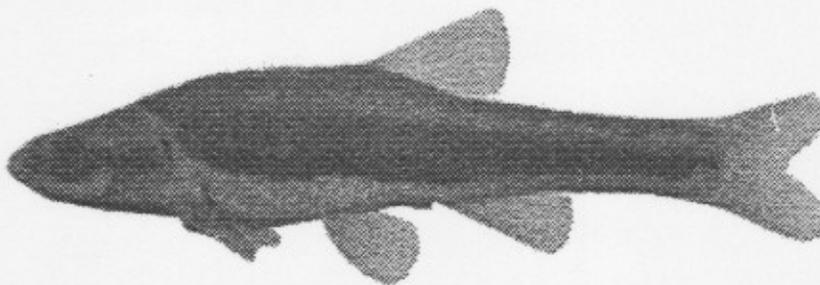


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- Blackside dace (*Phoxinus Cumberlandensis*), a cyprinid species listed as Threatened by the U.S. Fish and Wildlife Service, is apparently restricted to about 30 stream in the upper Cumberland drainage of Kentucky and Tennessee (O'Bara 1985). Although habitat degradation, usually associated with mining and forest clearing, is considered to be the greatest threat, the introduction of non-native game fish, such as rainbow trout (*Oncorhynchus mykiss*), may also have a negative effect on remaining blackside dace populations. In a spring 1995 survey of stomach contents taken from 435 recently stocked rainbow trout captured by anglers on Stony Creek, Giles County, Virginia, 5% contained cyprinid remains (USFS Center for Aquatic Technology Transfer, unpublished data). Thus, given the opportunity, stocked rainbow trout are capable of preying on blackside dace.

The purpose of this study was to 1) determine the distribution and abundance of blackside dace and rainbow trout in Middle Fork Beaver Creek, 2) determine the extent of trout predation on blackside dace, and 3) provide baseline data that can be used with an existing USFS habitat data base.

Study Stream - Middle Fork of Beaver Creek is located primarily within the Beaver Creek Wilderness Area, McCreary County, Kentucky. Middle Fork was chosen because 1) previous surveys indicate that Middle Fork contains a substantial blackside dace population, 2) an extensive USFS stream-habitat database exists for the Beaver Creek watershed, and 3) rainbow trout have periodically been stocked in an attempt to create a wild, self-sustaining population. Although Middle Fork is protected by its Wilderness status, private lands within the Beaver Creek drainage may also pose a potential threat to this population (O'Bara 1985).

Methods - Visual estimation techniques were used to estimate surface area of selected habitat types and abundance of blackside dace in Middle Fork Beaver Creek during July 1995 (Hankin and

Reeves 1985; Dolloff et al 1993). Middle Fork was surveyed from the Forest Service bridge¹, upstream about 10.4 river kilometers (rkm; 6.4 miles) to the confluence of Maxwell Branch (Figure 1). Sampling strata were based on naturally occurring habitat: pools (areas in the stream with low water velocity, stream bed gradient near zero, and smooth water surface) and riffles (areas in the stream with relatively steep gradient, shallow water, relatively high velocity, and turbulent surface).

All habitat in the study section was identified by unit type (pools and riffles). The first unit of each habitat type selected for sampling (diver estimation of fish abundance) was determined randomly. Additional units (55 pools and 17 riffles) were selected systematically. Underwater observations and visual estimates of unit size were made in each of the systematically selected habitat units. When a sample unit was encountered, two observers, using face masks and snorkels, started at the downstream end and proceeded slowly upstream to the head of the unit while searching for blackside dace and rainbow trout. All individuals observed in the habitat unit were counted. When an individual was sighted, the fish was directed out of the line of travel by the diver's hand to prevent double counting. Hipchain measurements were used to locate each sample unit on 7.5 minute USGS topographic maps (Figure 2; Appendix A).

Population estimates (by habitat unit) of all species captured by two-pass removal (one DC backpack electrofishing unit; Zippin 1958) were used to calibrate visual estimates of blackside dace. Eleven pools and nine riffles were systematically selected from sampled units upstream of Little Hurricane Fork (Figure 2). Units selected for electrofishing were measured (area) with a 15-m measuring tape and marked for the electrofishing survey with an identification flag at the upper and lower boundaries. Visual estimates of habitat area were

¹ a preliminary underwater survey of 20% of pools and 10% of riffles indicated blackside dace are absent below the bridge.

paired with measured habitat area for 11 pools and nine riffles. All estimates of pool and riffle area were multiplied by the calibration ratio \hat{Q} (1.028 and 0.886, respectively) to more accurately depict the density (number of fish observed divided by the unit area) of blackside dace in the diver-estimated units. The ratio (\hat{R}) of number observed by divers to depletion estimates was used to calibrate diver estimates. All fish captured during the two-pass depletions were identified and blackside dace were weighed (g) and measured (mm).

Results - Blackside dace were first observed 1.1 rkm (0.68 miles) above the Forest Service bridge and appear to be well distributed upstream of this point (Figure 3). The species was observed in 76.4% of the pools and 23.4% of the riffles in Middle Fork. We estimate that pools in the study section contain 3,284 (95% confidence interval \pm 651) blackside dace. Nine individuals were observed in three riffles, none of which were in the paired samples (electrofished units); therefore, we were unable to estimate the total abundance of blackside dace in riffle habitat. Nevertheless, blackside dace are considered to be a pool species (Etnier and Starnes 1995) and were observed only in slack water microhabitat within the riffles during this study.

Blackside dace densities tend to increase from downstream to upstream as indicated by a weak but significant linear relationship between blackside dace densities and rkm ($R = 0.33$; $P = 0.02$; Figure 4). The highest density of blackside dace was observed in Pool-190, located 7.5 rkm (4.7 miles) above the Forest Service bridge (Figure 2). Pool-190 appears to be a forming oxbow, characterized by deeply undercut banks with dense cover formed by root mats protruding from the bank into the water column. We estimate this 165 m² pool contained 221 blackside dace.

Lengths and weights were measured for 47 blackside dace captured during the electrofishing surveys. The length-weight relationship indicates that the middle fork blackside dace

population is predominately composed of two age classes: young-of-year and age 2+ adults (Figure 5). According to Etnier and Starnes (1995) blackside dace life span is three years with individuals reaching about 50 mm by the end of their second summer (age 1+ fish). This age class is not well represented in our data set indicating a partial recruitment failure in the 1994 cohort.

In addition to blackside dace, 10 other fish species were identified in the study section during the electrofishing survey (Table 1). Population estimates by habitat unit, based on two-pass depletions (Zippin 1958), of each species are given in Table 2. Only two age 1+ rainbow trout were observed during this study: one in Riffle-40 and one in Pool-50 (Figure 2).

Conclusions and Recommendations - Blackside dace are fairly abundant and widely distributed in the Middle Fork study area. Nevertheless, it is important to point out that a single catastrophic event could severely affect this population. For example, a manure spill in Elliott Creek, a stream similar in size to Middle Fork but located near Riner, Virginia, virtually eliminated the fish community of this stream (Ensign et al. In Press). Due to the potential threat of habitat degradation within the Beaver Creek watershed we advise this population be monitored periodically.

Rainbow were observed in only two habitat units in the study area and therefore the Middle Fork population is extremely low. We believe such a small population of trout to be no threat to blackside dace in Middle Fork. Based on our observations of the habitat and fish fauna, we suggest that Middle Fork is not capable of supporting a self-sustaining population of rainbow trout. Continued stocking for a put-and-take fishery, however, may be detrimental to the Middle Fork blackside dace population.

Finally, we have included blackside dace densities by habitat unit as well as the location of these units in this report (Appendix A). This information, along with the Middle Fork

habitat database, can be used to investigate relationships between blackside dace abundance and stream habitat in Middle Fork. We recommend further analysis of blackside dace and stream habitat be conducted to better understand the species habitat requirements and link habitat use patterns to potential changes in land use within the watershed.

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Table 1. Fish species identified in the Middle Fork study area.

Common Name	Scientific Name
Blackside Dace	<u>Phoxinus cumberlandensis</u>
Rainbow trout	<u>Oncorhynchus mykiss</u>
Creek chub	<u>Semotilus atromaculatus</u>
Striped darter	<u>Etheostoma virgatum</u>
Rainbow darter	<u>E. caeruleum</u>
Arrow darter	<u>E. sagitta</u>
Least brook lamprey	<u>Lampetra aepyptera</u>
Northern hogsucker	<u>Hypentelium nigricans</u>
Rosefin shiner	<u>Lythrurus ardens</u>
Stonecat	<u>Noturus flavus</u>
White sucker	<u>Catostomus commersoni</u>



Figure 1. Middle Fork of Beaver Creek. Arrows represent the study area

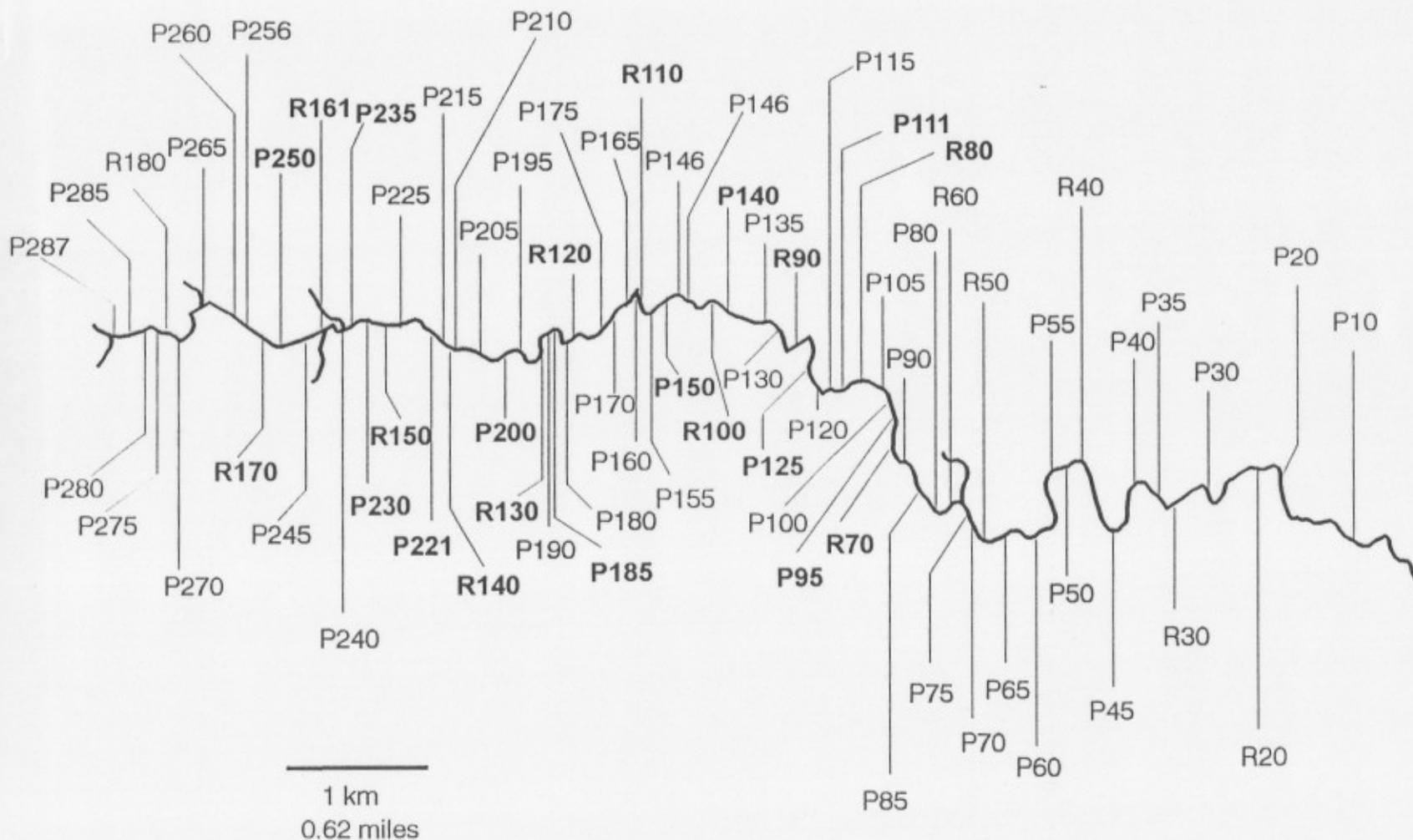


Figure 2. Location of sample sites on Middle Fork. Sites sampled by electrofishing methods are indicated in bold type. Site locations are given in Appendix A. Pools and riffles are represented by P and R, respectively.

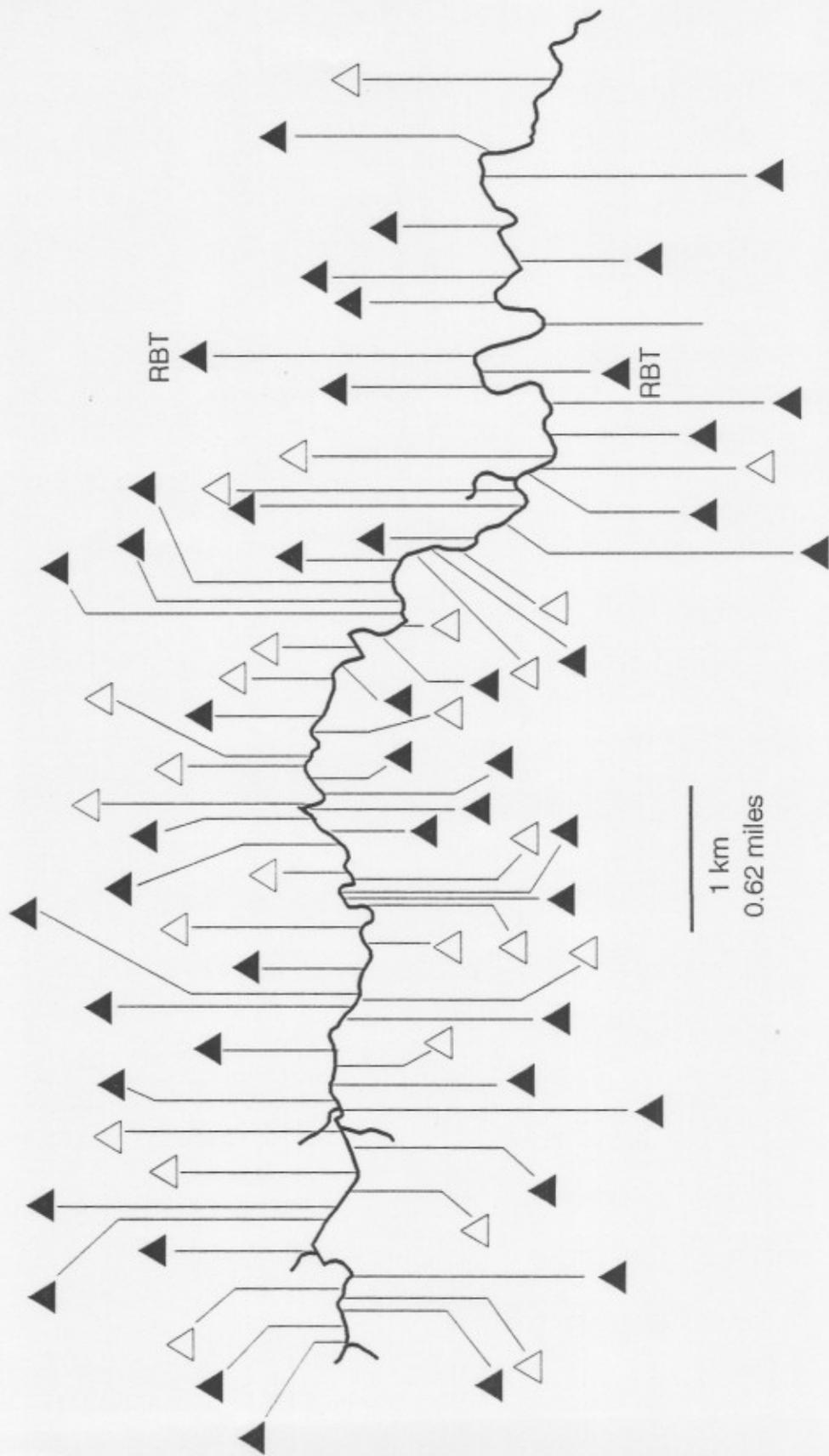


Figure 3. Distribution of Blackside dace in the Middle Fork study area. Triangles indicate sample sites. Solid triangles and RBT represent sites where blackside dace and rainbow trout were observed, respectively. Site numbers are given in Figure 2.

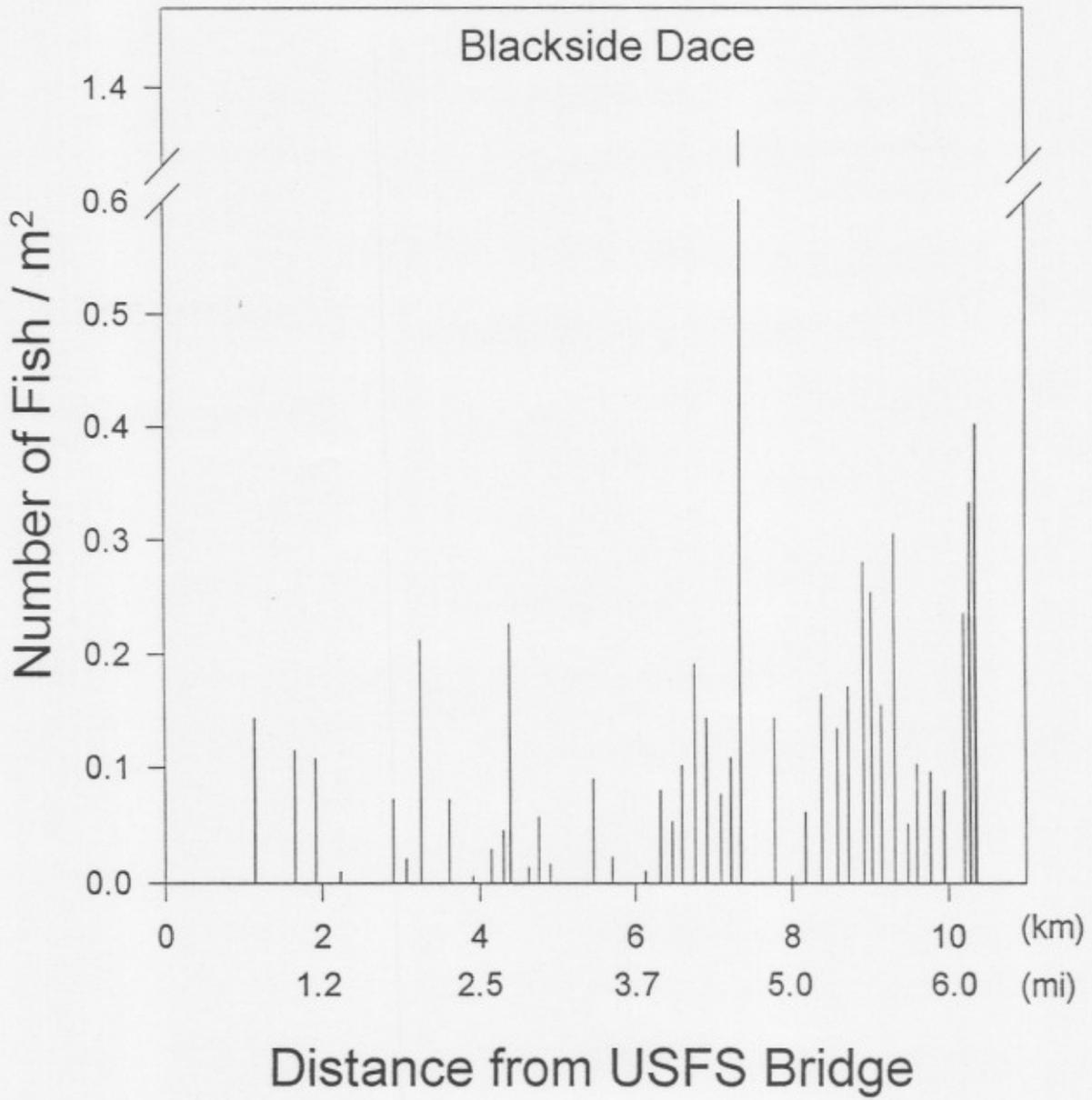


Figure 4. Density of blackside dace, by habitat unit, in Middle Fork Beaver Creek from the Forest Service bridge to Maxwell Branch. Note the break in the Y-axis.

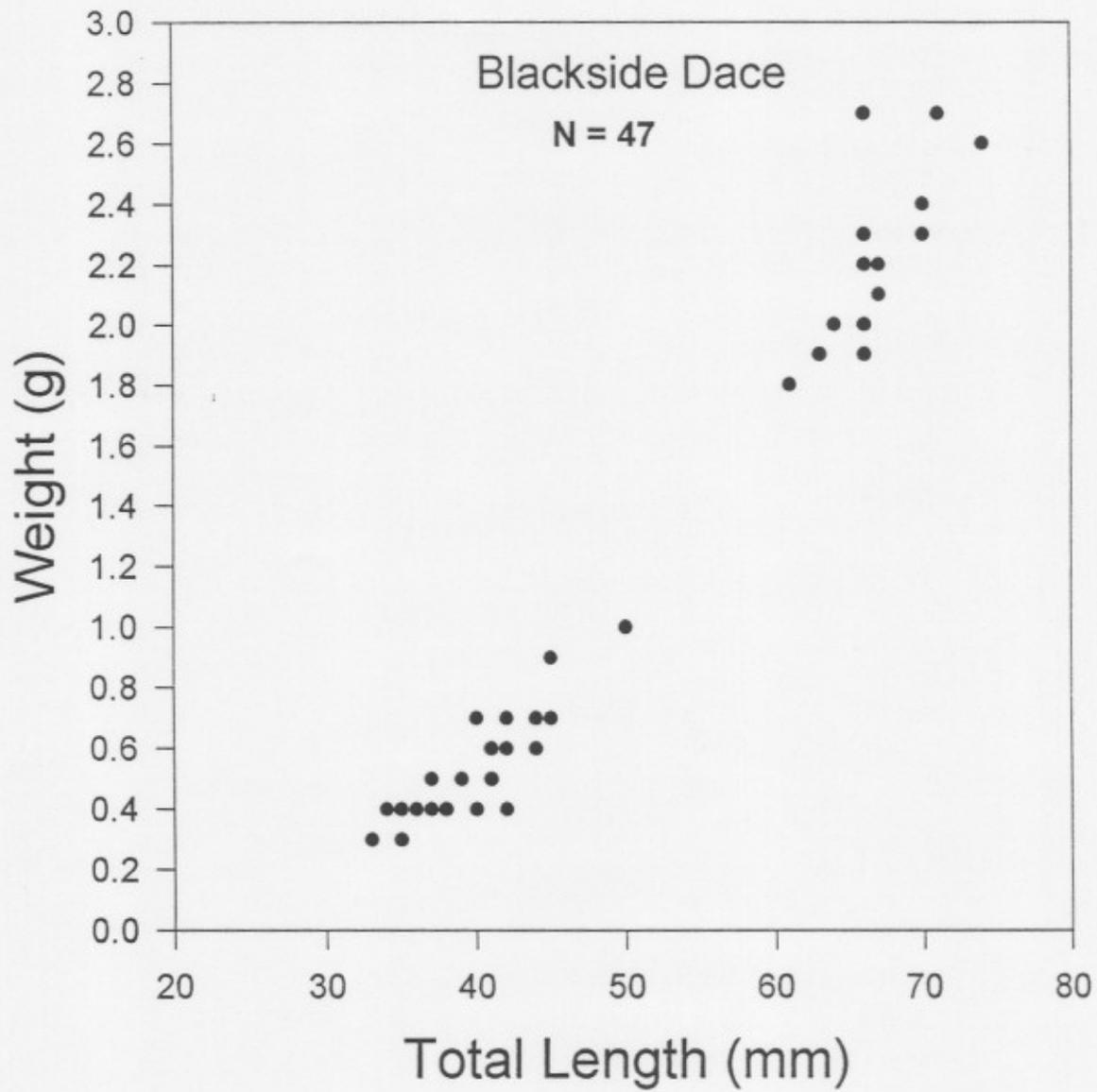


Figure 5. Length-weight relationship for blackside dace in Middle Fork Beaver Creek.

Appendix A. Location of each sample unit in relation to USFS bridge in meters (m) and feet (ft), corrected area of each sample unit in square meters (m²) and square feet (ft²), and density of blackside dace (BSD) in Middle Fork of Beaver Creek.

Type	No.	Dist. (M)	Dist. (ft)	Area (m ²)	Area (ft ²)	BSD	BSD/m ²	BSD/ft ²
Pool	10	511.9	1679.0	370.1	4112.0	0	0.000	0.000
Pool	20	1146.0	3759.0	51.4	571.1	7	0.143	0.013
Riffle	20	1331.7	4368.0	110.8	1230.6	4	0.040	0.004
Pool	30	1654.9	5428.0	154.2	1713.3	18	0.115	0.010
Riffle	30	1872.9	6143.0	70.9	787.6	7	0.104	0.009
Pool	35	1919.2	6295.0	41.1	456.9	4	0.108	0.010
Pool	40	2232.3	7322.0	308.4	3426.7	3	0.010	0.001
Pool	45	2421.0	7941.0	36.0	399.8	0	0.000	0.000
Riffle	40	2427.4	7962.0	13.3	147.7	1	0.111	0.010
Pool	50	2609.8	8560.0	514.0	5711.1	0	0.000	0.000
Pool	55	2903.7	9524.0	41.1	456.9	3	0.072	0.006
Pool	60	3069.2	10067.0	143.9	1599.1	3	0.020	0.002
Pool	65	3254.6	10675.0	27.8	308.4	6	0.212	0.019
Riffle	50	3314.9	10873.0	13.3	147.7	0	0.000	0.000
Pool	70	3420.7	11220.0	308.4	3426.7	0	0.000	0.000
Pool	75	3614.6	11856.0	61.7	685.3	4	0.072	0.006
Riffle	60	3741.5	12272.0	31.0	344.6	0	0.000	0.000
Pool	80	3914.0	12838.0	246.7	2741.3	1	0.006	0.001
Pool	85	4150.9	13615.0	51.4	571.1	1	0.029	0.003
Pool	90	4305.5	14122.0	97.7	1085.1	4	0.045	0.004
Riffle	70	4382.0	14373.0	21.6	239.6	0	0.000	0.000
Pool	95	4390.5	14401.0	61.7	685.3	14	0.227	0.020
Pool	100	4469.5	14660.0	82.2	913.8	0	0.000	0.000
Pool	105	4625.0	15170.0	113.1	1256.4	1	0.013	0.001
Riffle	80	4712.8	15458.0	9.2	102.0	1	0.161	0.014
Pool	111	4759.8	15612.0	25.7	285.6	1	0.057	0.005
Pool	115	4904.0	16085.0	92.5	1028.0	1	0.016	0.001
Pool	120	5195.4	17041.0	58.6	651.1	0	0.000	0.000
Pool	125	5321.6	17455.0	72.0	799.6	0	0.000	0.000
Riffle	90	5379.0	17643.0	8.9	99.2	0	0.000	0.000
Pool	130	5461.9	17915.0	32.9	365.5	3	0.090	0.008
Pool	135	5584.4	18317.0	56.5	628.2	0	0.000	0.000
Pool	140	5707.3	18720.0	133.6	1484.9	3	0.022	0.002
Riffle	100	5951.2	19520.0	34.8	386.4	0	0.000	0.000
Pool	146	5968.9	19578.0	331.0	3678.0	0	0.000	0.000
Pool	150	6127.7	20099.0	102.8	1142.2	1	0.010	0.001
Pool	155	6317.7	20722.0	74.0	822.4	6	0.080	0.007
Riffle	110	6419.8	21057.0	19.7	219.0	0	0.000	0.000
Pool	160	6467.1	21212.0	27.8	308.4	1	0.053	0.005

Appendix A. Continued

Type	No.	Dist. (M)	Dist. (ft)	Area (m ²)	Area (ft ²)	BSD	BSD/m ²	BSD/ft ²
Pool	165	6591.5	21620.0	87.4	970.9	9	0.101	0.009
Pool	170	6761.3	22177.0	30.8	342.7	6	0.191	0.017
Pool	175	6912.5	22673.0	41.1	456.9	6	0.143	0.013
Riffle	120	6940.9	22766.0	11.6	128.9	0	0.000	0.000
Pool	180	7089.9	23255.0	154.2	1713.3	12	0.076	0.007
Pool	185	7221.0	23685.0	18.5	205.3	2	0.108	0.010
Pool	190	7350.9	24111.0	164.5	1827.6	221	1.344	0.121
Riffle	130	7482.9	24544.0	21.3	237.0	0	0.000	0.000
Pool	195	7490.9	24570.0	21.6	240.0	0	0.000	0.000
Pool	200	7665.2	25142.0	19.8	220.0	0	0.000	0.000
Pool	205	7779.0	25515.0	185.0	2056.0	27	0.143	0.013
Pool	210	8002.1	26247.0	257.0	2855.6	1	0.006	0.001
Riffle	140	8116.2	26621.0	5.3	59.1	0	0.000	0.000
Pool	215	8171.9	26804.0	287.8	3198.2	18	0.061	0.006
Pool	221	8382.3	27494.0	97.5	1083.3	16	0.164	0.015
Pool	225	8581.7	28148.0	22.0	244.4	3	0.134	0.012
Riffle	150	8593.0	28185.0	9.6	106.7	0	0.000	0.000
Pool	230	8719.5	28600.0	23.4	260.0	4	0.171	0.015
Pool	235	8915.9	29244.0	52.5	583.3	15	0.281	0.025
Pool	240	9019.8	29585.0	52.2	580.3	13	0.254	0.023
Riffle	161	9074.1	29763.0	3.1	34.0	0	0.000	0.000
Pool	245	9147.3	30003.0	133.6	1484.9	21	0.154	0.014
Pool	250	9312.5	30545.0	52.4	581.8	16	0.306	0.028
Riffle	170	9408.5	30860.0	5.5	61.1	0	0.000	0.000
Pool	256	9483.2	31105.0	115.1	1279.3	6	0.051	0.005
Pool	260	9601.2	31492.0	57.6	639.6	6	0.102	0.009
Pool	265	9771.9	32052.0	77.1	856.7	7	0.096	0.009
Pool	270	9947.6	32628.0	185.0	2056.0	15	0.080	0.007
Riffle	180	10073.5	33041.0	8.9	98.4	0	0.000	0.000
Pool	275	10124.1	33207.0	24.7	274.1	0	0.000	0.000
Pool	280	10210.1	33489.0	32.9	365.5	24	0.717	0.065
Pool	285	10285.7	33737.0	226.2	2512.9	75	0.332	0.030
Pool	287	10359.1	33978.0	51.4	571.1	21	0.401	0.036