of habitats (Fig. 2b). Using the USEPA's Rapid Bioassessment form, each stream was evaluated for its habitat condition (Tables 4 and 5) and categories were summed to allow for interpretation (Table 6). Among all sites sampled, half were identified as sub-optimal and half were identified as marginal (Table 6). Many of these streams lack a diversity of habitats, exhibit high sediments loads, and in some cases reduced riparian cover (Tables 3-6). Among the three high gradient streams (Table 5), scores ranged from 128 to 136. Despite acid mine drainage impacts, Cherry Creek received the highest habitat score, due in large part to the relatively wide riparian corridor, rocky substrate, and presence of woody debris. Habitat for many sites changed little from 2022 (Argent and Kimmel 2022) to the present. However, there are differences between the two periods that can be attributed to the fact that only 25 streams were evaluated in 2022 compared to 28 in 2025; and the low flow conditions experienced in 2022 which impact scores for several categories on the habitat evaluation form. We did see an improvement in scores in the suboptimal category between the two periods, but this is due in part to increased flows at the time of this report. The threats (local construction, agriculture, road runoff, and lake level management) identified by Argent and Kimmel (2022)

remain and are unlikely to change. Connectivity between the lake and tributaries will be governed not only by rainfall, but by the rule band and management of lake levels.

Table 4 – Habitat evaluation rating scores for “low gradient” tributaries that feed Deep Creek Lake. UNT = unnamed tributary

Stream Name	Epifaunal Substrate	Pool Substrate	Pool Variability	Sediment Deposition	Channel Flow Status
North Glade R	12	9	10	8	12
Poland R	7	5	5	2	14
Green Glade	9	9	8	6	12
UNT - 1 Green Glade	9	7	9	6	7
UNT - 2 Green Glade	7	15	8	5	6
UNT - 3 Green Glade	10	9	5	9	6
Pawn R -1	11	15	9	8	12
Pawn R -2	Water Sample Only				
Bull's Arm R	7	12	9	5	9
Red R	9	12	8	5	12
Murray Swamp R	8	11	6	6	9
Brushy Hollow	6	14	5	5	9
Shingle Camp	8	12	7	6	10
Gravelly R	10	9	7	7	14
UNT - 3 McHenry	5	9	9	8	12
UNT - 2 McHenry	4	7	11	4	14
UNT - 1 McHenry	11	16	10	12	10
Hoop Pole R	8	12	6	6	8
UNT - 21 DC	11	8	7	5	9
Meadow Mountain R	13	10	11	9	15
UNT - 23 DC (Chatterton R)	12	11	10	9	12
UNT - 24 DC	12	10	9	8	10
Deep Creek	10	14	9	9	15
UNT - 25 DC	11	11	12	9	15
UNT - 24a Pawn R	12	13	11	10	12
UNT - 26 DC	Dry				
Arrowhead R	13	10	14	12	14

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Continued.

Table 4 – Continued. UNT = unnamed tributary.

	Channel Alteration	Channel Sinuosity	Bank Stability	Vegetative Protection	Riparian Veg Zone Width	Aggregate Score
North Glade R	12	10	14	15	18	120
Poland R	11	10	15	12	16	97
Green Glade	8	9	10	11	7	89
UNT - 1 Green Glade	16	12	15	14	15	110
UNT - 2 Green Glade	16	13	14	15	14	113
UNT - 3 Green Glade	17	15	13	15	15	114
Pawn R -1	16	14	14	10	7	116
Pawn R -2	Water Sample Only					
Bull's Arm R	15	7	14	14	11	103
Red R	11	7	13	7	5	89
Murray Swamp R	13	8	14	11	10	96
Brushy Hollow	15	9	12	12	12	99
Shingle Camp	12	10	12	11	14	102
Gravelly R	14	8	11	13	8	101
UNT - 3 McHenry	14	5	12	11	9	94
UNT - 2 McHenry	13	10	14	10	9	96
UNT - 1 McHenry	13	6	13	12	10	113
Hoop Pole R	14	14	14	13	11	106
UNT - 21 DC	12	12	13	12	11	100
Meadow Mountain R	17	14	14	12	13	128

UNT - 23 DC (Chatterton R)	16	13	12	15	13	123
UNT - 24 DC	14	10	11	14	6	104
Deep Creek	16	11	11	15	14	124
UNT - 25 DC	15	10	12	16	12	123
UNT - 24a Pawn R	15	12	11	15	14	125
UNT - 26 DC	Dry					
Arrowhead R	13	12	12	14	12	126

Table 5 – Habitat evaluation rating scores for “high gradient” tributaries that feed Deep Creek Lake. UNT = unnamed tributary.

	Epifaunal Substrate	Embeddedness	Velocity	Sediment Deposition	Channel Flow Status
Smith Run	12	5	11	7	9
UNT - 22 DC	10	15	13	12	13
Cherry Creek	16	13	14	11	18

	Channel Alteration	Frequency of Riffles	Bank Stability	Vegetative Protection	Riparian Veg Zone Width	Aggregate Score
Smith Run	18	15	15	18	16	128
UNT - 22 DC	16	13	14	14	11	131
Cherry Creek	13	15	16	13	7	136

Table 6 – Summary table created by summing the total of each habitat evaluation category (Barbour et al. 1999). Table was used to help classify each streams habitat condition.

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Qualitative Habitat Interpretation*	Total Habitat Rating Score	No. of Streams - 2022	No. of Streams - 2025
Optimal	200 to 166	0	0
Suboptimal	165 to 113	7	14
Marginal	112 to 60	18	14
Poor	59 and below	0	0
Total Streams Evaluated		25	28

Optimal: Conditions meet natural expectations and support a healthy aquatic community;
Suboptimal: Conditions are less than ideal but still satisfy expectations under most circumstances; **Marginal:** Moderate levels of degradation are present at frequent intervals.
Poor: Streams have been substantially altered and exhibit severe degradation

Macroinvertebrates

Macroinvertebrates were collected from 21 sampling stations around Deep Creek Lake. In total, 546 individuals representing 32 different taxa were documented. Station community abundances ranged from a low of one in UNT – 25 DC to a high of 71 in UNT – 22 DC (Appendix A). However, the total number of individuals collected averaged 26, preventing calculation of a Hilsenhoff Biological Index score (a method used to assess the health of streams by analyzing the abundance and tolerance of aquatic insects to pollution). Crayfish (Cambaridae) were the most frequently collected taxa, occurring in 13 of 21 sampled locations. Chironomids, a pollution tolerant form, represented nearly 10% of the abundance of macroinvertebrates collected; however, this result is slightly skewed because one site (UNT – 24 DC) produced 39 individuals.

The rating scale for pollution tolerance of a taxon ranged from 0 to 10, with 0 being the most sensitive to pollution and 10 being the least sensitive to pollution. The majority of macroinvertebrates collected were tolerant to pollution having rating scores ≥ 4 (Fig. 7). Three is the cutoff point for sensitivity. With respect to functional feeding groups, tributaries were dominated by predators (Fig. 8), increasing from 26% to 43% while collector-gatherers declined from 28% to 11% between 2022 and 2025 (Argent and Kimmel 2022). Other groups were similar in proportion to those of 2022 (Argent and Kimmel 2022). In summary, the macroinvertebrate communities of Deep Creek Lake tributaries remain similar to 2022, as evidenced by low taxonomic abundance and richness, and dominance of tolerant taxa, resulting in a lack of defined community structure.

Figure 7 – Frequency of occurrence of pollution tolerance rankings among macroinvertebrate taxa collected from Deep Creek Lake tributaries. Those macroinvertebrates listed as intolerant are classified with a score of 3 or less, while those classified as tolerant are classified with a score of 4 or more.

Figure 8 – Relative proportions of macroinvertebrate functional feeding groups.

Fish

Twenty-one tributaries were surveyed for fishes (Table 1). Among these stations, 16 yielded fish (Appendix B). In total, 15 different species were collected totaling 360 individuals. Tributary sites were dominated by three species (78% of the total sample), Blacknose Dace (*Rhinichthys obtusus*), Creek Chub (*Semotilus atromaculatus*) and Yellow Bullhead (*Ameiurus natalis*) (Fig. 9).

Several findings are worthy of note with respect to the fish collections. First, we documented several young-of-the-year lake species, Muskellunge (*Esox masquinongy*), Largemouth Bass (*Micropterus salmoides*), and Yellow Perch (*Perca flavescens*) and a relatively large Walleye (*Sander vitreus*) (Figs. 10 and 11). Their capture demonstrates the importance of select tributaries to the continued sustainability of the fishery as spawning and nursery areas. Second, the collection of wild Brook Trout (*Salvelinus fontinalis*) from Smith Run, which were first documented in 2022 (Argent and Kimmel 2022). The patches of gravel substrate (spawning areas; Fig. 5) and relatively undisturbed riparian corridor are very well suited for this species. Moreover, their presence speaks to the high-water quality found here. Lastly, the majority of tributaries contained few taxa suggesting that suitable habitats may be lacking for many species. This may be due in part to increased sediment loading, fluctuating water levels, or general lack of woody debris among selected tributaries. In comparison to our prior survey (Argent and Kimmel 2022) we captured nearly twice as many different species and 85 more individuals here. This is likely a reflection of the increased flows among tributaries and the maintenance of connectivity with the lake.

Figure 9 – Proportional fish catch collected from Deep Creek Lake tributaries. Other fish category represents fishes in which one individual was collected. The other fish category includes: Golden Shiner, Fathead Minnow, Stonecat, Muskellunge, and Walleye.

(b)

(b)

(a)

(a)

Figure 10 – Young of year Yellow Perch (a) and Muskellunge (b), captured from Pawn Run and Arrowhead Run, respectively.

Figure 11 – Adult Walleye captured from N. Glade Run.

Conclusion

As previously reported by Argent and Kimmel (2022), all sampled Deep Creek tributaries are impaired to varying degrees by a variety of anthropogenic influences (e.g., commercial, residential development, and agriculture). While chemical analysis suggests, that for the most part, conditions exist that are compatible with aquatic life, habitat analysis suggest that many streams are impacted by sediment loads, embedded substrates, and narrow riparian buffers. Maryland Department of the Environment (2010) documented similar findings concluding that one hundred percent of the stream miles are biologically impaired.

Cherry Creek, the largest tributary in the Deep Creek Lake watershed, has been historically impacted by coal extraction leading to episodes of AMD. Mitigation efforts have been completed in the headwaters and a limestone doser has been installed above the lake confluence. At the time of sampling, water quality was good – pH of 7.1, total alkalinity of 16 mg/l as CaCO₃. However as noted in Argent and Kimmel (2022), should this system fail, the stream and its lake cove would be negatively impacted. We suggest a comprehensive water quality monitoring effort to include seasonal periods of high and low flows to evaluate the overall efficacy of the treatment strategy.

The macroinvertebrates, while collected in low numbers are representative of more long-term conditions present within each tributary. A nearly even split between pollution tolerant and intolerant forms was documented here. Some streams (e.g., Smith Run) contained unique taxa to the basin, while others contain more common forms. Overall, there did not appear to be a complete dominance of any one type of macroinvertebrate, suggesting that many have survived periods of dewatering by using the hyporheic zone (an area below and adjacent to the stream where groundwater mixes with surface water).

The lake is managed as a multi-purpose (for both recreation and hydroelectric power) facility. As such, the resident tributary communities reveal little connectivity to Deep Creek Lake proper during portions of the year. The fish population of the lake is considerably different than that of the sampled tributaries, with select lake species utilizing the tributaries as nursery waters, as documented here. The seasonal fluctuation in water levels also impacts fish communities as many habitats that are present when at full pool are absent as the lake is drawn down. Our conclusions agree with those of Maryland Department of the Environment (2010) and suggest no changes to reported degrees of impairment identified in this watershed.

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Perl odid ae	<i>Isop erla</i>	pr	2										
Perl odid ae	<i>Cult us</i>	pr	2							1			
Perl odid ae	<i>Yugu s</i>	pr	2										
Pter onar cyid ae	<i>Allo narc ys</i>	sh	0									5	
Hyd rops ychi dae		fc	5			1							

Appendix A. – Continued.

Appendix A. – Continued

Fam ily or Taxa	Gen us	FF	Poll utio n	1	2	3	4	5	6	7a	9	10	11
Hyd rops ychi dae	<i>Che umat opsy che</i>	fc	6	10						10	30		
Hyd rops ychi dae	<i>Dipl ectr ona</i>	fc	0		1			9	14			3	
Phil opot amid ae	<i>Chi mar ra</i>	fc	4	1									
Phil opot amid ae	<i>Dolo phil odes</i>	fc	0									3	2
Brac hyce ntrid ae		fc	1					1					
Lepi dost omat idae	<i>Lepi dost oma</i>	sh	1	1		1	2	1	7				9

Limnephilidae	<i>Hydatophylax</i>	sh	2										5
Limnephilidae	<i>Pycnopsyche</i>	sh	4								1		
Limnephilidae	<i>Anabolia</i>	sh	5										
Elmidae		cg	5										
Elmidae	<i>Macronychus</i>	sc	2							2	1		
Corydalidae	<i>Nigronia</i>	pr	4	15				1	4				
Sialidae	<i>Sialis</i>	pr	6				4						
Tabanidae		pr	6				1						
Chironomidae		cg	6			1					13		
Simuliidae		fc	6			1							
Tipulidae		sh	4	1		1	2		2				
Tipulidae	<i>Dicranota</i>	pr	3							1			
	<i>Hexatoma</i>	pr	2	2						1		2	
	<i>Pedicia</i>	pr	6										1
	<i>Tipula</i>	sh	4					1	2	2			
Total Taxa				10	4	10	9	6	8	10	10	10	7

Total Abundance				36	9	57	18	14	37	30	59	30	20
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cg = collector gatherer, fc = filterer collector, pr = predator, sh = shredder, and sc = scraper
Pollution tolerance values were obtained from Barbour et al (1999). Scores range from 0 to 10,
with 0 representing pollution intolerance and 10 representing pollution tolerance.

Appendix A. – Continued.

Appendix A. – Continued.

[illegible]

Bae tida e		cg	6											
Eph eme rida e	<i>Eph eme ra</i>	cg	2					1		2				
Eph eme rida e	<i>Lito bra nch a</i>	cg	4					2						
Hep tage niid ae		sc	3		1							1		3
Hep tage niid ae	<i>Mac cafe riu m</i>	sc	3							2				
Aes hnid ae		pr	3					1						
Aes hnid ae	<i>Boy eria</i>	pr	2					1						1
Cor dule gast rida e	<i>Cor dule gast er</i>	pr	3					1						
Go mph idae		pr	4						1					
Cal opte rygi dae	<i>Cal opte ryx</i>	pr	6											
Coe nagr ioni dae	<i>Lest idae</i>	pr	8		1									
Chl oro perl idae		pr	0											
Leu ctri dae	<i>Leu ctra</i>	sh	0						39			3		1
Ne mou rida e	<i>Am phin emu ra</i>	sh	3						12					

[illegible]

	<i>Pedicia</i>	pr	6			1								
	<i>Tipula</i>	sh	4							1				
Total Taxa				2	3	3	4	7	7	10	3	5	1	8
Total Abundance				7	4	10	31	17	71	23	42	8	1	22

Appendix B – Summary of fishes collected from Deep Creek Lake tributaries. Only streams containing fish are reported here. Refer to Table 1 for a complete list of streams sampled and corresponding stream names associated with numbers.

[illegible]

Blacknose Dace	<i>Rhinichthys obtusus</i>	22		3	6	7	26	41			14					2
Creek Chub	<i>Semotilus atromaculatus</i>	5		7	3	5	18	22			7	12			5	23
White Sucker	<i>Catostomus commersonii</i>						13	1				3				2
Yellow Bullhead	<i>Ameiurus natalis</i>	14	6		1						4		20	5	4	
Brown Bullhead	<i>Ameiurus nebulosus</i>													12	6	
Stone cat	<i>Noturus flavus</i>															1
Brook Trout	<i>Salvelinus fontinalis</i>								10							

Muskelunge	<i>Esomaspiongy</i>																1
Bluegill	<i>Lepomis macrochirus</i>									5							
Large mouth Bass	<i>Micropterus salmoides</i>												1	2	1		
Johnny Darter	<i>Etheostoma nigrum</i>	2							1				3				3
Yellow Perch	<i>Percalavesceus</i>			2			2						3	1			
Walleye	<i>Sander vitreus</i>	1															

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