2/12/2004

RE: Corrections to:

Whalen, J. K., J. D. Moran, M. P. Joyce, C. N. Roghair, and C. A. Dolloff. 2002. Assessment of stream habitat, fish, macroinvertebrates, sediment, and water chemistry for eleven streams in Land Between the Lakes National Recreation Area, Kentucky and Tennessee. Unpublished File Report. Blacksburg, VA. U.S. Department of Agriculture, Forest Service, Southern Research Station.

In January 2004, while working with data from the 2001 Land Between the Lakes (LBL) stream inventories, Alan Clingenpeel, Forest Hydrologist, Ouachita National Forest noted that spring cavefish (*Forbesichthys agassizi*) had been captured in Bear Creek, but were not included in Whalen et al. (2002). I spoke with J. K. Whalen, field crew leader, and he confirmed that spring cavefish had been captured in Bear Creek. Data for the surveys were originally recorded on paper and the fish were likely missed when entered into spreadsheets for analysis. I reviewed the original paper data and concluded that the following corrections should be noted:

p. 12: 32 (not 31) total species were captured; spring cavefish were captured in Bear Creek, which drains towards Barkley Lake (Cumberland River drainage)

p 18: 19 (not 18) species were found in Bear Creek, spring cavefish were omitted from the table

p. 49: spring cavefish (*Forbesichthys agassizi*) should be included in the species list

p. 64: spring cave fish were omitted from the table; we captured the following number of cavefish in each habitat unit: P9=2; P19=5; P29=5; R9=4; P40=1; P49=0; R19=0; P59=0; P69=0

p. 65: spring cavefish were captured during electrofishing at 307 m, 623 m, 1105 m, 1269 m, and 1543 m; no cavefish were captured upstream of 1543 m

Any questions regarding these corrections should be directed to Craig Roghair at the following address:

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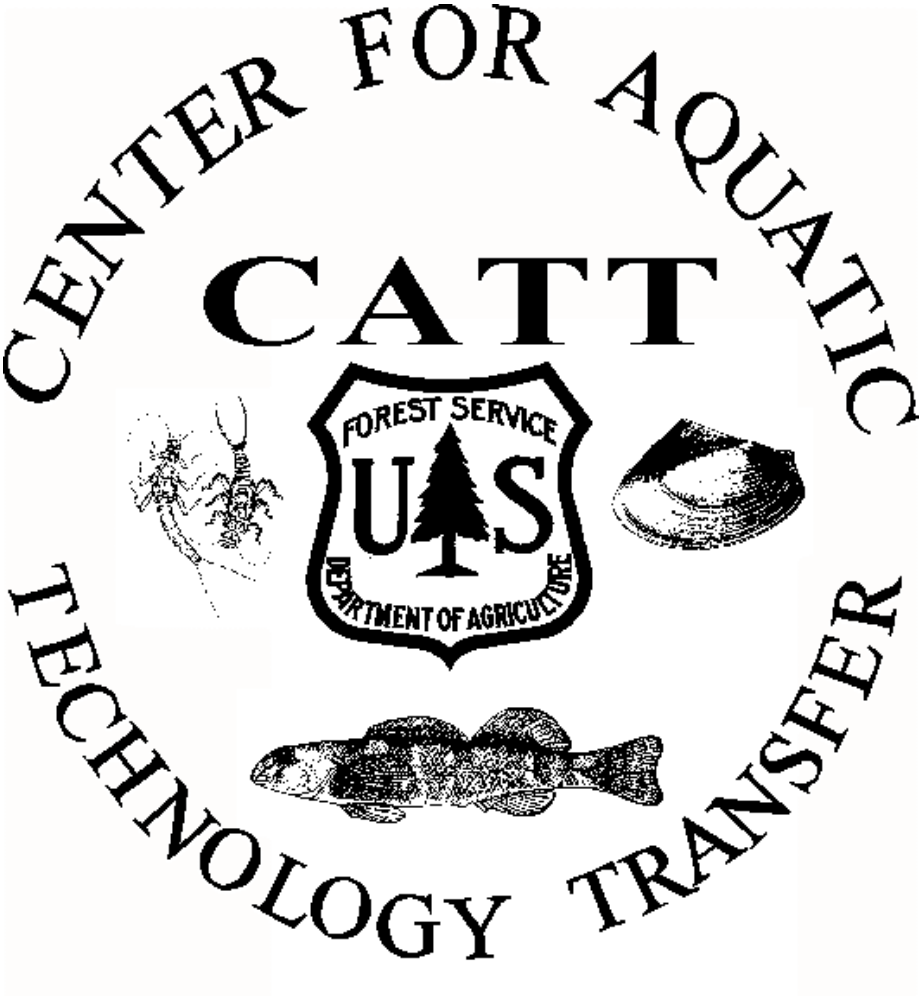
Assessment of Stream Habitat, Fish, Macroinvertebrates, Sediment, and Water Chemistry for Eleven Streams in Land Between the Lakes National Recreation Area, Kentucky and Tennessee



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Introduction

When Kentucky Lake (Kentucky Dam, 1944) and Lake Barkley (Barkley Dam, 1966) were created on the Tennessee and Cumberland Rivers a large, inland peninsula was formed between the lakes. In 1963, President John F. Kennedy designated the peninsula as Land Between the Lakes National Recreation Area (LBL). The Tennessee Valley Authority managed natural resources within the Recreation Area until the LBL Protection Act passed control to the U. S. Forest Service in 1999. The Protection Act directed the Forest Service to prepare land and resource management plans as soon as possible.

In July 2001, at the request of LBL managers, the U. S. Forest Service Center for Aquatic Technology Transfer (CATT) performed surveys on 11 streams flowing into Lake Barkley and Kentucky Lake. We inventoried stream habitat, fish, macroinvertebrates, sediments, and water chemistry to provide LBL managers with baseline data needed to develop resource management plans.

Study Site

Nearly 90% of the 170,000 acre LBL peninsula is forested, however it is also considered a major tourist attraction, with over 2 million visitors annually. LBL contains 420 miles of road with 90 bridges and 5 dams, 200 miles of hiking and biking trail, 80 miles of horse and wagon trails, over 1500 developed campsites, and an off highway vehicle area. LBL also has a nature center, planetarium, elk and bison prairie, and several information centers.

The area contains numerous streams, the majority of which are considered intermittent. Two streams, Crooked Creek and Bear Creek, are considered to be perennial. The streams either flow directly into bays on Lake Barkley or Kentucky Lake, or flow into secondary impoundments (e.g. Crooked Creek flows into Energy Lake, which drains to Lake Barkley). We surveyed a total of eleven streams in LBL; 4 drained directly into Lake Barkley, 3 into Kentucky Lake, and 4 to inland impoundments.

Methods

Habitat Survey

We used the basinwide visual estimation technique (BVET) (Hankin and Reeves 1988, Dolloff et al. 1993) to inventory stream habitat in eleven streams (Figure 1&2). Habitat in each of the streams was classified and inventoried by a two-person crew using two-stage visual estimation techniques. During the first stage, one crew member identified each habitat unit by type, estimated surface area, average and maximum depth, and dominant and subdominant substrates (Table 1) for every habitat unit, and estimated residual depth (average depth minus riffle crest depth), and the degree to which substrates were embedded for pools.

Habitat unit types included pools (areas in the stream with concave bottom profile, gradient equal to zero, greater than average depth, and smooth water surface), and riffles (areas in the stream with convex bottom profile, greater than average gradient, less than average depth, and turbulent water

surface). Glides (areas in the stream similar to pools, but with average depth and flat bottom profile) were identified during the survey but were grouped with pools for data analysis. Runs (areas in the stream similar to riffles but with average depth, less turbulent flow, and flat bottom profile) and cascades (areas in the stream with > 12% gradient, high velocity, and exposed bedrock or boulders) were grouped with riffles for data analysis. The length (0.1 m) of each habitat unit was measured with a hip chain and wetted width was visually estimated. Average depth of each habitat unit was estimated by taking depth measurements at various places across the channel profile with a graduated staff marked in 5 cm increments. We visually estimated the percent of the total substrate surface area that was embedded. We considered substrate to be embedded if interstitial spaces around large substrate particles were filled by smaller substrate particles.

The second crew member classified and inventoried large woody debris (LWD) within the stream channel, determined the Rosgen (1996) channel type for each habitat unit, and recorded data on a Husky Hunter data logger. LWD was divided into four classes (Table 2). All woody debris less than 1 m long and less than 5 cm in diameter were omitted from the survey. Rosgen channel type was estimated visually based on channel type descriptions found in Rosgen (1996) (Table 3).

The first unit of each habitat type selected for intensive (second stage) sampling (i.e. accurate measurement of surface area) was determined randomly. Additional units were selected systematically (every 5^{th} or 10^{th} unit for each habitat type, measured more frequently in shorter streams). The width of each systematically selected habitat unit was measured with a 30-m measuring tape at intervals ranging from about 1 m to 15 m. Interval size was determined by the length and the morphology of the unit (i.e. interval of measured width increased with increasing unit length). In each of the systematically selected riffles we also estimated the bankfull stream channel width as described by Harrelson et al. (1994), and measured channel gradient with a clinometer. Surveys were terminated where the stream became intermittent (wetted channel width was less than 0.5 m) or was completely dewatered for at least 500 m.

The relationship between estimated surface area and measured surface area typically is strongly and positively correlated when the estimates are made by experienced personnel; thus we could correct visual estimates by multiplying them by a calibration ratio (Hankin and Reeves 1988). The calibration ratio, the estimated true total area, and the variance of the area estimator were calculated separately for each habitat type and each section. BVET calculations were computed with a Microsoft Excel spreadsheet using the formulas found in Dolloff et al. (1993). Data were summarized using Excel spreadsheets and SigmaPlot graphics software.

Fish

A fish survey was performed by electrofishing every 5^{th} or 10^{th} pool and riffle depending on stream length (electrofished more frequently in shorter streams). Three passes were made through each habitat unit with a 700V AC backpack electrofishing unit and two netters. The total number of each

species captured in each pass was recorded. Data were used to describe the relative abundance and distribution of each species in each stream.

Macroinvertebrates

Macroinvertebrate samples were collected every 500 or 1000 m depending on the total stream length (samples collected more frequently in shorter streams). A 100 m long sample site was randomly selected from within the first 500 or 1000 m reach and subsequent sample sites were located every 500 or 1000 m thereafter. Samples were collected every three meters within the 100 m sample site, for a total of 33 samples per site. We used a random numbers table to determine the location of the sample within the wetted channel (distance from right bank) for each of the 33 samples. All 33 samples collected within the 100 m reach were combined to form a single sample for each site.

Samples were collected by a two-person crew using a D-frame dipnet. One individual held the dipnet with the opening facing upstream and timed the second individual, who disturbed the substrate within a 0.3 m^2 area in front of the dipnet. If the substrate in front of the net was completely sand, it was agitated to a depth of 5-10 cm (finger length) for 5 seconds. We collected all other samples by disturbing the area in front of the net for 15 seconds; cobbles, boulders, woody debris, and large organic materials were lifted and thoroughly rubbed, and smaller substrates were agitated, taking care to sweep sample materials into the dipnet.

Samples were analyzed under the supervision of Michael P. Joyce (CATT), with assistance from Steven Hiner (Virginia Tech, Aquatic Entomologist). All macroinvertebrates were removed from the samples and identified to family. We calculated a total of 12 metrics for each sample site:

- # captured – total number of macroinvertebrates collected
- % chironomidae – number of chironomid larvae divided by # captured, then multiplied by 100 (chironomids are generally pollution tolerant organisms)
- % EPT – number of Ephemeroptera, Plectoptera, and Tricoptera divided by # captured, then multiplied by 100 (Ephemeroptera, Plectoptera, and Tricoptera are generally pollution sensitive organisms)
- % 5 Dominant Taxa – sum of the relative abundance percentages for the five most common taxa in the sample (communities dominated by few taxa may reflect impaired conditions)
- - Modified HBI – version of the Hilsenhoff Biotic Index based on tolerance values from 0-10; HBI summarizes the overall pollution tolerance of the community, with 0 indicating low pollution tolerance and 10 indicating high pollution tolerance
- % Haptobenthos – number of individuals in the sample that require clean, course substrate materials upon which to cling divided by # captured, then multiplied by 100
- EPT Index – total number of Ephemeroptera, Plectoptera, and Tricoptera taxa collected (Ephemeroptera, Plectoptera, and Tricoptera are generally pollution sensitive organisms)
- # Ephemeroptera – number of Ephemeroptera taxa collected

- % Ephemeroptera – total number of Ephemeroptera divided by # captured, then divided by 100
- SDI (Simpson's Diversity Index) – index of site diversity, scores range from 0-1, with 1 indicating highest site diversity
- # Intolerant taxa – total number of taxa from each sample that had a tolerance value of 0-5 on a 10 point tolerance scale (low numbers of intolerant taxa may reflect impaired conditions)
- % Scrapers – total number of species in the scraper functional feeding group divided by # captured, then multiplied by 100 (specialized feeding groups such as scrapers are generally thought to be well represented in healthy streams)

Values provided by calculating these metrics should be compared to a local stream with reference conditions. If a reference stream is not used, as was the case here, values can be compared relatively between the streams.

Sediment

We used U. S. EPA (1999) sediment sampling protocols to perform pebble counts in the survey streams. Pebble count sites corresponded to the 100 m reaches used for macroinvertebrate sampling. Where possible, we didn't collect sediment and macroinvertebrate samples from the same habitat units, to limit bias in either sample. Sediment measurements were assumed to be representative of each 100 m stream reach.

Pebble counts were performed by walking perpendicular transects within the bankfull channel (Harrelson et al. 1994). The person walking the transect (caller) began at the edge of the bankfull channel on one side of the stream and walked heel-to-toe across the stream channel to the opposite bank. At each step the caller picked up the pebble at the tip of their toe and measured its intermediate axis. This procedure was repeated until 100 pebbles were measured. Due to difficulty in measuring their intermediate axis, clay, silt, sand, and bedrock were placed into categories (Table 1). If detritus, LWD, or other organic materials were encountered, we sampled the rock substrate found directly below them. We performed pebble counts in riffles unless no riffle habitat was available at a site, in which case we performed pebble counts in pools.

We used the pebble count data to calculate the D_{50} (median particle diameter), D_{33} (33^{rd} percentile of particle diameter sizes), D_{84} (84^{th} percentile of particle diameter sizes), and percent fine sediment (<2 mm). We calculated D_{84} and D_{33} to more completely describe the distribution of particle sizes within the bankfull channel.

Water Chemistry

We used an Oakton waterproof pH/CON 10 meter to record pH, conductivity, and water temperature data for each stream. Sample sites corresponded to the 100 m reaches used for macroinvertebrate and sediment sampling. Where possible, we didn't collect water chemistry, sediment and macroinvertebrate samples from the same habitat units, to limit bias in any of the samples. We

collected readings by lowering the probe into a riffle to within 1.0 cm of the substrate and holding it in place until the meter stabilized. Readings were taken in pool tails when riffle habitat was not available.

Results

Habitat Survey

Cumberland River Drainage

Curry Hollow

We surveyed 1.8 km of Curry Hollow, from its confluence with Fulton Bay until it ran dry near Gray Cemetery. The mean bankfull channel width was 7 m, 100% of the channel was Rosgen channel type C, and the average gradient was 3%. Small and large gravels dominated the substrate, and in 78% of pools substrate was embedded. We encountered more than 140 pieces of LWD per km in Curry Hollow. Ten percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Barnes Hollow

We surveyed Barnes Hollow from its confluence with Hematite Lake until it ran dry 1.6 km upstream. The mean bankfull channel width was 10 m, 100% of the channel was Rosgen channel type C, and the average gradient was 2%. Small and large gravel dominated the substrate, and in 6% of pools substrate was embedded. Organic materials were the dominant substrate in >20% of pools. We encountered less than 20 pieces of LWD per km in Barnes Hollow. Five percent of the total surface are of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Crooked Creek

We surveyed 4.7 km of Crooked Creek, from its confluence with Energy Lake until it ran dry several hundred meters south of route 134. The mean bankfull channel width was 10 m, 100% of the channel was Rosgen channel type C, and the average gradient was 1%. Large gravel, small gravel, and clay dominated the substrates, and no pools had embedded substrate. We encountered 60 pieces of LWD per km in Crooked Creek. Seven percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Prior Creek

We surveyed 2.0 km of Prior Creek, from its confluence with Prior Bay until it ran dry near the Homeplace. The mean bankfull channel width was 16 m, 100% of the channel was Rosgen channel type C, and the average gradient was 2%. Small and large gravel dominated the substrate, and in 98% of pools substrate was embedded. We encountered less than 35 pieces of LWD per km in Prior Creek. Three percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Crockett Creek

We surveyed Crockett Creek from its confluence with Crockett Bay until it ran dry near the end of route 372, 2.5 km upstream. The mean bankfull channel width was 6 m, 100% of the channel was

Rosgen channel type C, and the average gradient was 3%. Small and large gravel dominated the substrate, and in 61% of pools substrate was embedded. We encountered more than 120 pieces of LWD per km in Crockett Creek. Eight percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Barret Creek

We surveyed Barret Creek from its confluence with Bards Lake until it ran dry 1.7 km upstream. The mean bankfull channel width was 6 m, 100% of the channel was Rosgen channel type C, and the average gradient was 1%. Clay, small gravel, and large gravel dominated substrate, and in 3% of pools substrate was embedded. We encountered more than 90 pieces of LWD per km in Barrett Creek. Four percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Brandon Spring Branch

We surveyed Brandon Spring Branch from its confluence with Bards Lake until it ran dry 700 m upstream. Clay, large gravel, and and silt dominated the stream substrate. We encountered 24 pieces of LWD per km in Brandon Spring Branch. We did not find any wetted riffle habitat on Brandon Spring Branch. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Bear Creek

Bear Creek was dry from just upstream of its confluence with Lake Barkley to a point 1340 m upstream of Route 100 (The Trace). We surveyed Bear Creek from where the channel became wetted until we reached a marsh 3.0 km upstream. The mean bankfull channel width was 11 m, 100% of the channel was Rosgen channel type C, and the average gradient was 2%. Small gravel, large gravel, and clay dominated substrate, and in 98% of pools substrate was embedded. We encountered less than 40 pieces of LWD per km in Bear Creek. Six percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Tennessee River Drainage

Byrd Creek

We surveyed Byrd Creek from its confluence with Byrd Bay until it ran dry 1.4 km upstream. Seventy-seven percent of the channel was Rosgen type C and the remainder was type B. Small gravel, large gravel, clay, and organic material dominated the substrate. We encountered 15 pieces of LWD per km in Byrd Creek. We did not find any wetted riffle habitat on Byrd Creek. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Panther Creek

We surveyed 2.9 km of Panther Creek, from its confluence with Panther Bay to near the end of route 400 on South Fork Panther Creek, where the creek ran dry. The mean bankfull channel width was 11 m, 55% of the channel was Rosgen channel type C and the remainder was type B, and the average

gradient was 2%. Small gravel, large gravel, and cobble dominated substrate, and in 91% of pools substrate was embedded. We encountered less than 80 pieces of LWD per km in Panther Creek. Twenty-eight percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Lost Creek

We surveyed Lost Creek from its confluence with Lake Kentucky until it ran dry 2.9 km upstream. The mean bankfull channel width was 12 m, 100% of the channel was Rosgen channel type C, and the average gradient was 2%. Large gravel, small gravel, and cobble dominated substrate, and in 71% of pools substrate was embedded. We encountered less than 95 pieces of LWD per km in Lost Creek. Twenty-five percent of the total surface area of the stream was riffle. See Table 4 and Appendix A for habitat survey summaries and detailed results.

Fish

We captured a total of 31 species of fish using backpack electrofishing in the 11 streams we surveyed (Table 5). None of the 31 species were found in all 11 streams. Chain pickerel, creek chubsucker, and blackspotted topminnow each occupied nine streams, whereas brook silverside, slough darter, warmouth, and bigeye shiner occupied one stream each. Most species were found throughout the entire length of the stream, however the largemouth and spotted bass and yellow bullheads were typically captured in the downstream reaches of the streams (Appendix B). All species occupied pool habitats, but only darters, creek chubs, dace, stonerollers, and sculpin were frequently captured in riffles. We captured smallmouth bass, rosyside dace, and bigeye shiner only in streams draining to Kentucky Lake (Tennessee River drainage), and captured brook silverside, slough darter, bluegill, warmouth, and southern redbelly dace only in streams draining to Barkley Lake (Cumbreland River drainage). All other species were captured in both drainages (Appendix B).

Macroinvertebrates

Panther Creek and Lost Creek (Tennessee River drainage) had the best overall metric results (Table 7). Streams in the Cumberland River drainage generally scored poorly when compared to Panther Creek and Lost Creek (Table 6). We forwarded our metric results to Greg Pond (Kentucky Department of Environmental Protection) for additional analysis. He can be contacted directly for further data interpretation (greg.pond@mail.state.ky.us).

Sediment

We performed pebble counts at a total of 33 sites in the 11 streams we surveyed (Table 8). The number of sample sites per stream ranged from 1 to 8, depending on the length of the survey and the amount wetted riffle habitat available. D_{33}, D_{50}, and D_{84} fell within the range of small to large gravel (3 mm – 100 mm) for every stream, with the exception of Brandon Spring Branch, which had clay, silt, and sand for D_{33}, D_{50}, and D_{84}, respectively. The percent of material ≤ 2 mm in the pebble counts ranged from

0 to 95%. Pebble counts sites in Curry Hollow and Barnes Hollow all contained more than 20% material ≤ 2 mm. Sample sites in Prior Creek, Byrd Creek, and the upstream reaches of Barrett Creek and Lost Creek contained relatively low amounts of sediment ≤ 2 mm.

Water Chemistry

We collected water chemistry data at a total of 28 sites in the 11 streams we surveyed (Table 9). Individual site pH ranged from 6.23 (Crooked Creek) to 7.80 (Bear Creek), conductivity ranged from 52 µS (Crooked Creek) to 316 µS (Bear Creek), and water temperature ranged from 17.7 C (Bear Creek) to 30.7 C (Brandon Springs Branch).

Discussion and Recommendations

There appeared to be two major factors influencing stream conditions in LBL: 1) stream hydrology, and 2) impoundments. The majority of the streams we surveyed were intermittent, containing pools separated by dry sections up to several hundred meters long. Neither Brandon Spring Branch nor Byrd Creek contained any wetted riffle habitat. Lack of habitat diversity (few or no riffles) had obvious effects of the fish and macroinvertebrate communities in the streams. Panther Creek and Lost Creek, the two streams with the most riffle area contained the largest diversity of fish species and scored best on macroinvertebrate metrics.

When Lake Barkely and Kentucky Lake were created in the mid-1900's most of the streams lost a large portion of their wetted area. The streams that we surveyed are the headwater remnants of streams that once flowed directly into the Cumberland and Tennessee Rivers. In addition, secondary impoundments were created on several streams near their confluences with the TVA impoundments. Without historical data or comparison to reference streams we could not estimate the magnitude of the impoundments' impacts, but signs of their influence were evident. Fish and macroinvertebrate species typically associated with lakes or large rivers such as bass and sunfish species, *Chaoborus* (the phantom midge), and the bryozoan *Pectinatella magnifica* were found in LBL streams. Our crews noted that in several streams it was difficult to distinguish where the streams started and the lakes ended. In the most extreme cases, such as in Brandon Spring Brach, the stream was little more than a bay of the lake.

LBL managers are charged with developing management plans for streams in which they have little control over the two major factors shaping both the streams themselves and their biological communities. Although most standard stream management scenarios are clearly not appropriate, our data suggest several issues that could be addressed. For example, given that dewatering seemed to have detrimental effects on community diversity, any activity that removes water from these streams should be limited, especially during low flow periods. Other factors such as low amounts of LWD and high levels of substrate embeddedness in some streams may need to be addressed. There was variability in the distribution and relative abundance of fish species both between and within streams. LBL may wish to perform further surveys to determine the status of locally rare species. Water chemistry results were

generally acceptable, however repeated sampling to verify results at sites with low pH (less than 6.5) is advised. In addition, sites with relatively high conductivity levels could indicate areas with increased levels of pollutants. These areas should be sampled again to verify readings or monitored further in the future. Finally, any future monitoring program will need to address the effects of recreation (roads, trails, campgrounds, ORV use, etc.) on stream habitat and biological communities.

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Table 1. Substrate size classes used during BVET habitat surveys. Diameter was estimated for the intermediate axis.

Size Class	Class Name	Diameter (mm)
1	organic debris	
2	clay	
3	silt	
4	sand	Silt – 2
5	small gravel	3 – 10
6	large gravel	11 – 100
7	cobble	101 – 300
8	boulder	>300
9	bedrock	

Table 2. Large woody debris (LWD) size classes used during BVET habitat surveys. Diameter was measured at thickest portion of LWD piece. All woody debris less than 1 m long and less than 5 cm in diameter were omitted from the survey.

Size Class	Length (m)	Diameter (cm)
1	< 5	10-50
2	< 5	>50
3	> 5	10-50
4	> 5	>50

Table 3. Rosgen (1996) channel type descriptions used during BVET habitat surveys.

	A	B	C	D	E	F	G
Entrenchment	< 1.4	1.4 – 2.2	> 2.2	n/a	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 12	> 12	< 12
Sinuosity	1 – 1.2	> 1.2	>1.2	n/a	> 1.5	> 1.2	> 1.2
Slope	.04 - .099	.02 – 0.39	< .02	< .04	< .02	< .02	.02 - .039

Table 4. BVET habitat survey results for eleven streams in LBL, 2001. Surveys with their downstream starting point at a bay drained directly into Lake Barkley (Cumberland drainage) or Kentucky Lake (Tennessee drainage). Those with their downstream starting point at a lake drained into an impoundment before entering the larger lakes. Bear Creek was dry at its confluence; we began its survey 1340 m upstream of route 100. na = data not applicable or not recorded. Detailed stream summaries are located in appendix A.

	Cumberland River Drainage								Tennessee River Drainage		
Stream:	**Curry**	**Barnes**	**Crooked**	**Prior**	**Crockett**	**Barrett**	**Brandon**	**Bear**	**Byrd**	**Panther**	**Lost**
Survey Date (2001):	07/25	07/27	na	07/27	07/27	07/23	07/23	07/31	07/27	07/25	07/26
Downstream Starting Point:	Bay	Lake	Lake	Bay	Bay	Lake	Lake	Rt. 100	Bay	Bay	Bay
Upstream Ending Point:	dry	dry	dry	dry	dry	dry	dry	marsh	dry	dry	dry
Total Distance Surveyed (km):	1.8	1.6	4.7	2.0	2.5	1.7	0.7	3.0	1.4	2.9	2.9
Mean Channel Width (m):	7.0	10.3	10.5	16.2	5.8	5.9	na	10.9	na	10.7	12.1
Average Channel Gradient (%):	3	2	1	2	3	1	na	2	na	2	2
Percent of Total Area Pools:	90	95	93	97	92	96	100	94	100	72	75
Number of Pools:	46	34	91	41	88	35	5	81	21	103	89
Number of Pools per km:	26	22	19	21	36	21	7	27	15	36	31
Percent of Pool Habitat Surveyed as Glides:	11	18	29	10	16	20	0	9	5	16	7
Total Pool Area (m^2):	3587	2673	10846	8497	8667	7196	1651	7528	2036	9326	10139
+/- (m^2):	933	599	1395	356	306	277	na	487	102	910	691
Correction Factor:	0.88	0.83	1.05	1.07	1.09	1.03	1.20	0.98	1.07	0.90	0.95
Mean Pool Area (m^2):	78	79	119	207	98	206	330	93	97	91	114
Mean Maximum Depth (cm):	51	64	61	76	42	76	76	65	55	65	63
Mean Average Depth (cm):	28	38	40	38	23	47	37	36	32	37	36
Mean Residual Pool Depth (cm):	24	32	37	31	21	39	na	33	na	27	29
Percent Pools with > 35% Embeddedness:	78	6	0	98	61	3	100	98	100	91	71
Percent of Total Area Riffles:	10	5	7	3	8	4	na	6	na	28	25
Number of Riffles:	17	6	37	9	35	19	0	26	0	70	64
Number of Riffles per km:	9	4	8	5	14	12	na	9	na	24	22
Total Riffle Area (m^2):	400	140	838	295	709	309	na	459	na	3685	3368
+/- (m^2):	47	na	71	na	38	19	na	63	na	214	683
Correction Factor:	1.01	2.00	1.39	0.83	1.55	1.14	na	1.06	na	1.05	1.07
Mean Riffle Area (m^2):	24	23	23	33	20	16	na	18	na	53	53
Mean Maximum Depth (cm):	4	8	7	11	8	13	na	8	na	15	12
Mean Average Depth (cm):	2	5	5	6	4	7	na	5	na	9	7
Number of LWD pieces per km:	143	16	60	32	126	94	24	36	15	80	95
LWD < 5 m, < 55 cm:	87	12	42	7	84	50	12	9	4	35	59
LWD < 5 m, > 55 cm:	8	3	1	3	12	28	0	1	3	2	1
LWD > 5 m, < 55 cm:	35	0	17	19	23	2	12	20	6	32	30
LWD > 5 m, > 55 cm:	13	2	0	4	7	13	0	6	1	10	5
Rosgen's Channel Type Frequency (%):											
Type A:	0	0	0	0	0	0	0	0	0	0	0
Type B:	0	0	0	0	0	0	0	0	21	45	0
Type C:	100	100	100	100	100	100	100	100	79	55	100

Table 5. Fish species captured in LBL streams using backpack electrofishing, July 2001. Streams drained directly to Lake Barkley (Cumberland River drainage) or to Kentucky Lake (Tennessee River drainage), except for asterisked streams, which flowed into impoundments before draining to the lakes. Detailed electrofishing results and scientific names of species can be found in Appendix B.

	Cumberland River Drainage								**Tennessee River Drainage**		
	Curry	***Barnes**	***Crooked**	**Prior**	**Crockett**	***Barrett**	***Brandon**	**Bear**	**Byrd**	**Panther**	**Lost**
smallmouth bass									x	x	x
largemouth bass	x			x		x				x	x
spotted bass	x					x			x	x	x
chestnut lamprey				x	x						x
silver lamprey			x								
western mosquito fish						x		x	x		
brook silverside						x					
blackspotted topminnow	x		x	x	x	x	x	x	x	x	
sculpin				x	x						x
logperch						x				x	x
fantail darter	x	x	x		x			x	x	x	x
orangethroat darter				x	x	x		x	x	x	x
rainbow darter				x	x	x		x	x	x	x
black darter								x		x	x
slough darter								x			
longear sunfish	x		x			x		x		x	x
redear sunfish	x		x			x	x	x		x	x
dollar sunfish	x			x	x	x		x		x	x
bluegill				x		x					
warmouth						x					
orangespotted sunfish			x			x			x	x	x
green sunfish		x		x	x	x		x	x	x	x
creek chub			x	x		x		x	x	x	x
central stoneroller			x	x	x			x	x	x	x
creek chubsucker	x	x	x	x	x	x		x		x	x
rosyside dace										x	x
southern redbelly dace				x				x			
bigeye shiner										x	
yellow bullhead	x		x		x	x		x	x	x	x
pirate perch	x	x	x	x	x	x		x			
chain pickerel	x	x	x	x	x	x		x		x	x
Totals	11	5	12	15	13	20	2	18	12	21	21

Table 6. Macroinvertebrate metric results for streams in the Cumberland River (Lake Barkley) drainage, LBL, July 2001. Distance is meters upstream from beginning of survey (see Table 1). na = not collected

Stream	Site	# Captured	% Chironomidae	% EPT	% 5 Dominant Taxa	Modified HBI	% Hapto-benthos	EPT Index	# Ephemer-optera	% Ephemer-optera	SDI	# Intolerant Taxa	% Scrapers	Distance (m)
Curry	1	na	na	na	na	na	na	na	na	na	na	na	na	500
	2	47	17.0	42.6	76.6	5.3	34.0	4	4	42.6	0.88	4	23.4	1000
	3	102	9.8	0.0	95.1	7.7	1.0	0	0	0.0	0.42	2	0.0	1500
Barnes	1	33	12.1	0.0	84.8	7.0	0.0	0	0	0.0	0.85	1	0.0	801
	2	108	13.9	6.5	79.6	7.6	3.7	2	2	6.5	0.82	4	3.7	919
Crooked	1	na	na	na	na	na	na	na	na	na	na	na	na	625
	2	126	26.2	40.5	79.4	5.2	24.6	4	3	39.7	0.85	7	17.5	1124
	3	na	na	na	na	na	na	na	na	na	na	na	na	1814
	4	294	40.1	39.1	96.3	4.9	34.4	6	4	38.4	0.71	7	33.0	2050
	5	na	na	na	na	na	na	na	na	na	na	na	na	2500
	6	128	51.6	37.5	99.2	4.9	35.9	2	2	37.5	0.60	3	35.9	3032
	7	na	na	na	na	na	na	na	na	na	na	na	na	3525
	8	42	52.4	21.4	85.7	5.6	16.7	3	2	16.7	0.71	4	11.9	3999
Prior	1	131	45.8	17.6	92.4	5.7	38.2	3	2	16.8	0.71	3	13.7	600
Crockett	1	134	44.0	16.4	86.6	5.8	19.4	5	2	6.0	0.75	7	7.5	na
	2	30	36.7	16.7	73.3	6.0	16.7	3	3	16.7	0.84	4	6.7	na
Barrett	1	141	52.5	7.8	89.4	5.9	10.6	2	1	7.1	0.69	5	9.2	250
	2	152	78.3	3.3	92.8	5.9	4.6	3	3	3.3	0.38	6	4.6	850
	3	69	72.5	0.0	88.4	6.2	5.8	0	0	0.0	0.47	1	0.0	1350
Brandon	1	236	51.7	0.4	85.2	6.7	14.0	1	1	0.4	0.70	1	0.0	451
Bear	1	68	2.9	0.0	97.1	7.9	0.0	0	0	0.0	0.22	1	0.0	~500
	2	76	18.4	23.7	85.5	5.9	22.4	3	2	22.4	0.86	6	19.7	~1000
	3	101	6.9	43.6	86.1	5.1	44.6	4	1	19.8	0.80	6	19.8	~1500
	4	21	4.8	33.3	61.9	5.7	33.3	5	2	19.0	0.94	6	9.5	2624

Table 7. Macroinvertebrate metric results for streams in the Tennessee River (Kentucky Lake) drainage, LBL, July 2001. Distance is meters upstream from beginning of survey (see Table 1). na = not collected

Stream	Site	# Captured	% Chironomidae	% EPT	% 5 Dominant Taxa	Modified HBI	% Hapto-benthos	EPT Index	# Ephemer-optera	% Ephemer-optera	SDI	# Intolerant Taxa	% Scrapers	Distance (m)
Byrd	1	378	69.0	14.3	88.1	5.8	15.9	6	3	13.0	0.51	6	9.5	250
Panther	1	52	5.8	26.9	84.6	6.0	59.6	2	2	26.9	0.83	5	25.0	500
	2	55	12.7	1.8	89.1	7.4	18.2	1	1	1.8	0.74	5	7.3	900
	3	96	1.0	29.2	85.4	4.6	90.6	4	2	17.7	0.80	9	32.3	1400
	4	76	2.6	22.4	78.9	4.5	80.3	4	2	10.5	0.82	8	44.7	1900
	5	116	12.1	28.4	82.8	5.3	76.7	7	3	19.8	0.76	10	21.6	2400
Lost	1	158	13.9	33.5	86.7	3.7	75.3	5	1	8.9	0.76	7	51.9	na
	2	na	na	na	na	na	na	na	na	na	na	na	na	na
	3	126	1.6	25.4	87.3	3.8	76.2	4	1	7.1	0.72	6	56.3	na
	4	275	14.5	25.5	82.9	4.2	68.4	8	2	8.0	0.78	12	45.8	na
	5	260	9.2	49.6	89.6	3.6	84.6	8	3	42.3	0.73	13	73.5	na

Table 8. Pebble count results for streams in LBL, July 2001. Distance is meters upstream from beginning of survey (see Table 1). na = not recorded

Drainage	Stream	Site	D50 (mm)	D33 (mm)	D84 (mm)	≤2 mm (%)	Distance (m)
Cumberland River	Curry Hollow	1	20	10	36	21	500
		2	15	8	31	28	1000
		3	12	5	31	30	1500
	Barnes Hollow	1	15	8	40	22	801
		2	15	5	30	26	919
	Crooked Creek	1	15	10	40	12	625
		2	25	15	70	6	1124
		3	35	29	96	6	1814
		4	30	10	73	29	2050
		5	30	20	70	3	2500
		6	16	10	50	11	3032
		7	20	10	60	20	3525
		8	14	8	40	15	3999
	Prior Creek	1	20	15	41	7	600
	Crockett Creek	1	34	29	49	15	na
		2	21	12	43	18	na
	Barrett Creek	1	29	17	52	20	250
		2	30	25	56	1	850
		3	37	28	63	6	1350
	Brandon Spring Branch	1	silt	clay	2	95	451
	Bear Creek	1	30	16	61	17	~500
		2	na	na	na	na	~1000
		3	na	na	na	na	~1500
		4	32	21	64	18	2624
Tennessee River	Byrd Creek	1	21	19	35	4	250
	Panther Creek	1	18	11	42	18	500
		2	18	3	87	31	900
		3	9	3	72	30	1400
		4	25	20	50	14	1900
		5	26	20	55	0	2400
	Lost Creek	1	31	19	61	20	na
		2	38	28	60	20	na
		3	26	18	45	7	na
		4	44	24	69	8	na
		5	26	16	68	10	na

Table 9. Water chemistry results from streams in LBL, July 2001. Distance is meters upstream of survey start (see Table 1). na = not recorded

Drainage	Stream	Site	pH	Conductivity (µS)	Temperature (C)	Distance (m)
Cumberland River	Curry Hollow	1	6.70	111	26.4	500
		2	7.62	92	28.3	1000
		3	6.44	117	27.7	1500
	Barnes Hollow	1	6.34	138	27.4	801
		2	6.94	68	27.2	919
	Crooked Creek	1	na	na	na	625
		2	6.70	93	26.1	1124
		3	na	na	na	1814
		4	6.83	123	24.3	2050
		5	na	na	na	2500
		6	5.47	53	20.1	3032
		7	na	na	na	3525
		8	6.23	58	27.4	3999
	Prior Creek	1	7.04	250	25.9	600
	Crockett Creek	1	7.62	293	25.1	na
		2	7.01	169	25.4	na
	Barrett Creek	1	6.92	131	26.3	250
		2	na	na	na	850
		3	na	na	na	1350
	Brandon Spring Branch	1	7.10	103	30.7	451
	Bear Creek	1	7.80	272	26.3	~500
		2	7.60	260	25.4	~1000
		3	7.17	227	17.7	~1500
		4	6.96	316	20.9	2624
Tennessee River	Byrd Creek	1	6.42	109	24	250
	Panther Creek	1	7.54	258	23	500
		2	7.76	250	24.1	900
		3	7.66	249	23.4	1400
		4	7.59	196	25.5	1900
		5	6.87	155	21.3	2400
	Lost Creek	1	6.99	163	24.9	na
		2	na	na	na	na
		3	7.32	99	22.9	na
		4	7.02	145	22.3	na
		5	6.59	995	21.9	na

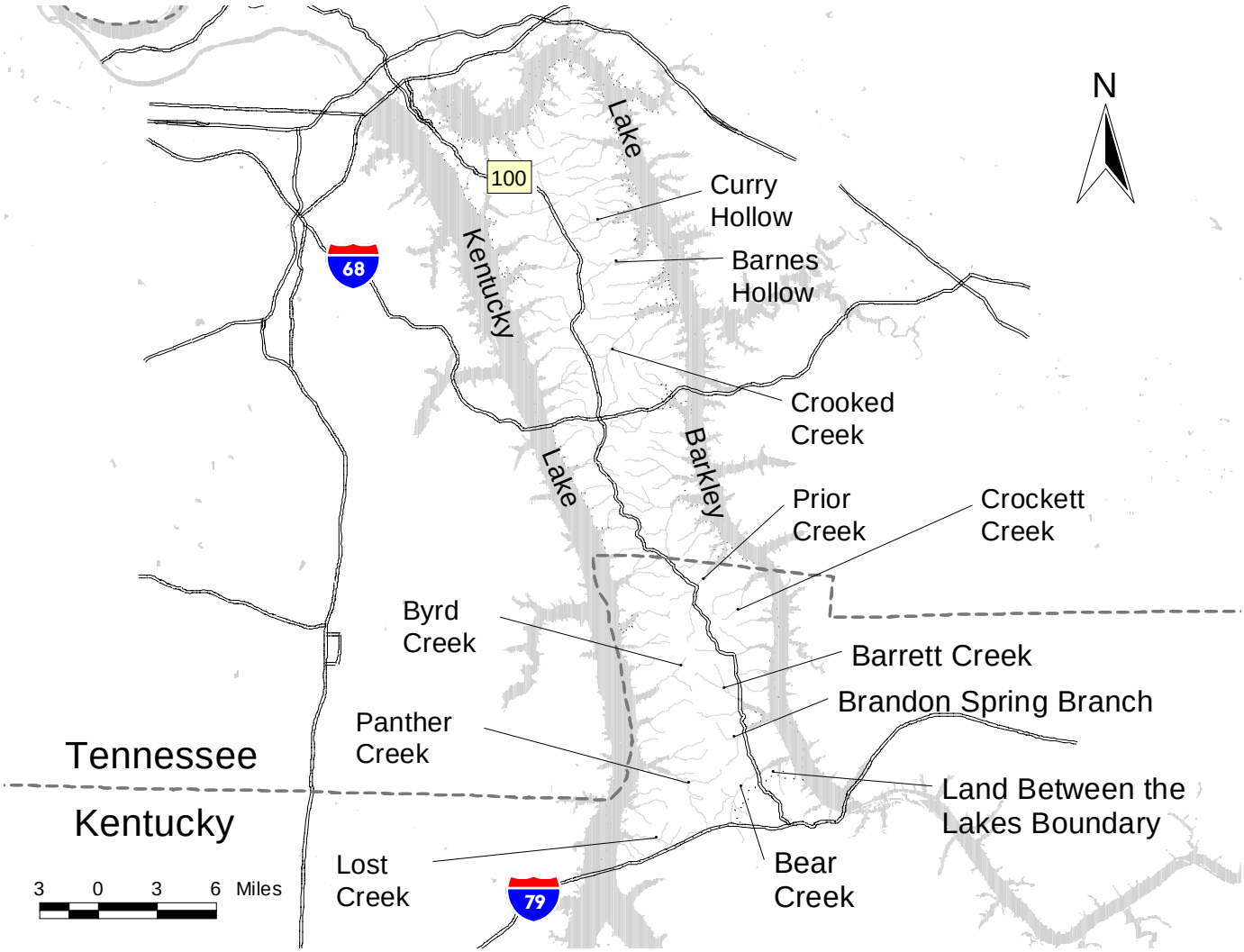

Figure 1. Location of LBL and streams surveyed in July, 2001.

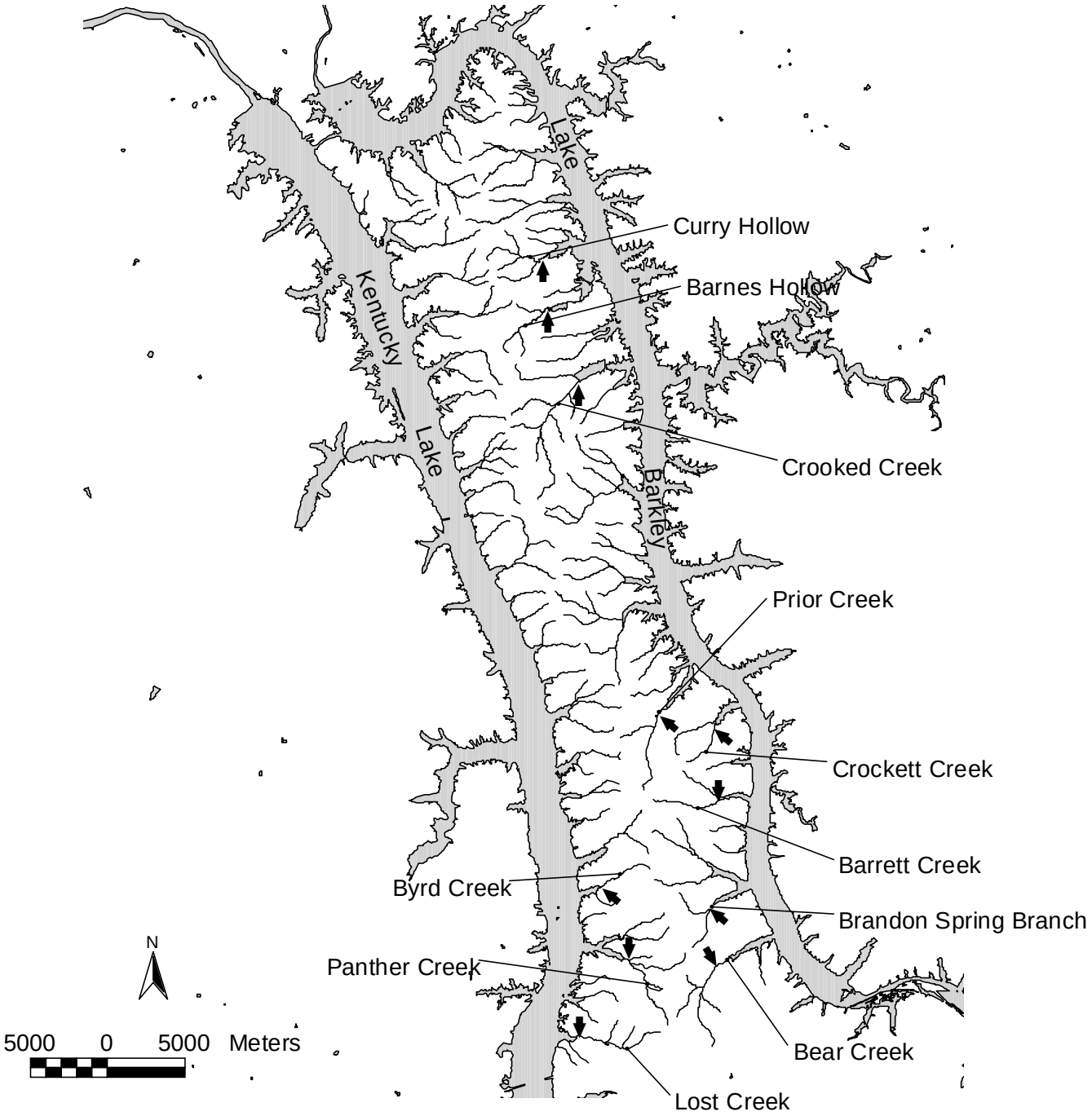

Figure 2. Location of LBL streams surveyed in July 2001. Arrows indicate starting points for stream habitat surveys. See Figure 1 for Recreation Area boundary and landmarks.

Appendix A: BVET Habitat Survey Results

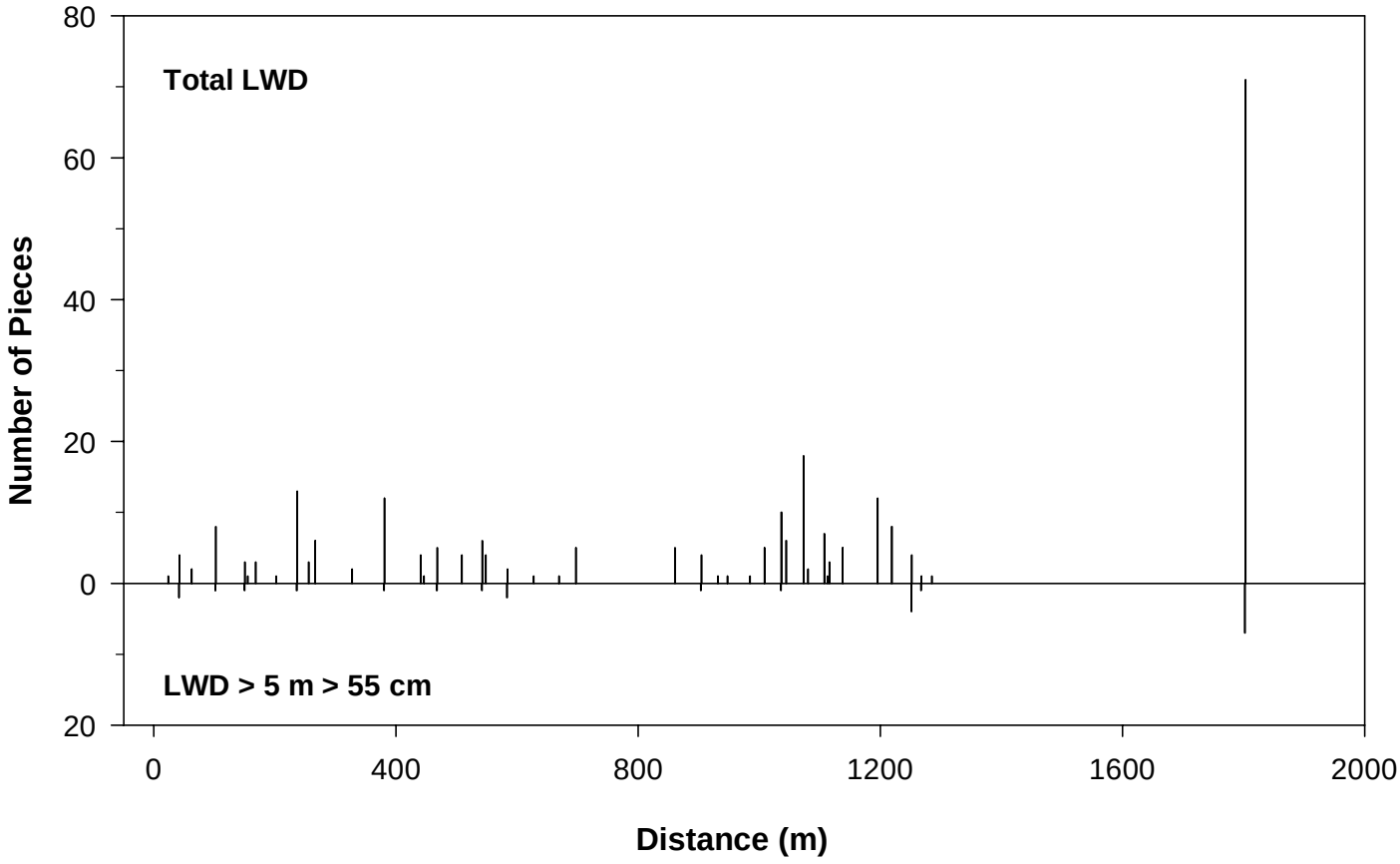

Figure A1. Distribution and abundance of LWD in Curry Hollow, July 2001.

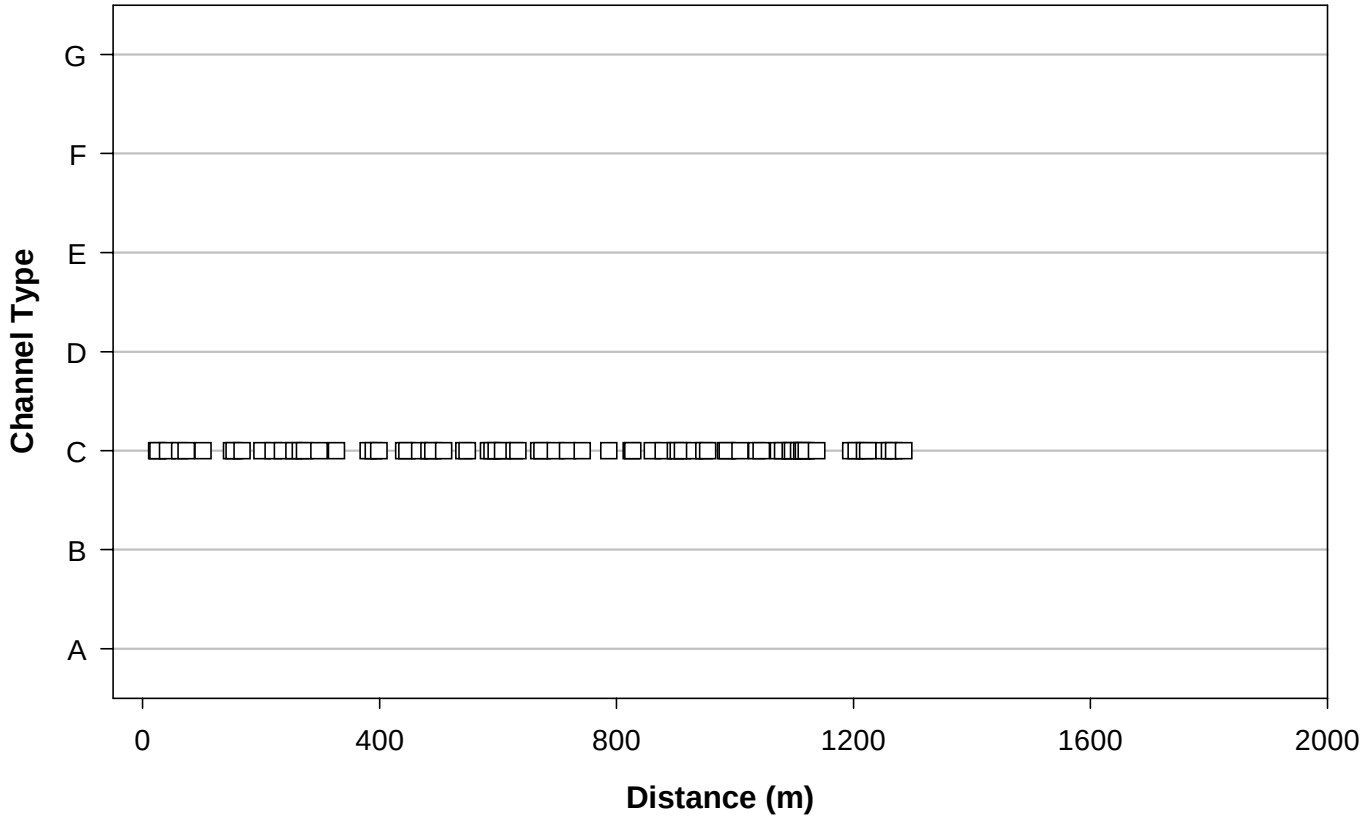

Figure A2. Rosgen's channel type distribution in Curry Hollow, July 2001.

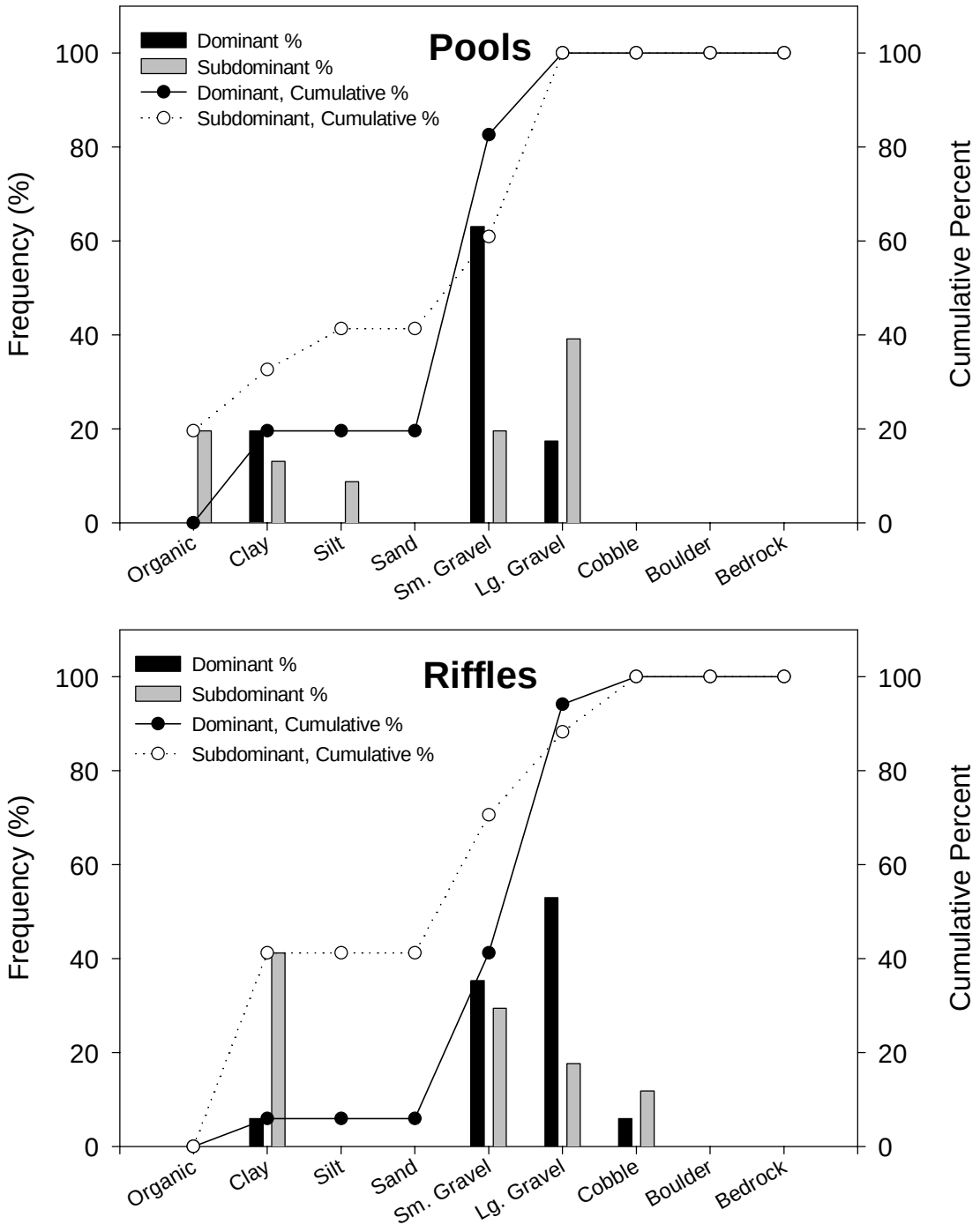

Figure A3. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Curry Hollow, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

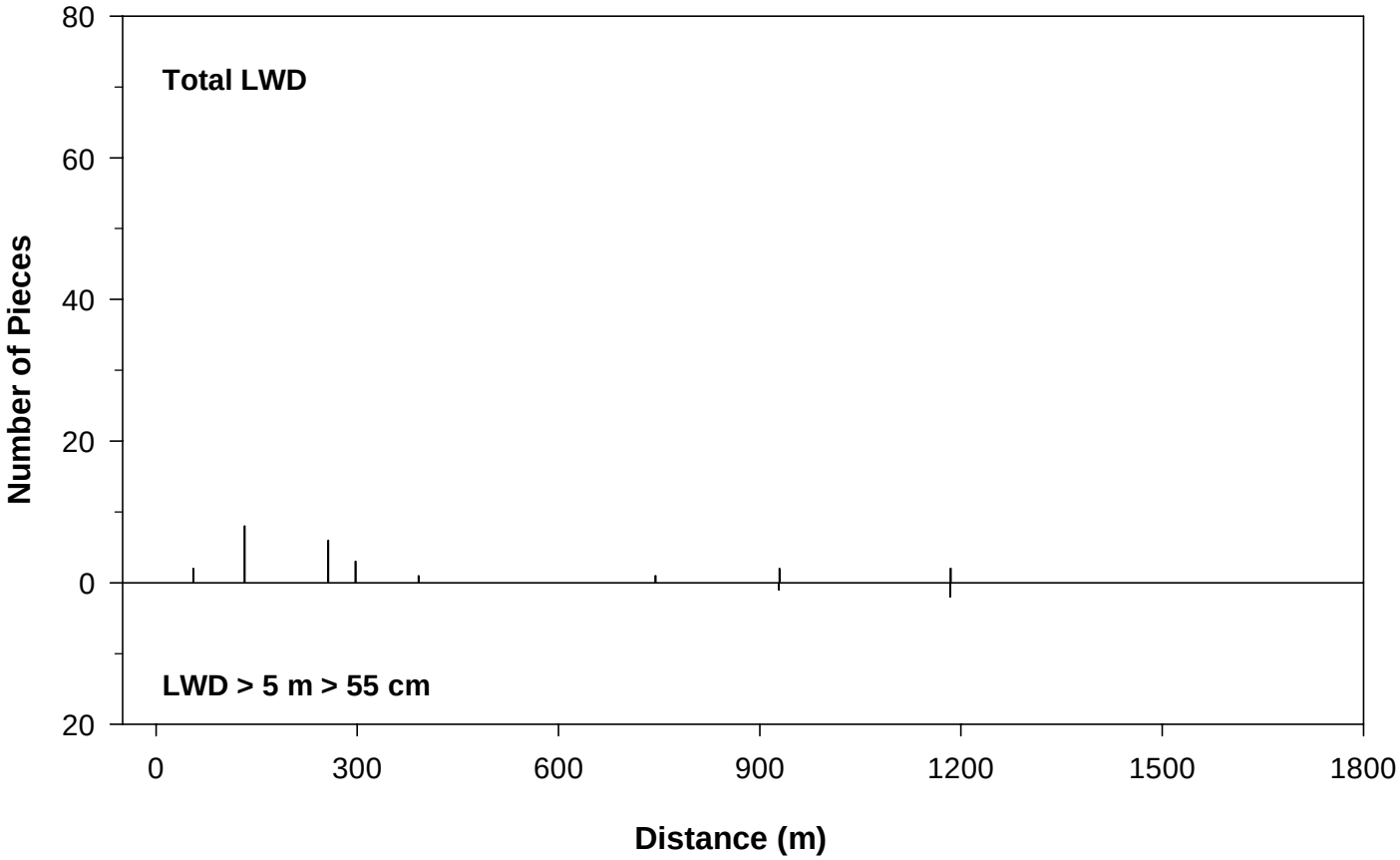

Figure A4. Distribution and abundance of LWD in Barnes Hollow, July 2001.

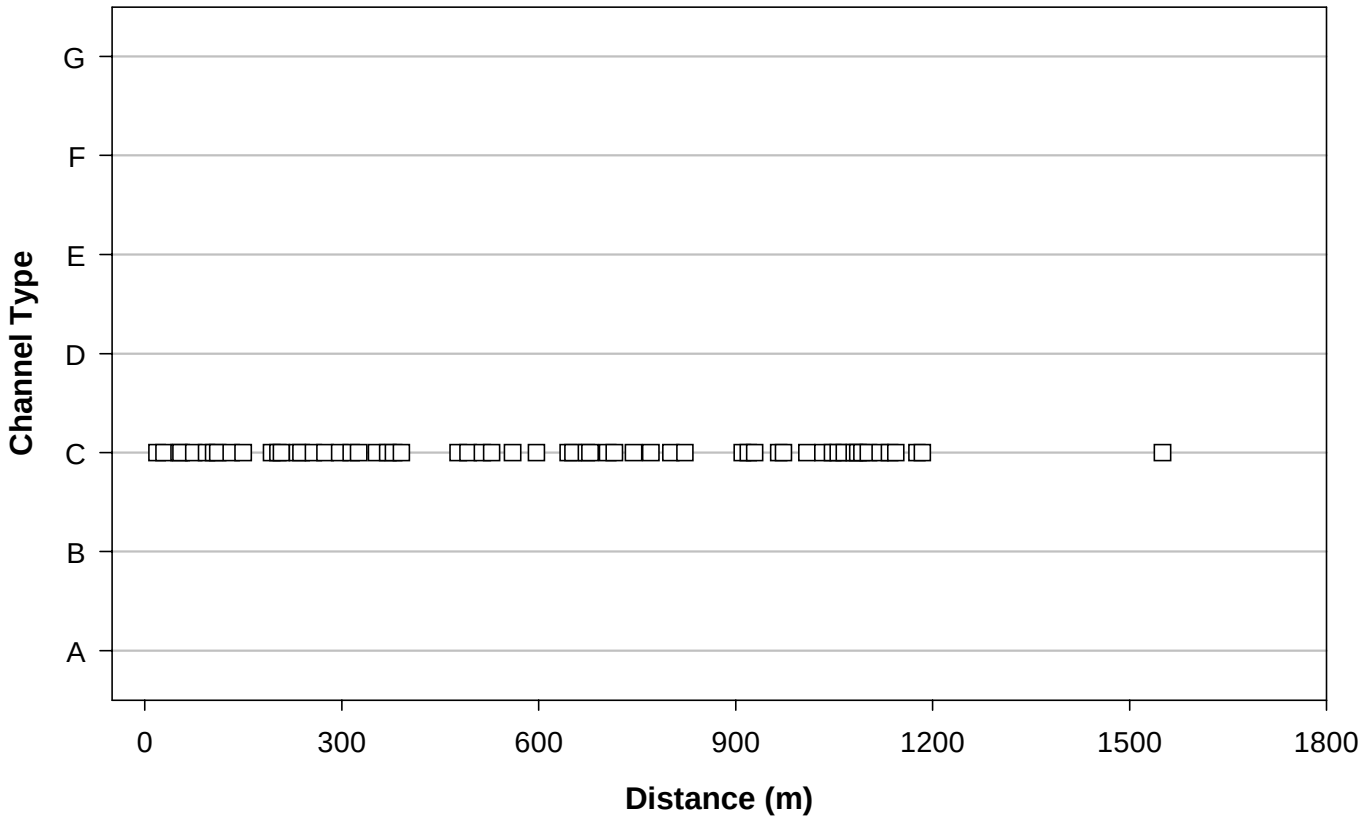

Figure A5. Rosgen's channel type distribution in Barnes Hollow, July 2001.

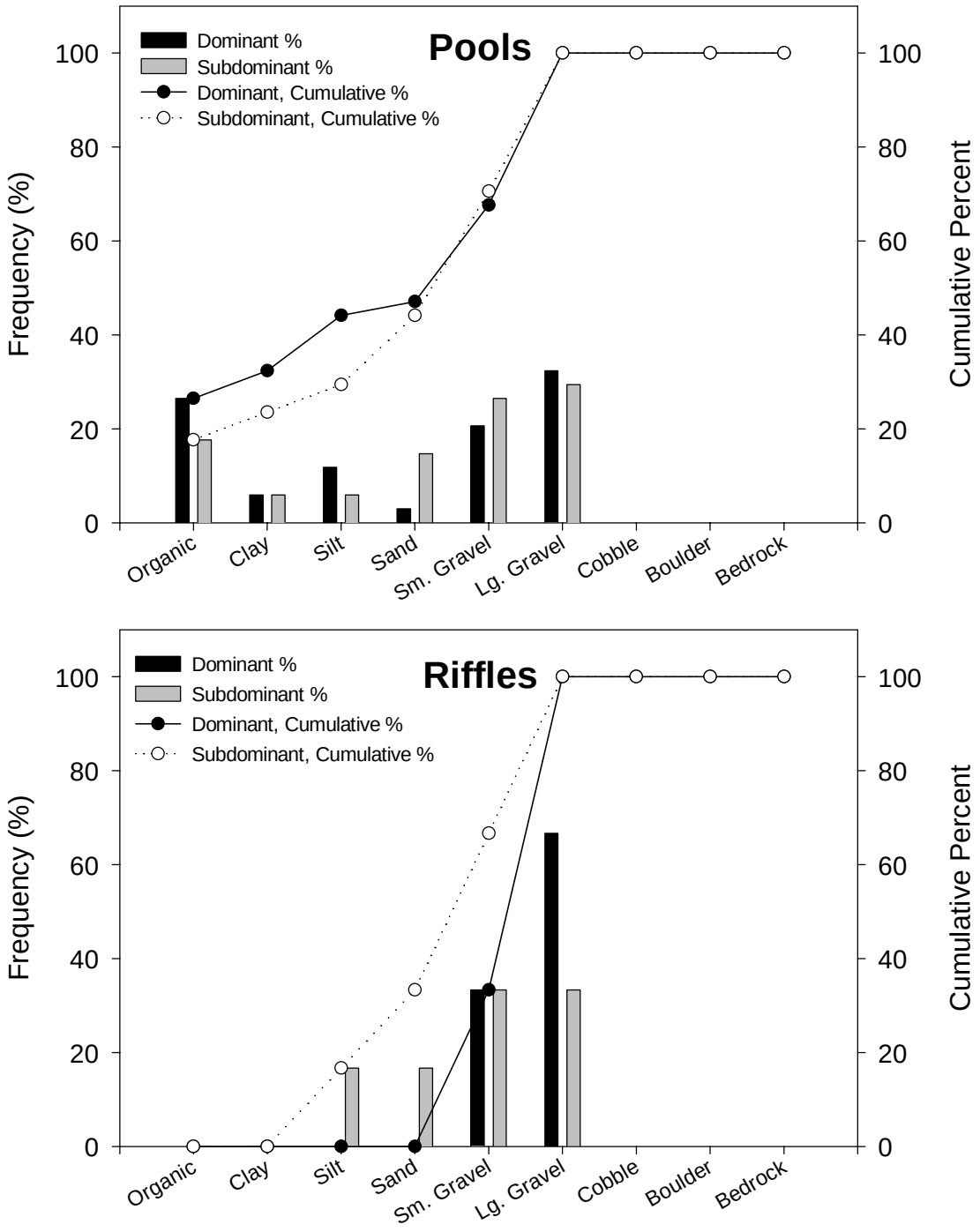

Figure A6. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Barnes Hollow, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

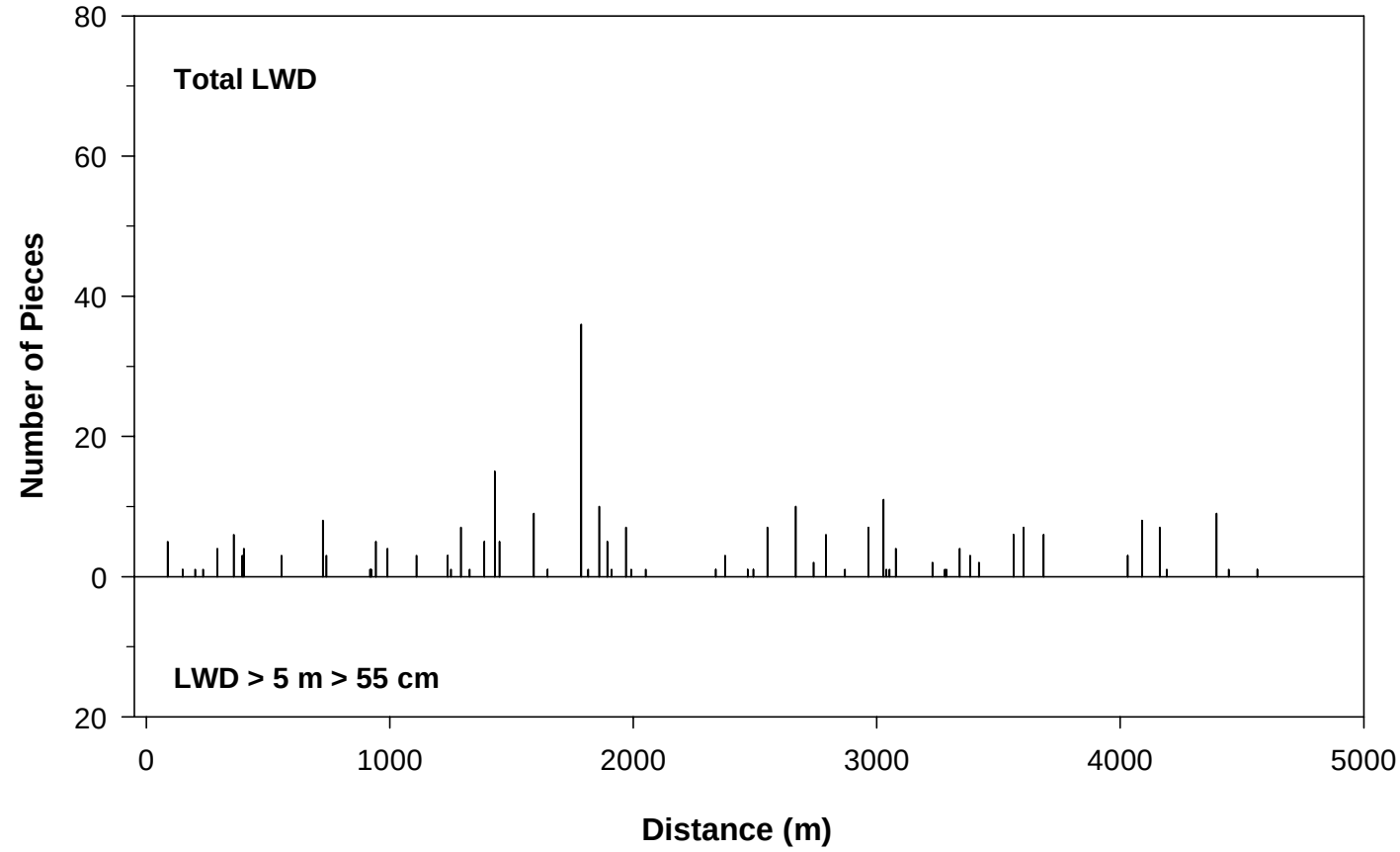

Figure A7. Distribution and abundance of LWD in Crooked Creek, July 2001.

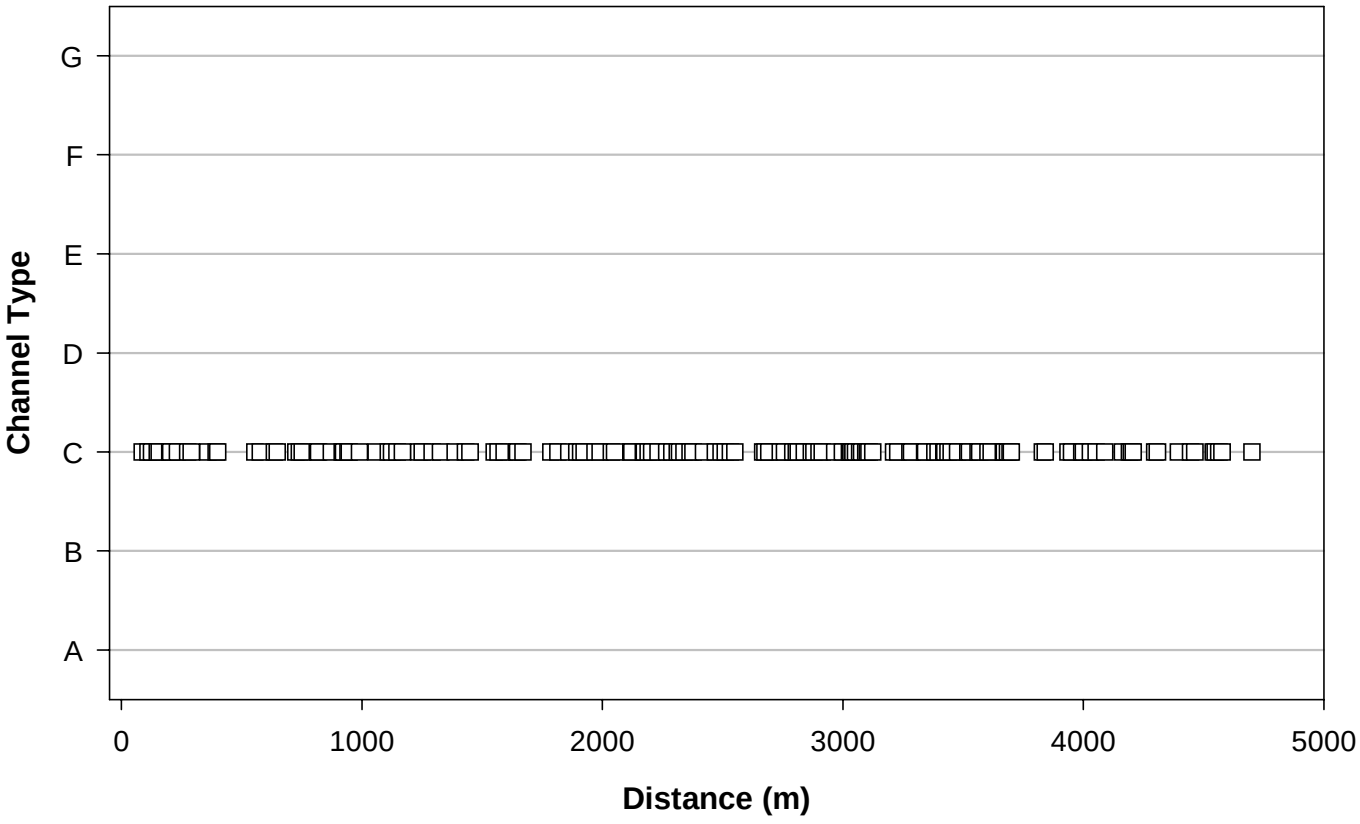

Figure A8. Rosgen's channel type distribution in Crooked Creek, July 2001.

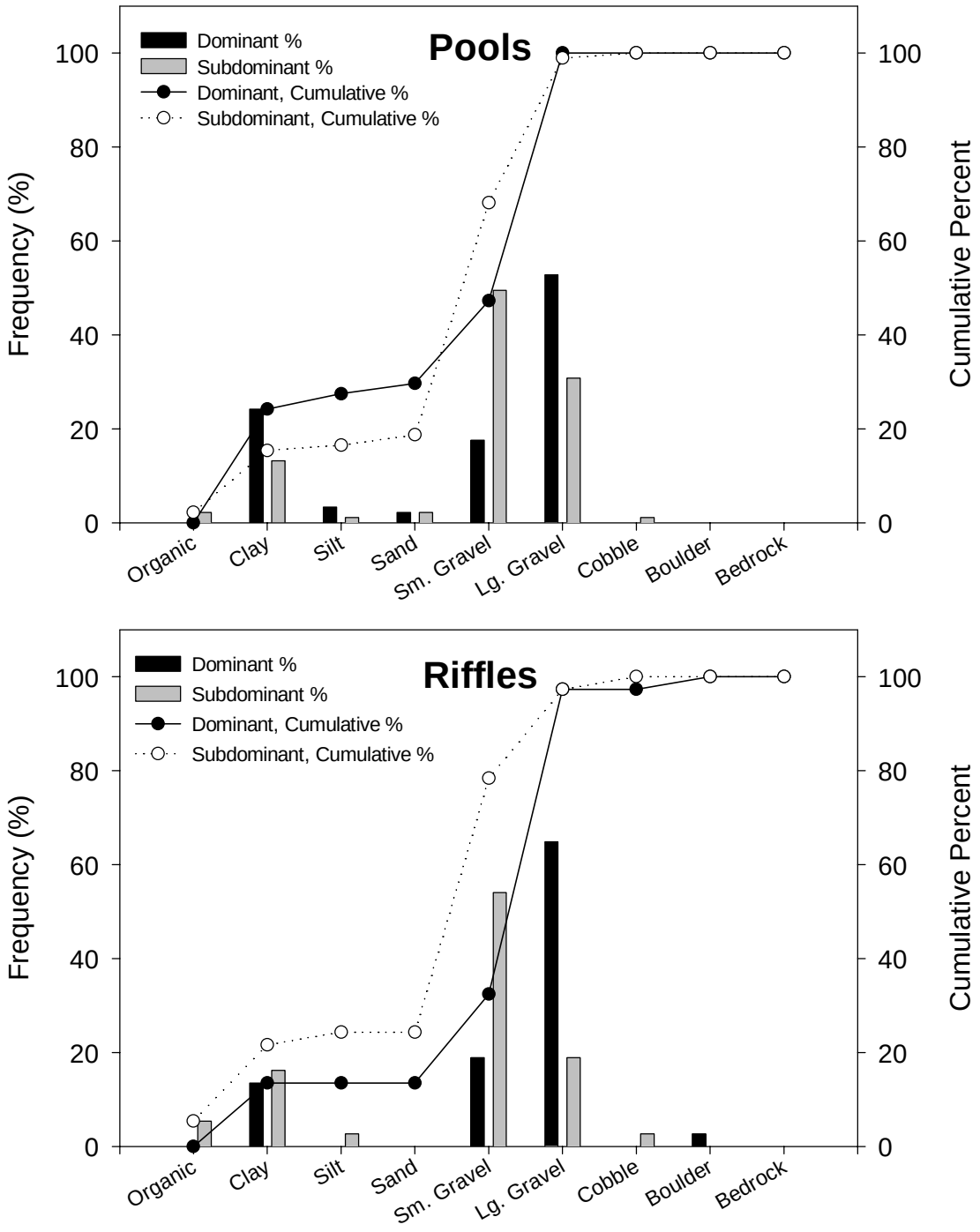

Figure A9. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Crooked Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

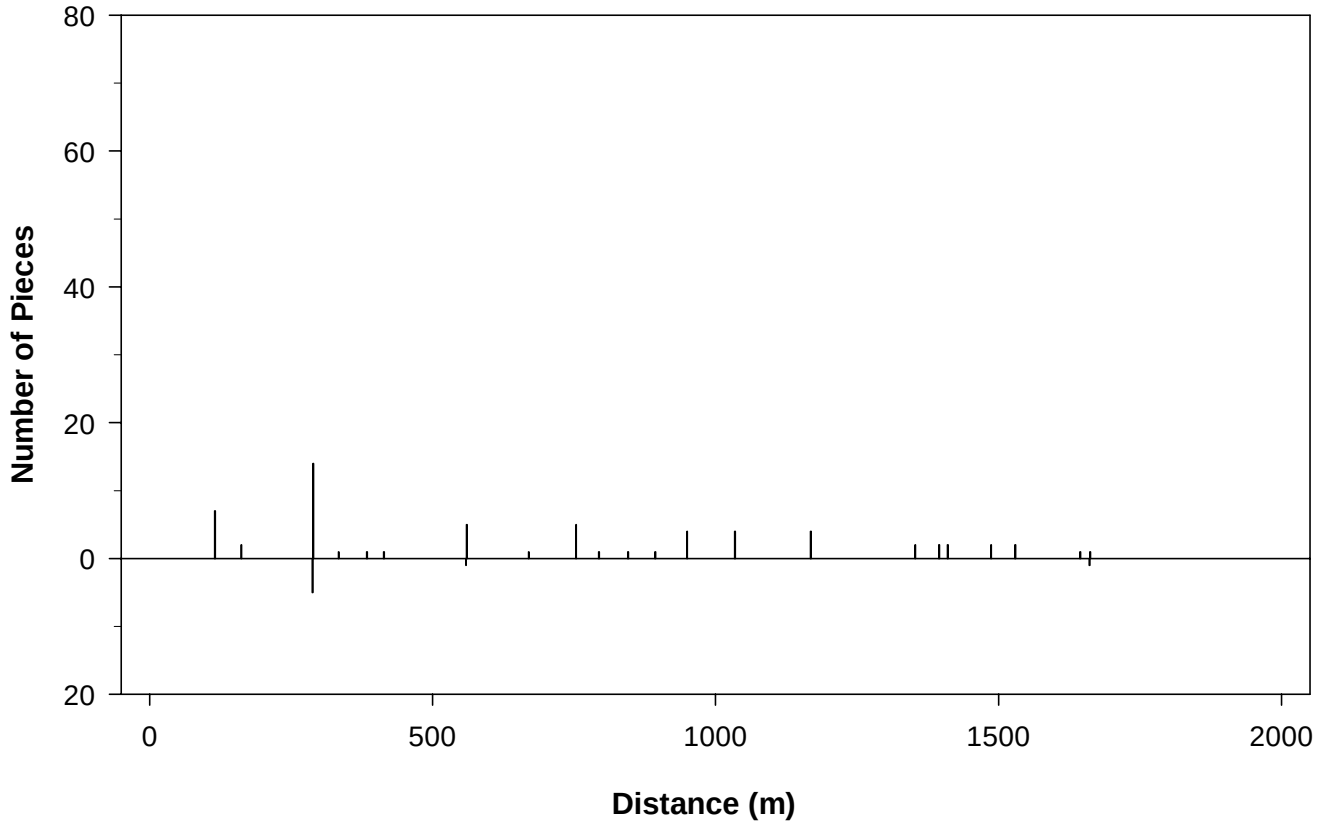

Figure A10. Distribution and abundance of LWD in Prior Creek, July 2001.

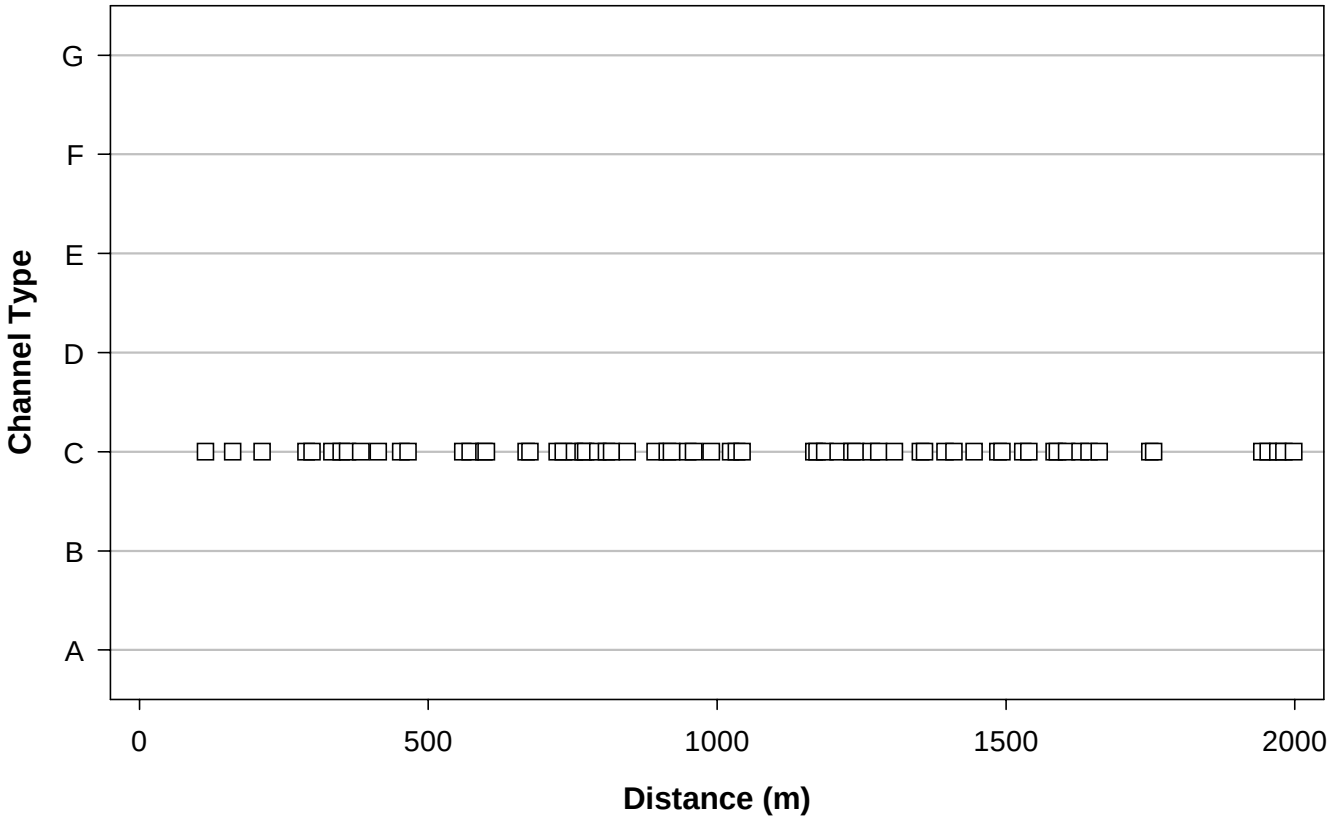

Figure A11. Rosgen's channel type distribution in Prior Creek, July 2001.

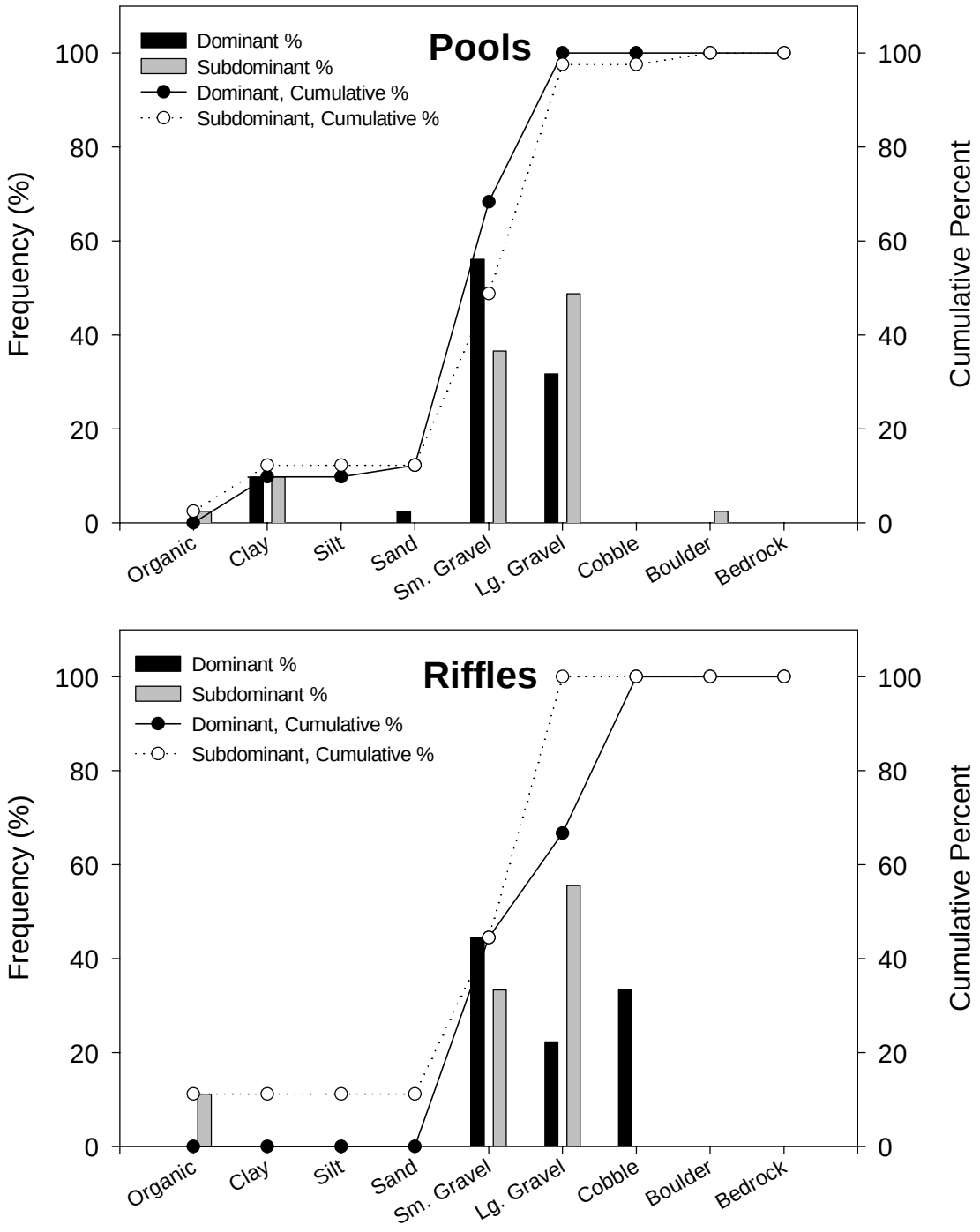

Figure A12. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Prior Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

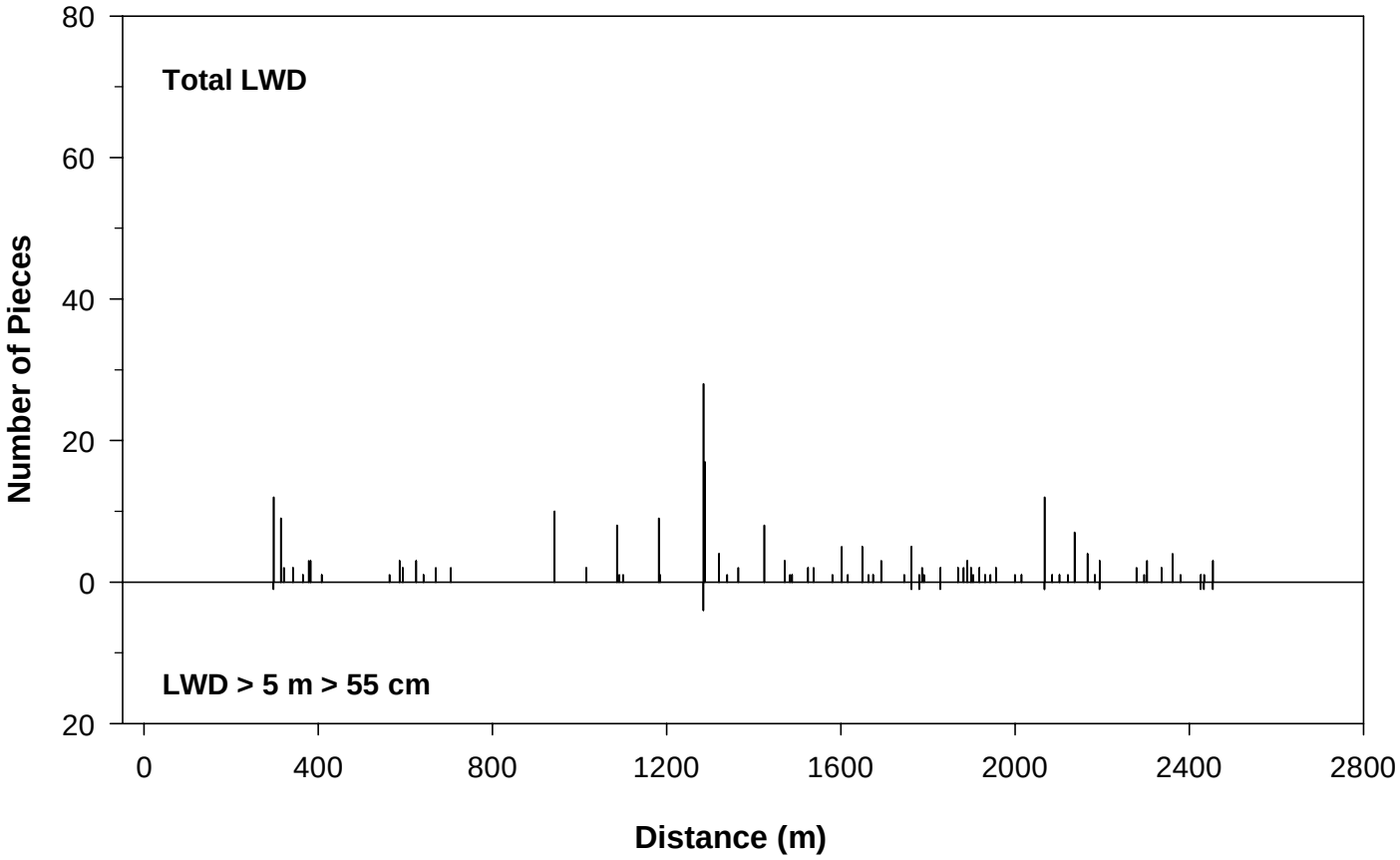

Figure A13. Distribution and abundance of LWD in Crockett Creek, July 2001.

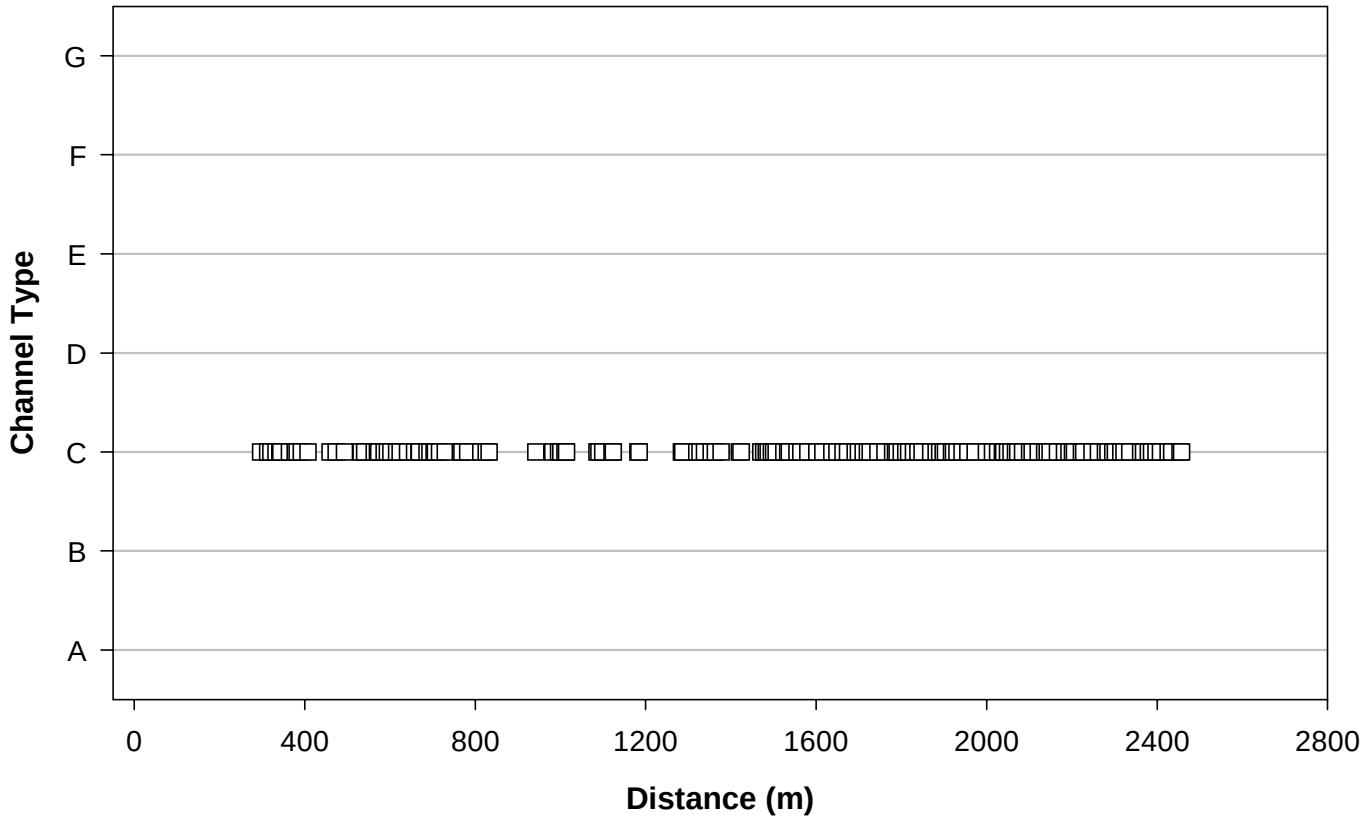

Figure A14. Rosgen's channel type distribution in Crockett Creek, July 2001.

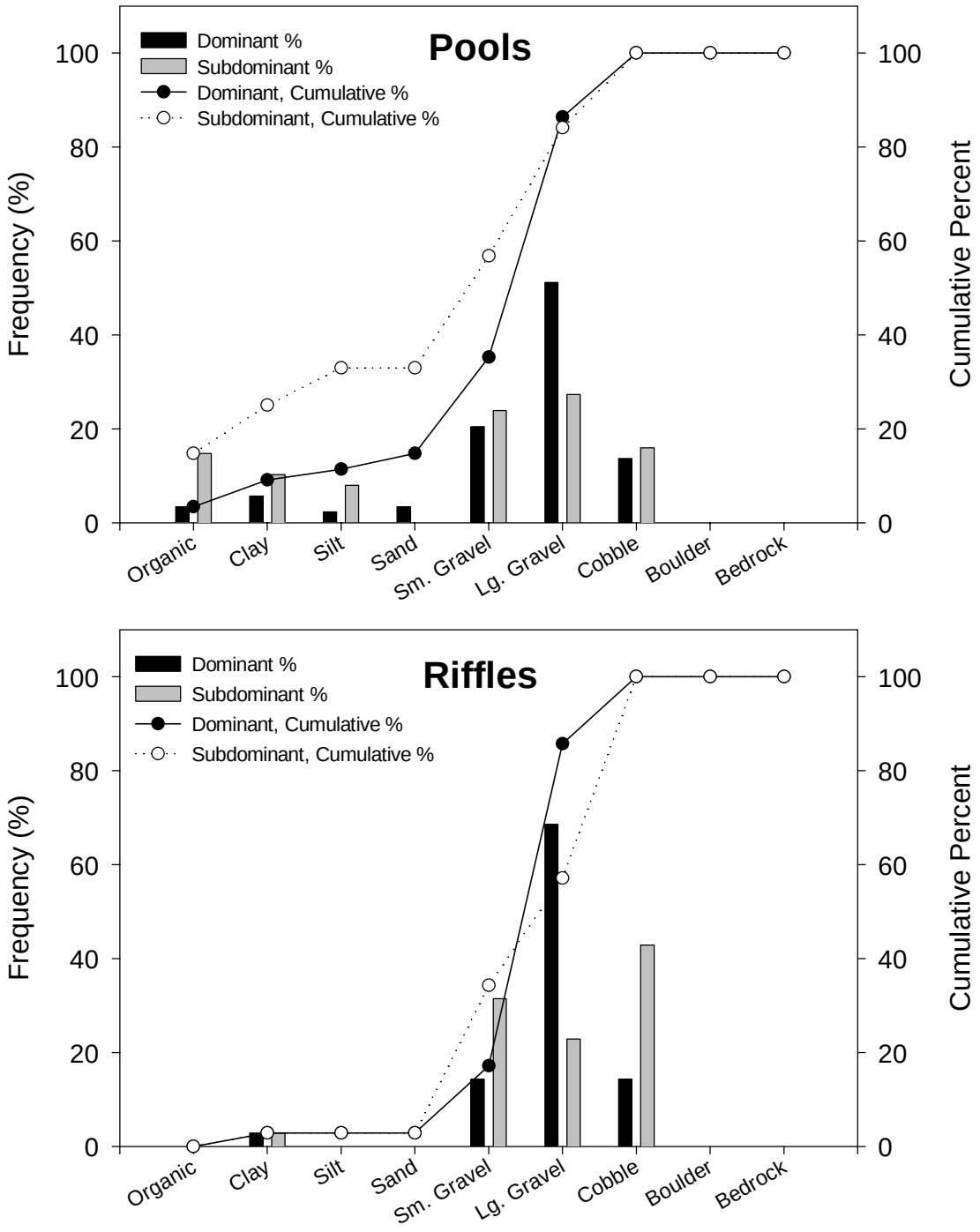

Figure A15. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Crockett Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

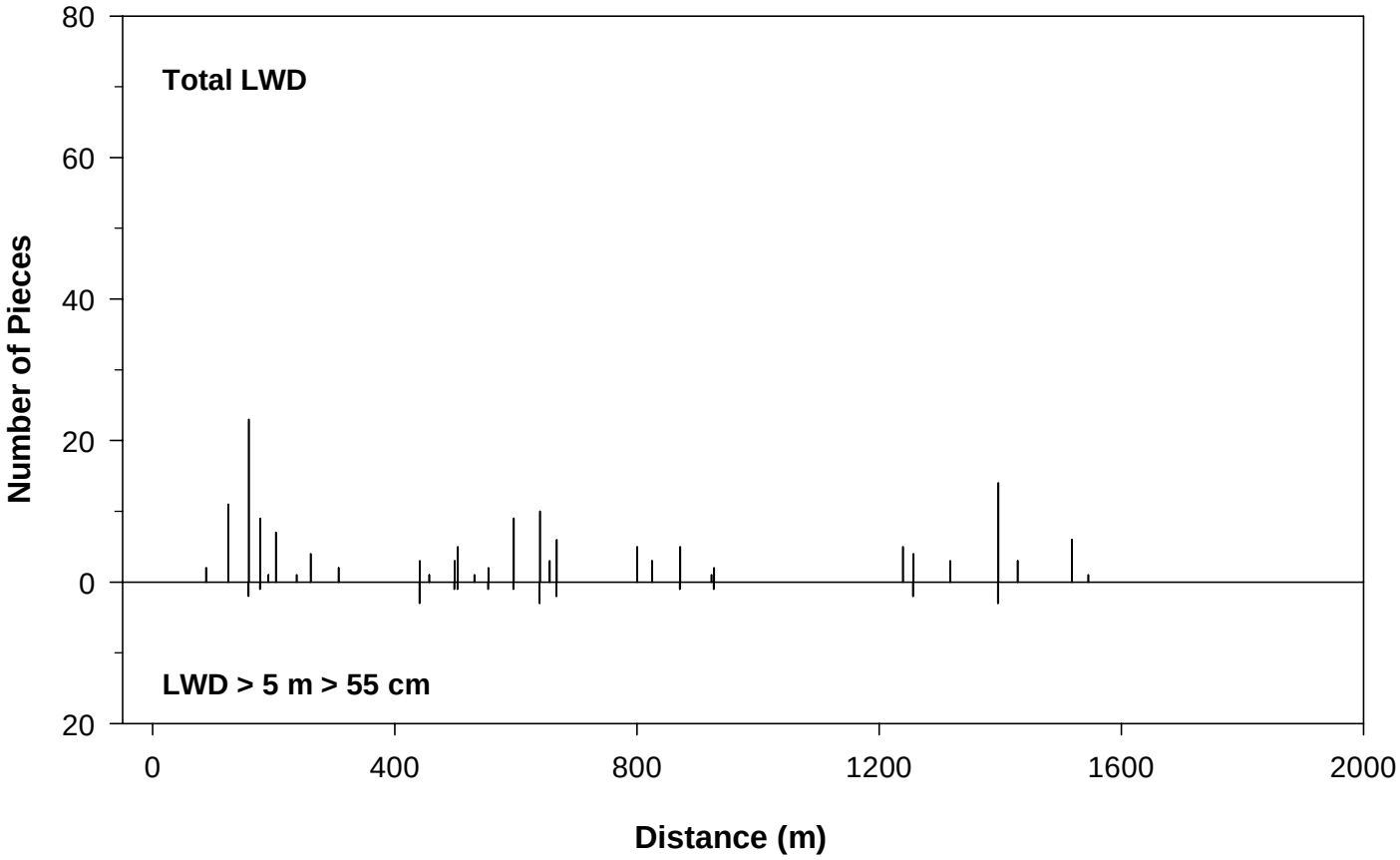

Figure A16. Distribution and abundance of LWD in Barrett Creek, July 2001.

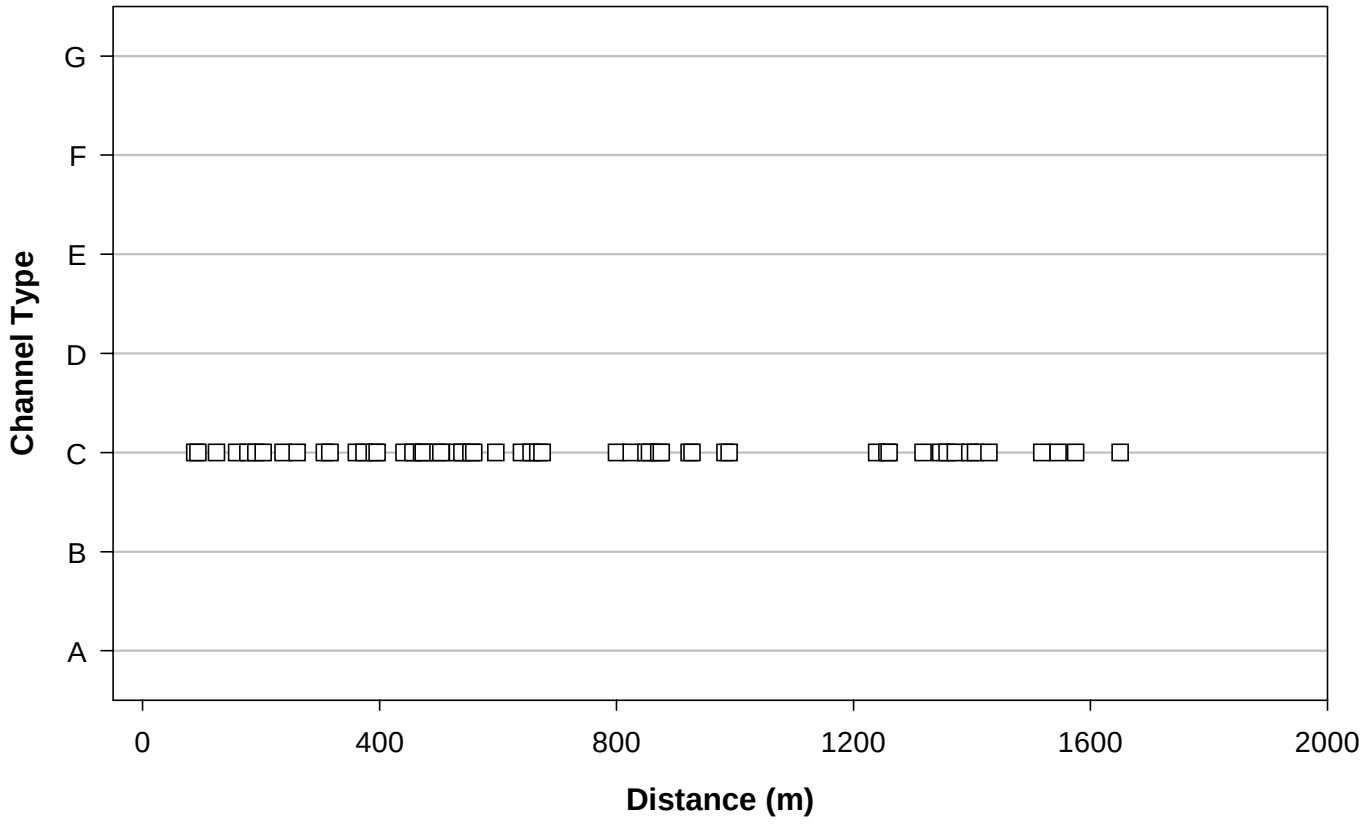

Figure A17. Rosgen's channel type distribution in Barrett Creek, July 2001.

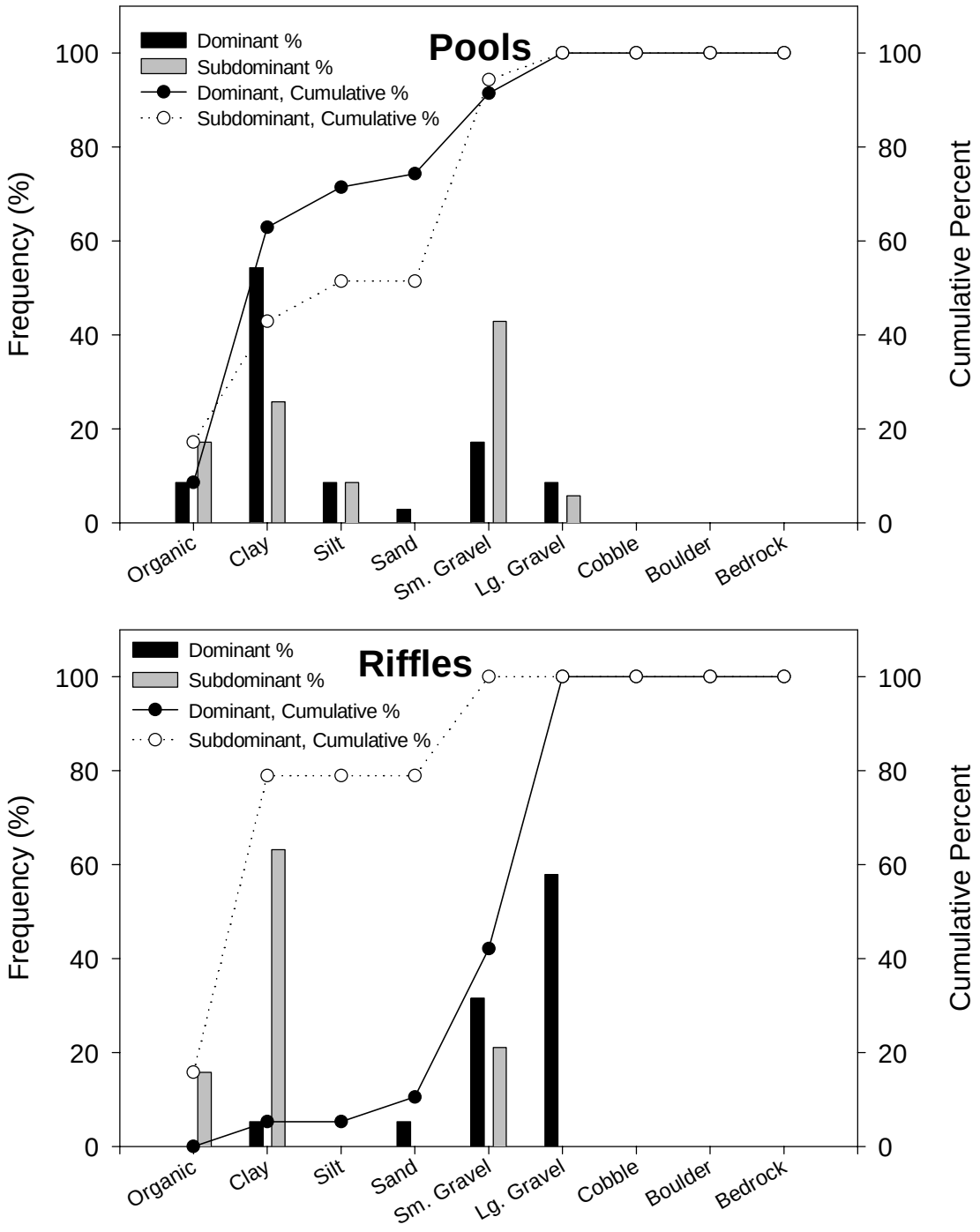

Figure A18. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Barrett Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

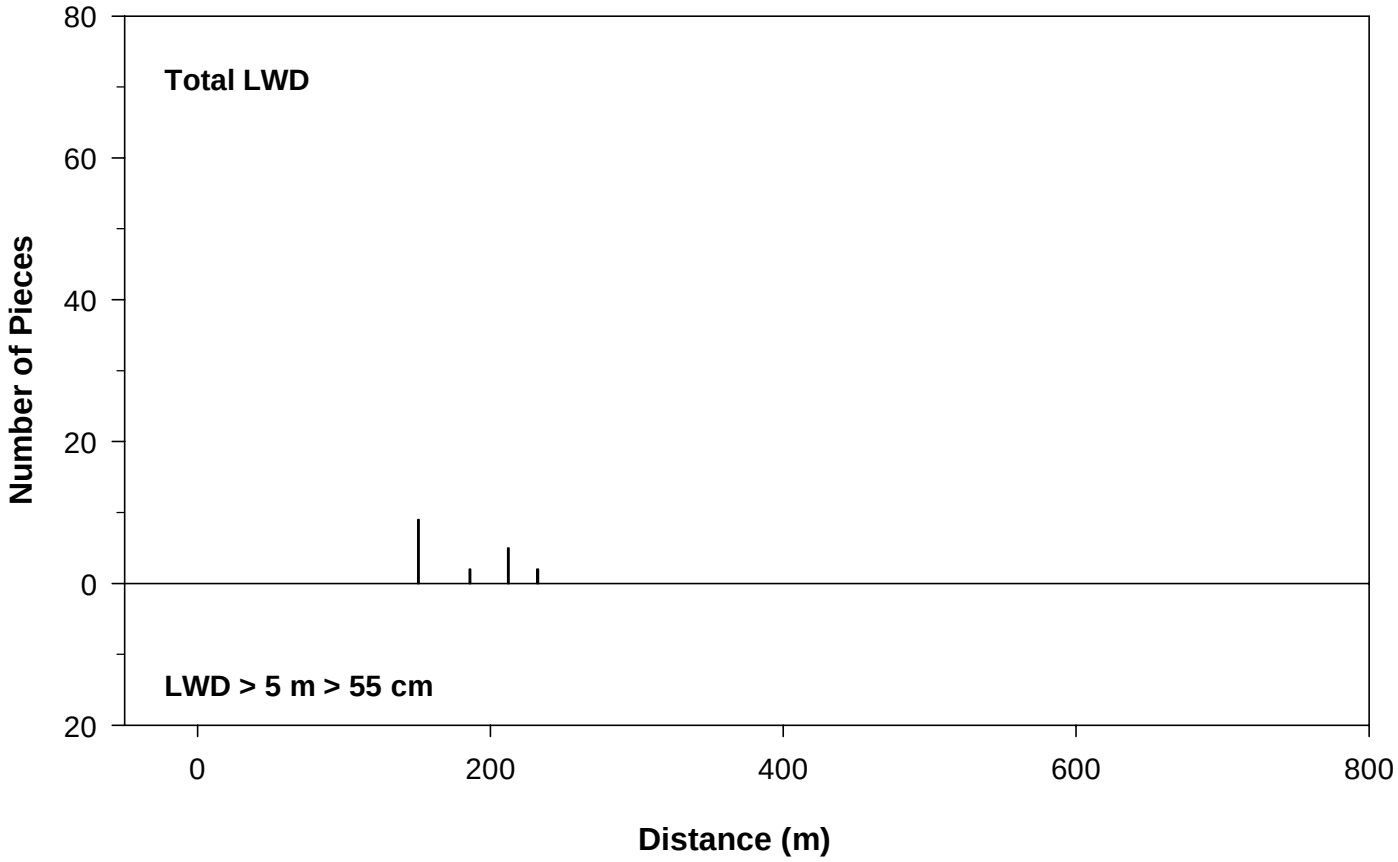

Figure A19. Distribution and abundance of LWD in Brandon Spring Branch, July 2001.

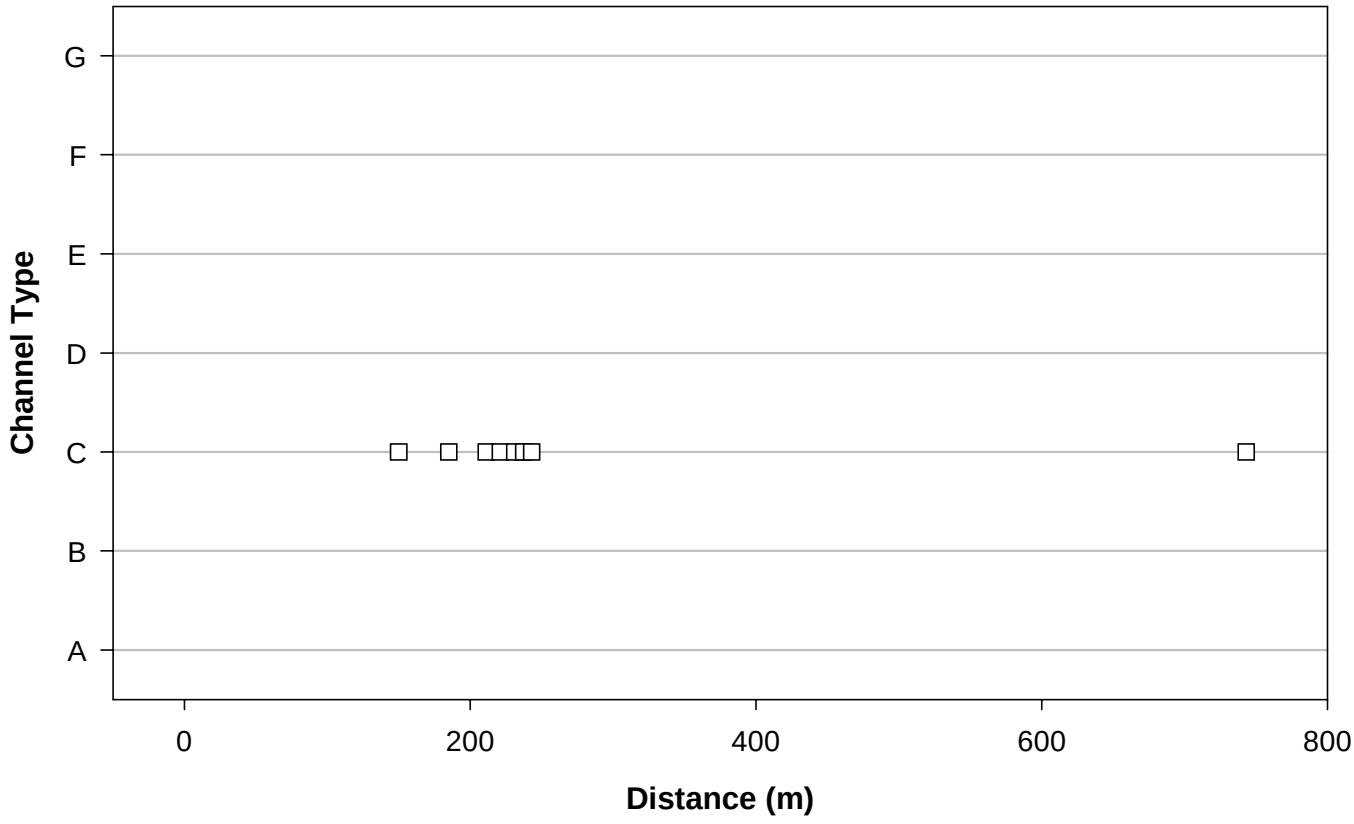

Figure A20. Rosgen's channel type distribution in Brandon Spring Branch, July 2001.

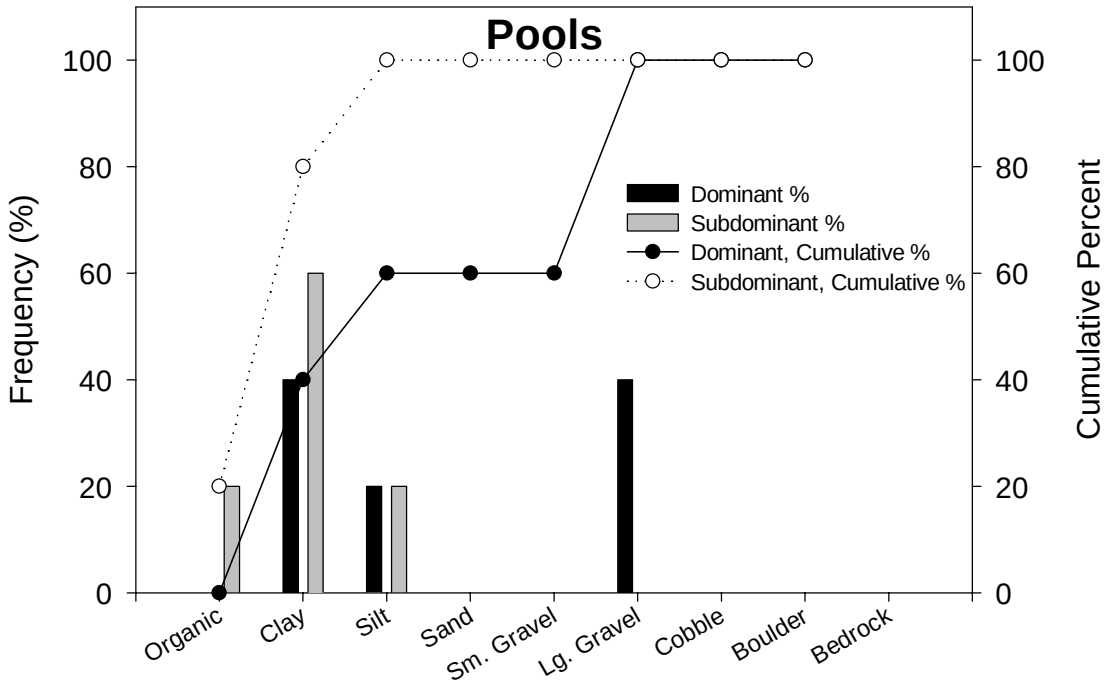

Figure A21. Frequency (percent) of dominant and subdominant substrate occurrence for pools in Brandon Spring Branch, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate. No wetted riffles were recorded in Brandon Spring Branch.

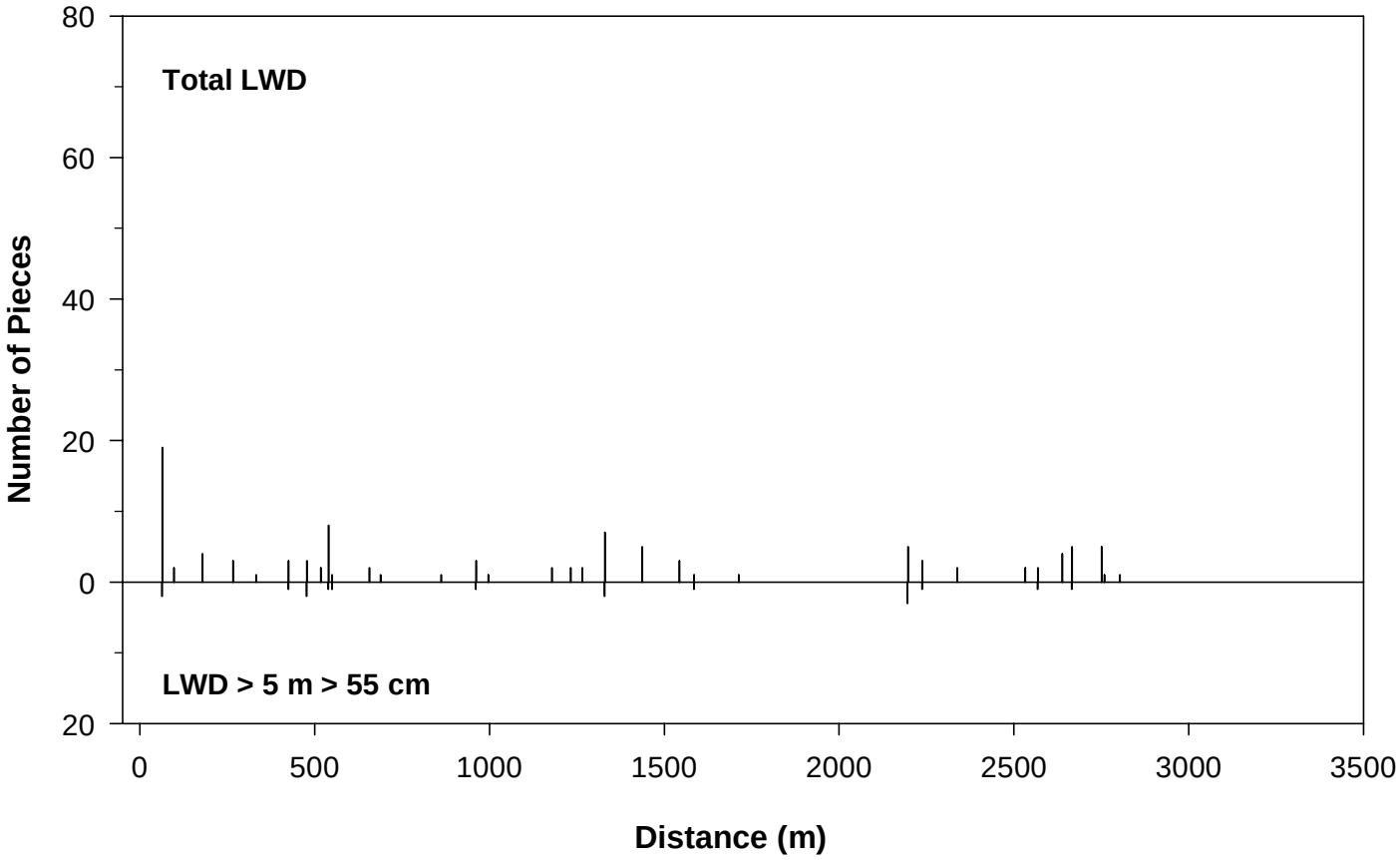

Figure A22. Distribution and abundance of LWD in Bear Creek, July 2001.

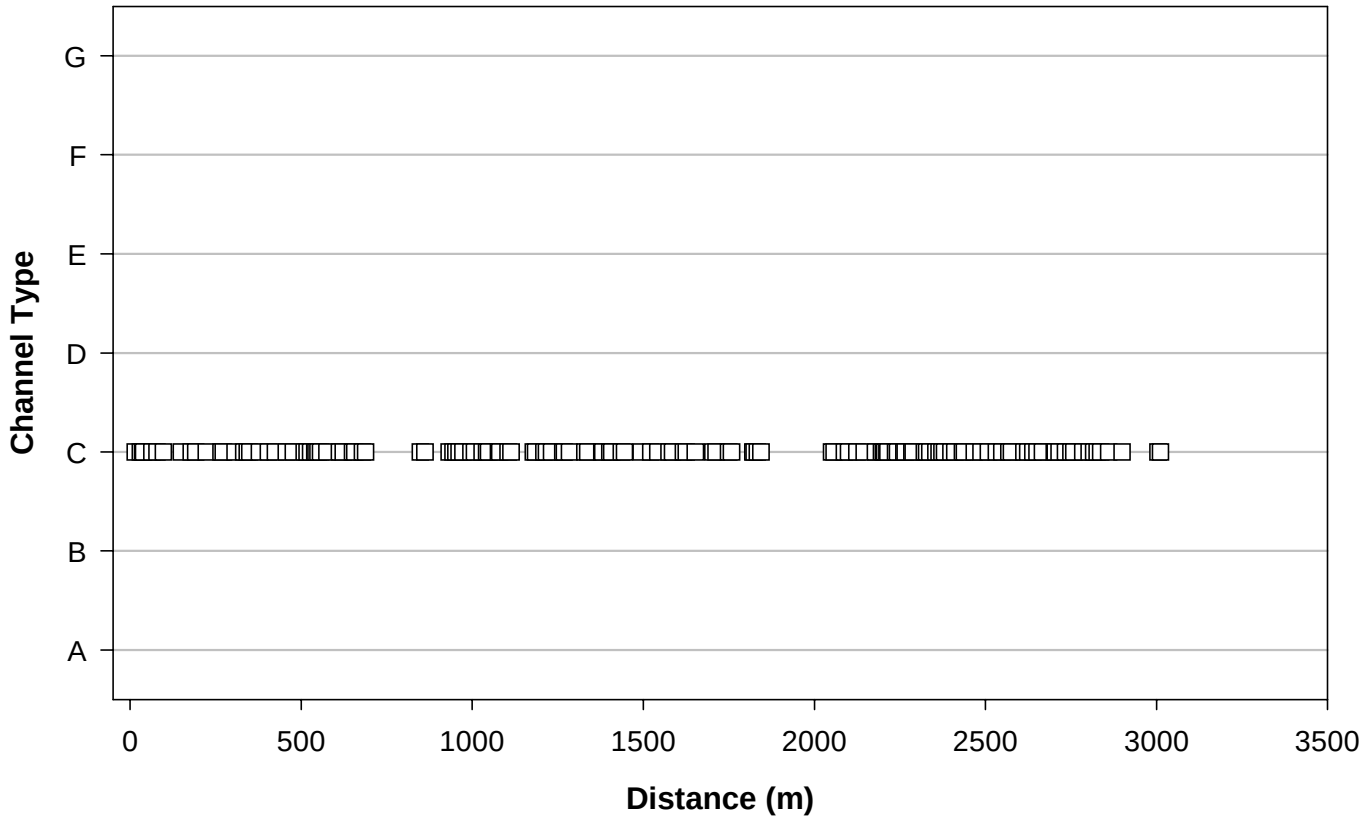

Figure A23. Rosgen's channel type distribution in Bear Creek, July 2001.

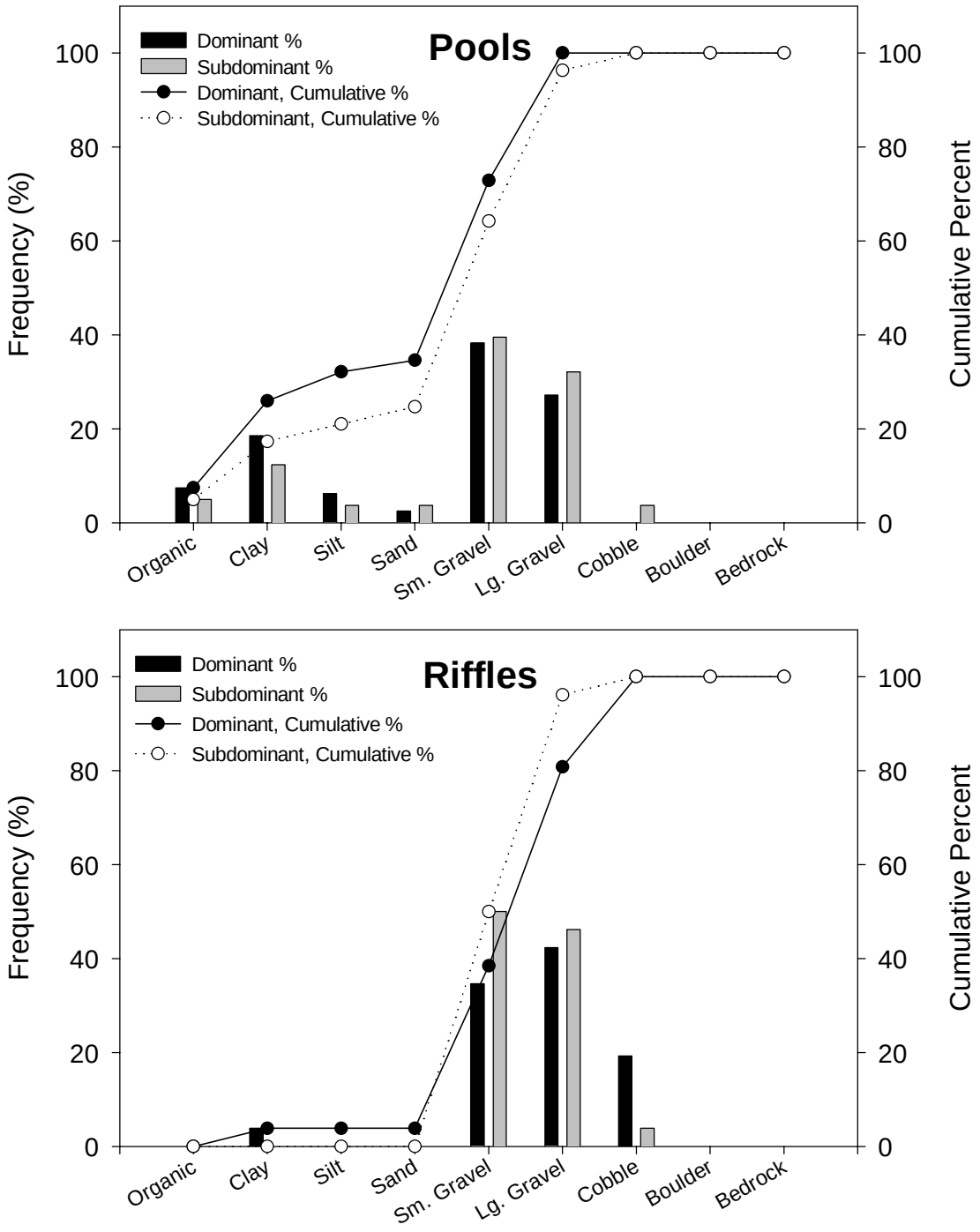

Figure A24. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Bear Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

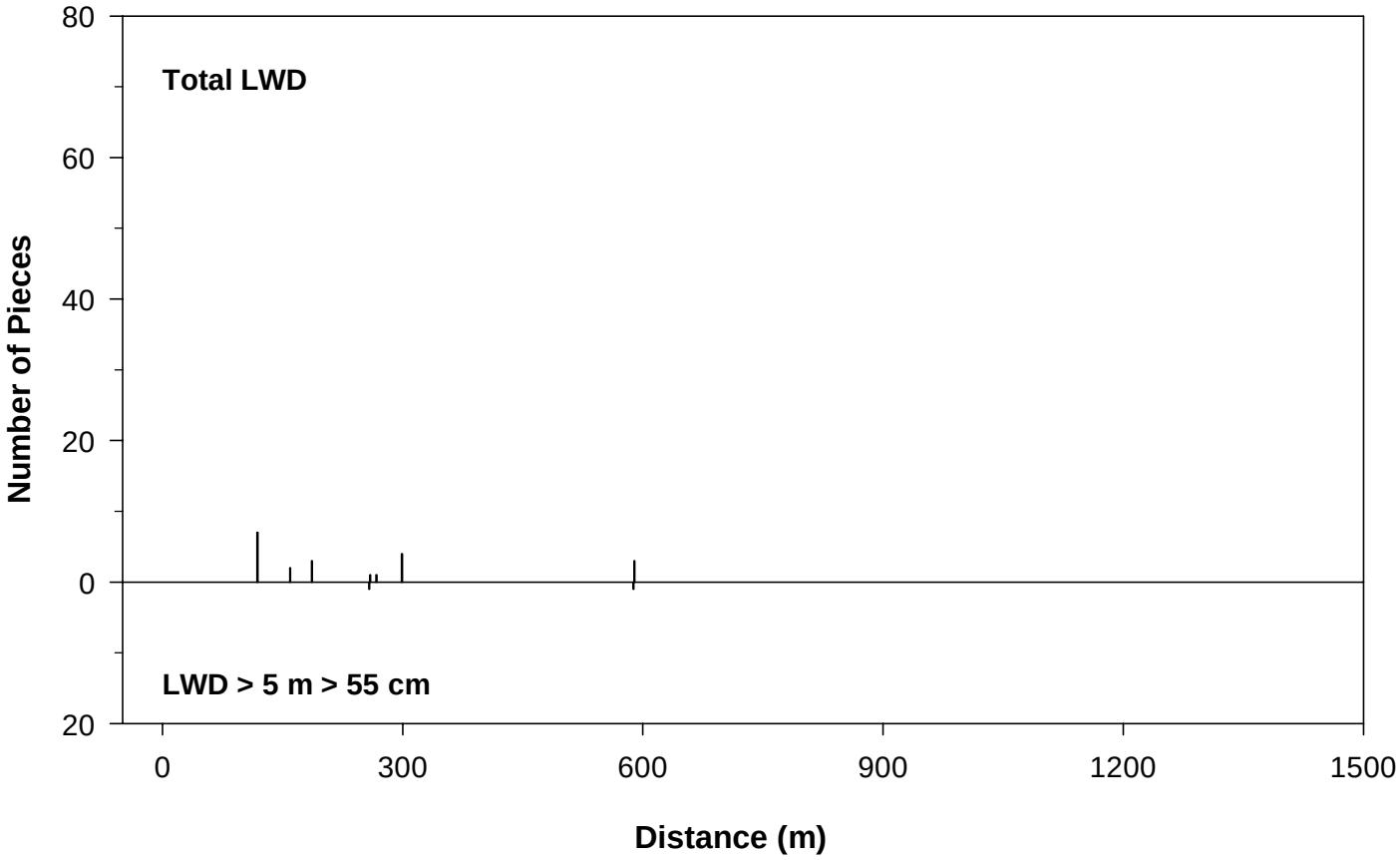

Figure A25. Distribution and abundance of LWD in Byrd Creek, July 2001.

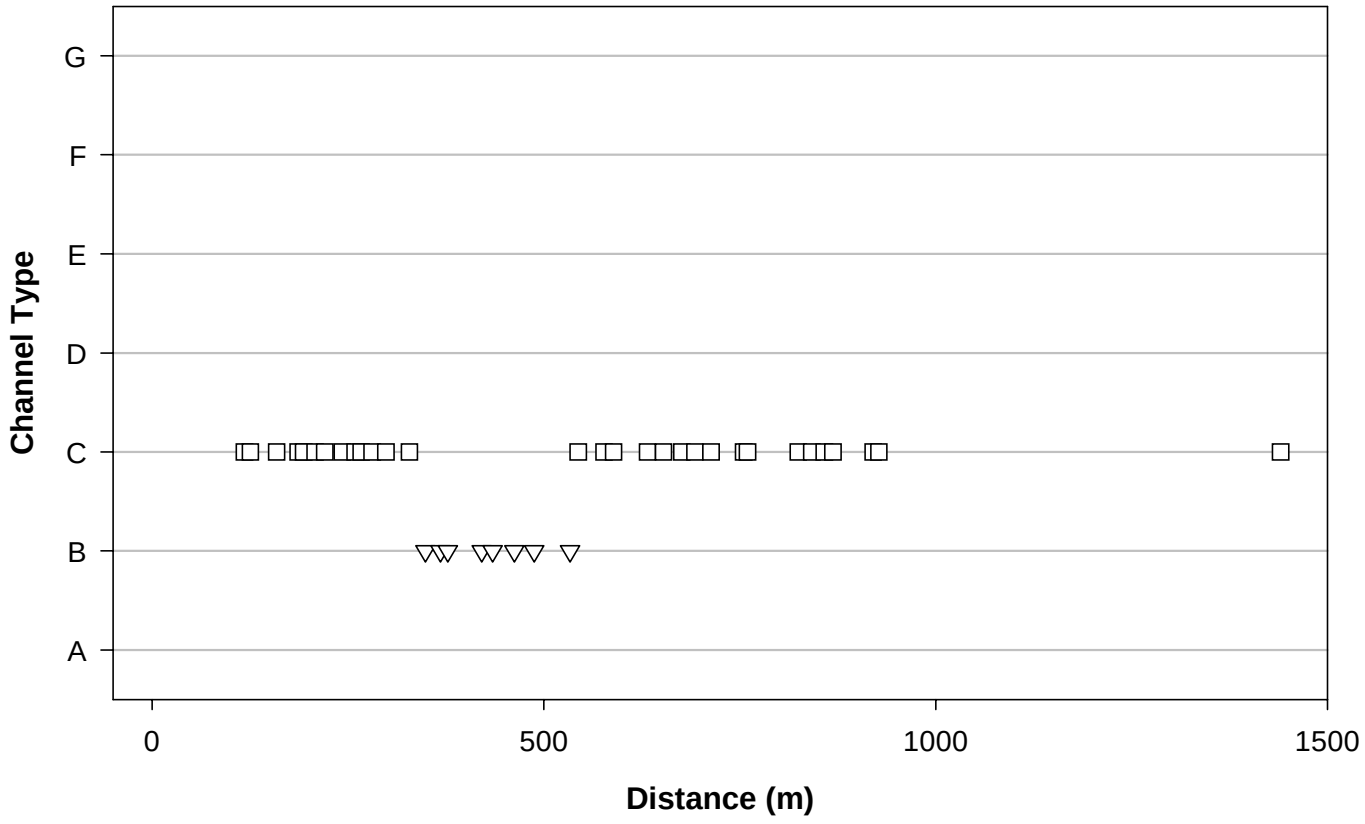

Figure A26. Rosgen's channel type distribution in Byrd Creek, July 2001.

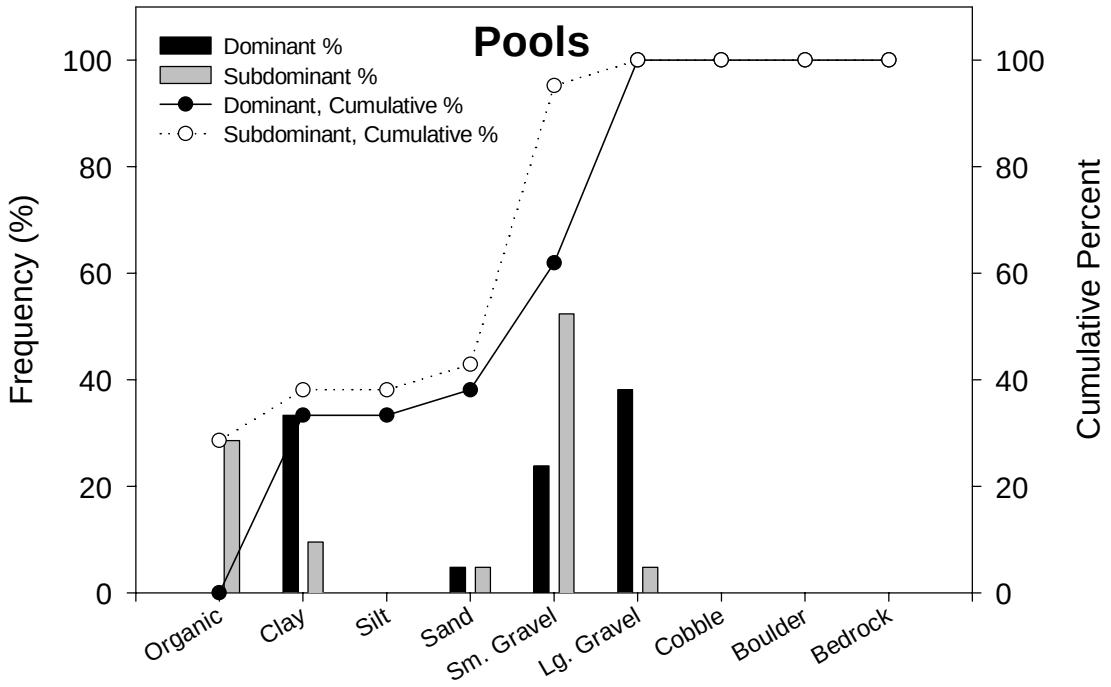

Figure A27. Frequency (percent) of dominant and subdominant substrate occurrence for pools in Byrd Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate. No wetted riffles were recorded in Byrd Creek.

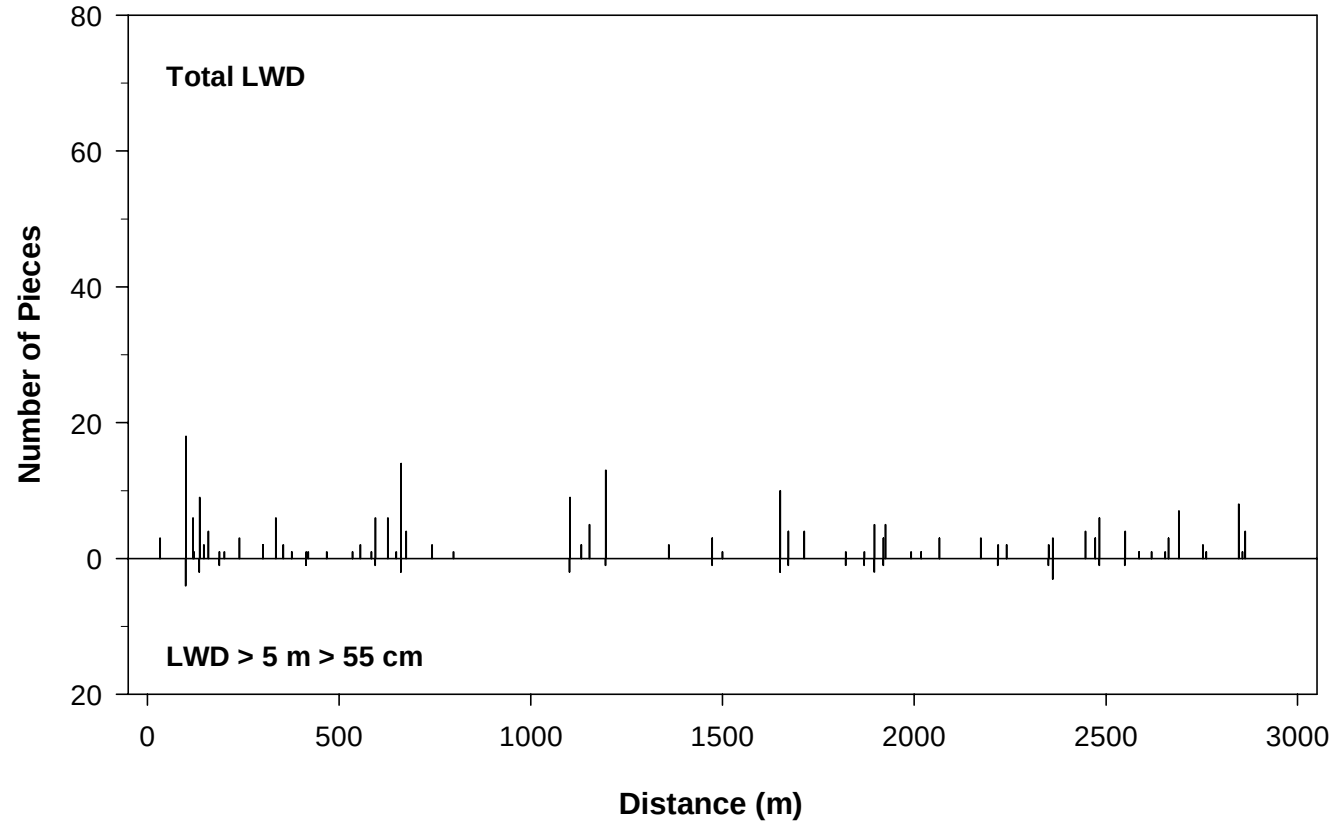

Figure A28. Distribution and abundance of LWD in Panther Creek, July 2001.

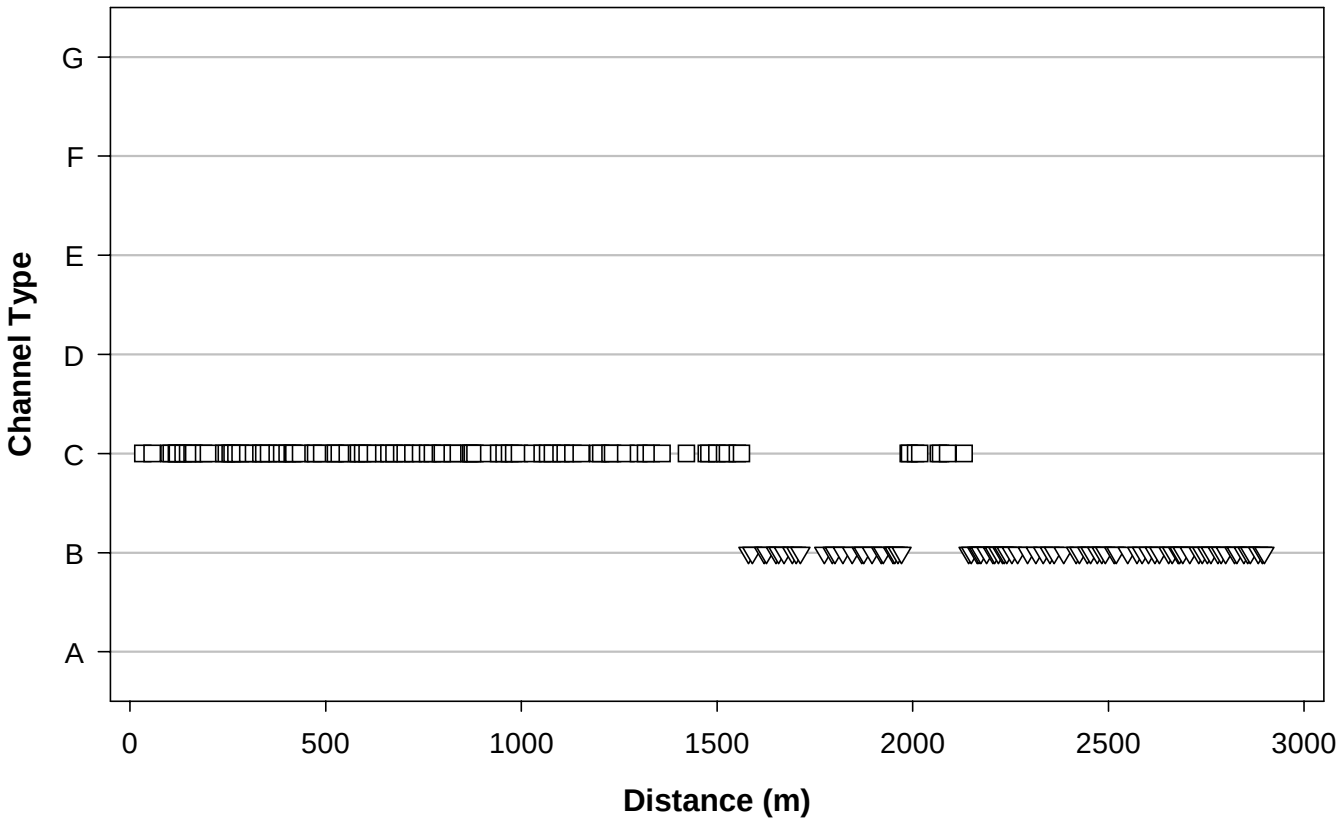

Figure A29. Rosgen's channel type distribution in Panther Creek, July 2001.

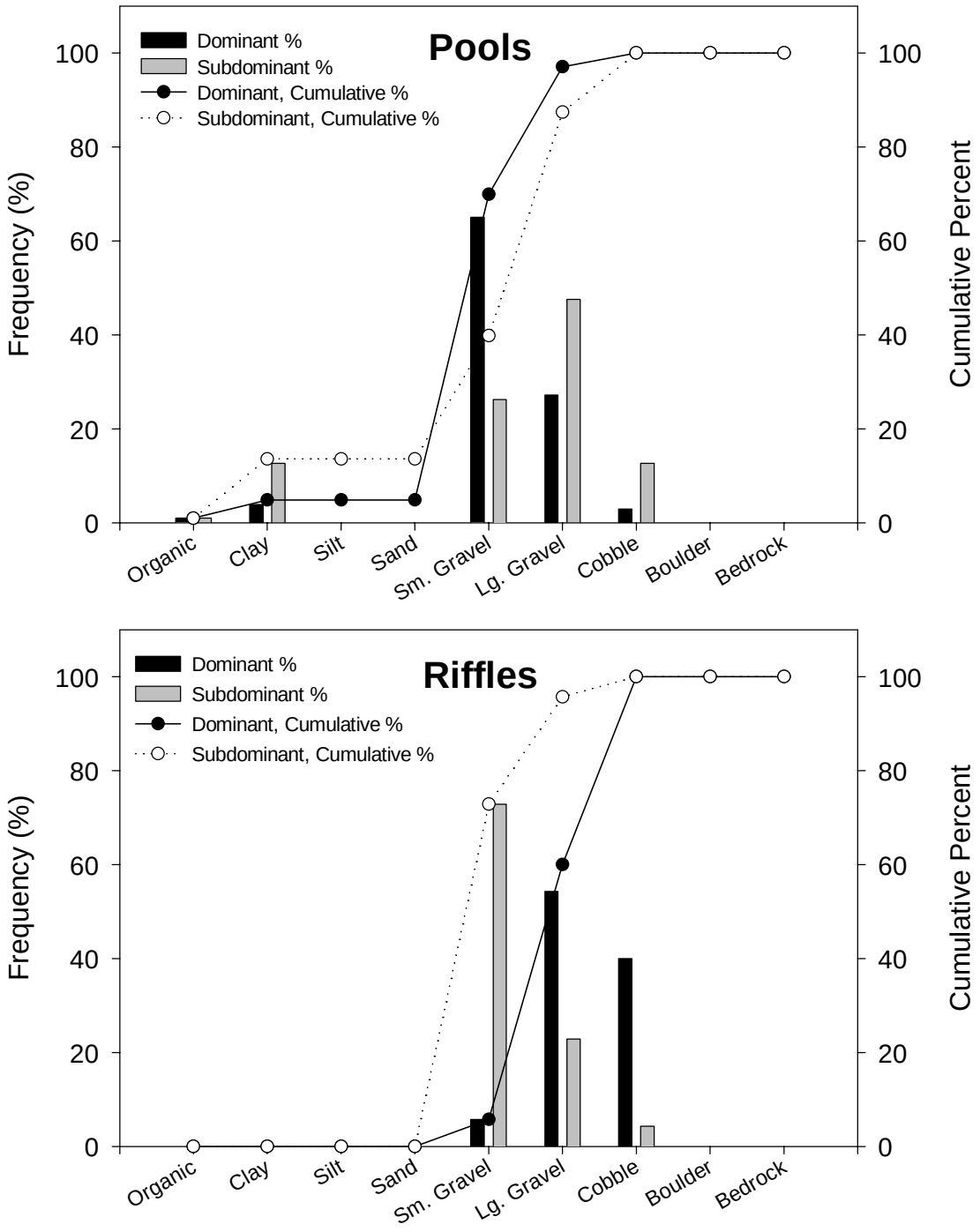

Figure A30. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Panther Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

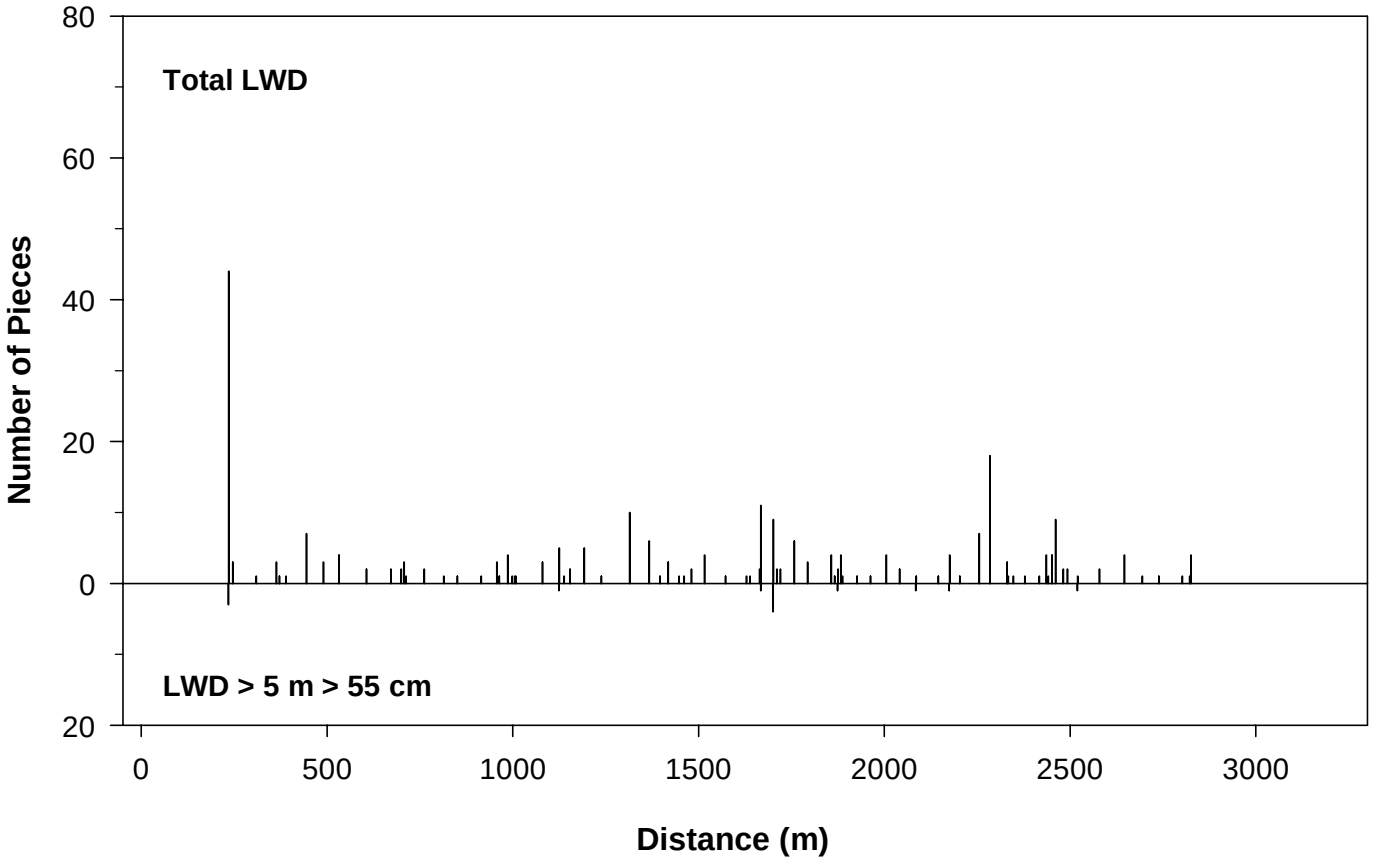

Figure A31. Distribution and abundance of LWD in Lost Creek, July 2001.

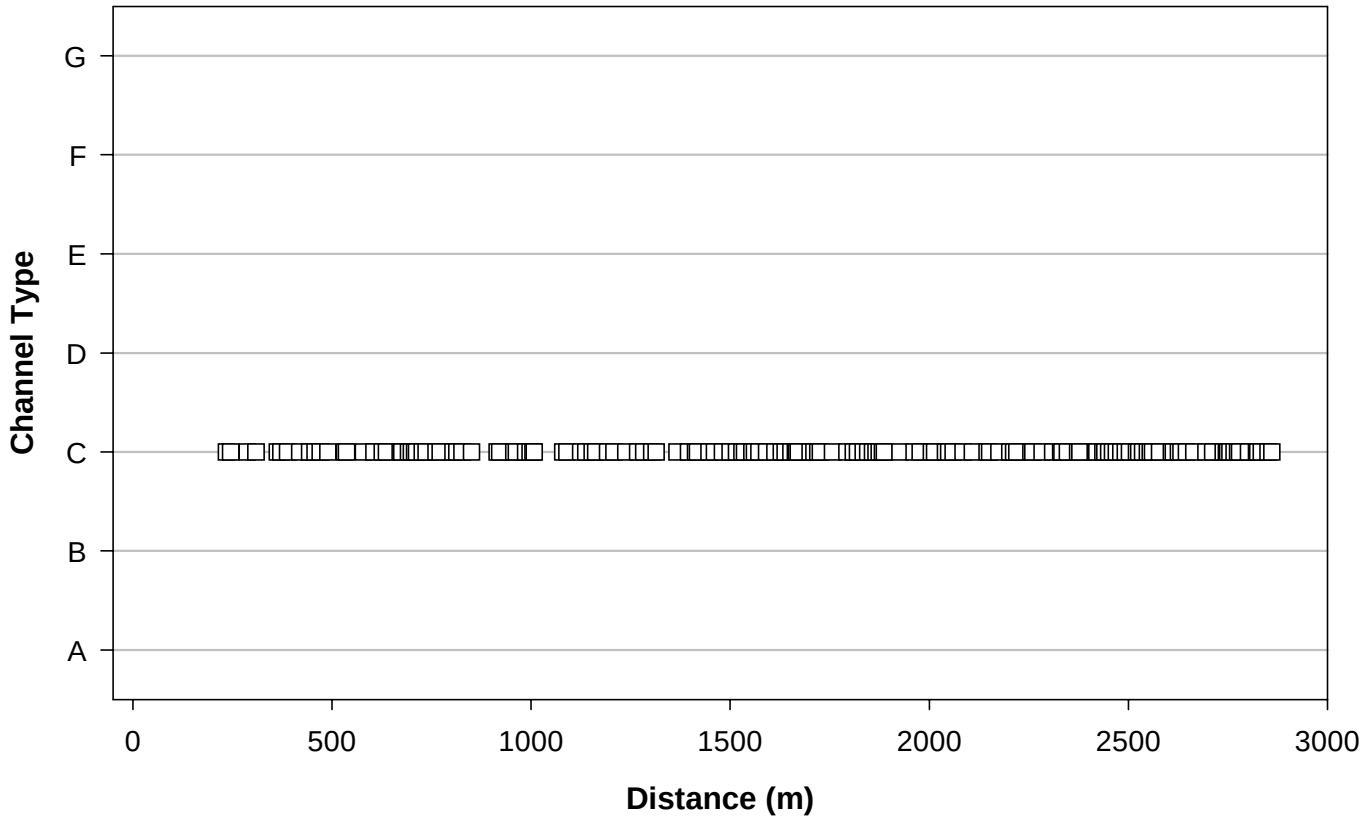

Figure A32. Rosgen's channel type distribution in Lost Creek, July 2001.

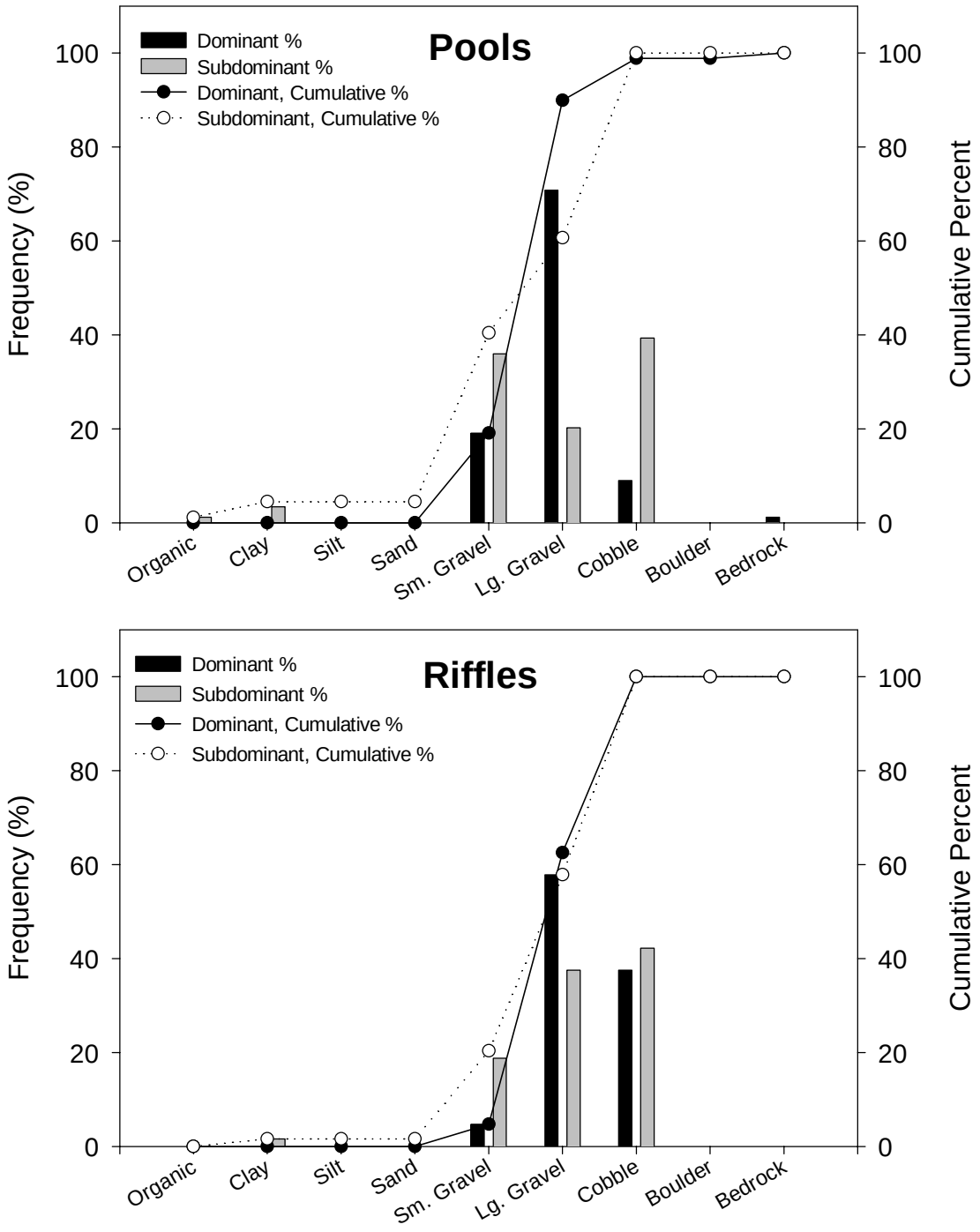

Figure A33. Frequency (percent) of dominant and subdominant substrate occurrence for pools and riffles in Lost Creek, July 2001. Solid dots and bars represent percent and cumulative percent of dominant substrate, open dots and gray bars represent percent and cumulative percent of subdominant substrate.

Appendix B: Electrofishing results

Table B1. Scientific names of fish species captured by backpack electrofishing in LBL streams, July 2001.

Common Name	Scientific Name
smallmouth bass	*Micropterus dolomieu*
largemouth bass	*Micropterus salmoides*
Kentucky spotted bass	*Micropterus punctulatus*
chestnut lamprey	*Ichthyomyzon castaneus*
silver lamprey	*Ichthyomyzon unicuspis*
western mosquito fish	*Gambusia affinis*
brook silverside	*Labidesthes sicculus*
blackspotted topminnow	*Fundulus olivaceus*
sculpin	*Cottus spp*
logperch	*Percina caprodes*
fantail darter	*Etheostoma flabellare*
orangethroat darter	*Etheostoma spectabile*
rainbow darter	*Etheostoma caeruleum*
black darter	*Etheostoma duryi*
slough darter	*Etheostoma gracile*
longear sunfish	*Lepomis megalotis*
redear sunfish	*Lepomis microlophus*
dollar sunfish	*Lepomis marginatus*
bluegill	*Lepomis macrochirus*
warmouth	*Lepomis gulosus*
orangespotted sunfish	*Lepomis humilis*
green sunfish	*Lepomis cyanellus*
creek chub	*Semotilus atromaculatus*
central stoneroller	*Campostoma anomalum*
creek chubsucker	*Erimyzon oblongus*
rosyside dace	*Clinostomus funduloides*
southern redbelly dace	*Phoxinus erythrogaster*
bigeye shiner	*Notropis boops*
emerald shiner	*Notropis atherinoides*
yellow bullhead	*Ameiurus natalis*
pirate perch	*Aphredoderus sayanus*
chain pickerel	*Esox niger*

Table B2. Total number and relative abundance of each species captured during 3-pass electrofishing in Curry Hollow, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P2**	**R2**	**P12**	**R7**	**P22**	**P37**	**P47**	**total**
distance from start (m):		24	26	327	590	627	1093	1285	
surface area (m^2):		71	4	147	19	30	6	94	
blackspotted topminnow	(n)	5	2	4	-	-	-	1	12
	(%)	4	6	25	-	-	-	7	5
creek chubsucker	(n)	-	-	2	-	-	14	-	16
	(%)	-	-	13	-	-	58	-	7
chain pickerel	(n)	-	-	7	-	1	5	7	20
	(%)	-	-	44	-	17	21	50	9
dollar sunfish	(n)	3	1	-	-	-	-	-	4
	(%)	2	3	-	-	-	-	-	2
fantail darter	(n)	4	6	-	-	-	3	-	13
	(%)	3	18	-	-	-	13	-	6
spotted bass	(n)	4	3	-	-	-	-	-	7
	(%)	3	9	-	-	-	-	-	3
longear sunfish	(n)	-	-	-	-	2	-	-	2
	(%)	-	-	-	-	33	-	-	1
largemouth bass	(n)	2	-	-	-	1	-	-	3
	(%)	2	-	-	-	17	-	-	1
pirate perch	(n)	80	21	3	-	2	2	6	114
	(%)	63	64	19	-	33	8	43	52
redear sunfish	(n)	16	-	-	-	-	-	-	16
	(%)	13	-	-	-	-	-	-	7
yellow bullhead	(n)	14	-	-	-	-	-	-	14
	(%)	11	-	-	-	-	-	-	6

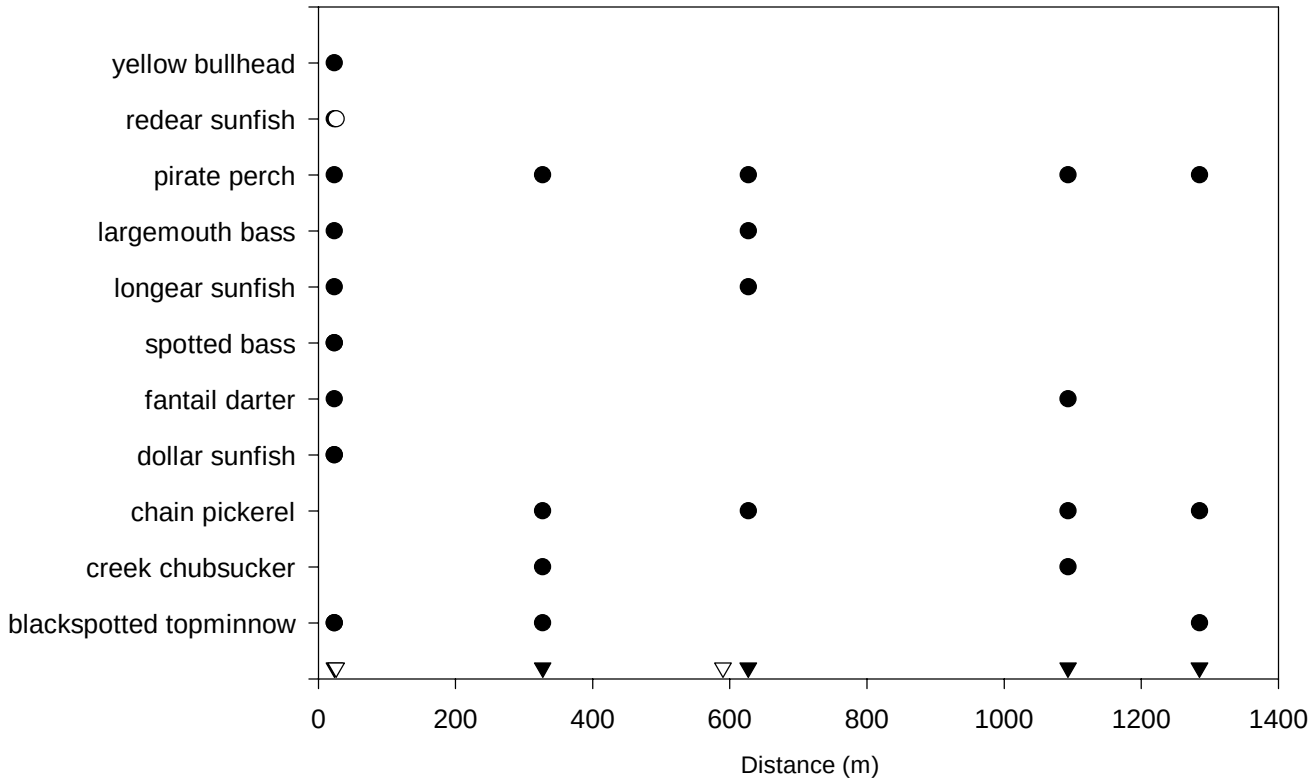

Figure B1. Location of fish captured during 3-pass electrofishing in Curry Hollow. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B3. Total number and relative abundance of each species captured during 3-pass electrofishing in Barnes Hollow, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P3**	**P13**	**R3**	**P23**	**P33**	**totals**
distance from start (m):		74	370	801	823	1144	
surface area (m^2):		111	87	24	73	53	
creek chubsucker	(n)	45	89	6	7	18	165
	(%)	94	84	86	58	90	85
chain pickerel	(n)	1	-	-	1	-	2
	(%)	2	-	-	8	-	1
fantail darter	(n)	1	-	-	-	-	1
	(%)	2	-	-	-	-	1
green sunfish	(n)	1	-	-	-	-	1
	(%)	2	-	-	-	-	1
pirate perch	(n)	-	17	1	4	2	24
	(%)	-	16	14	33	10	12

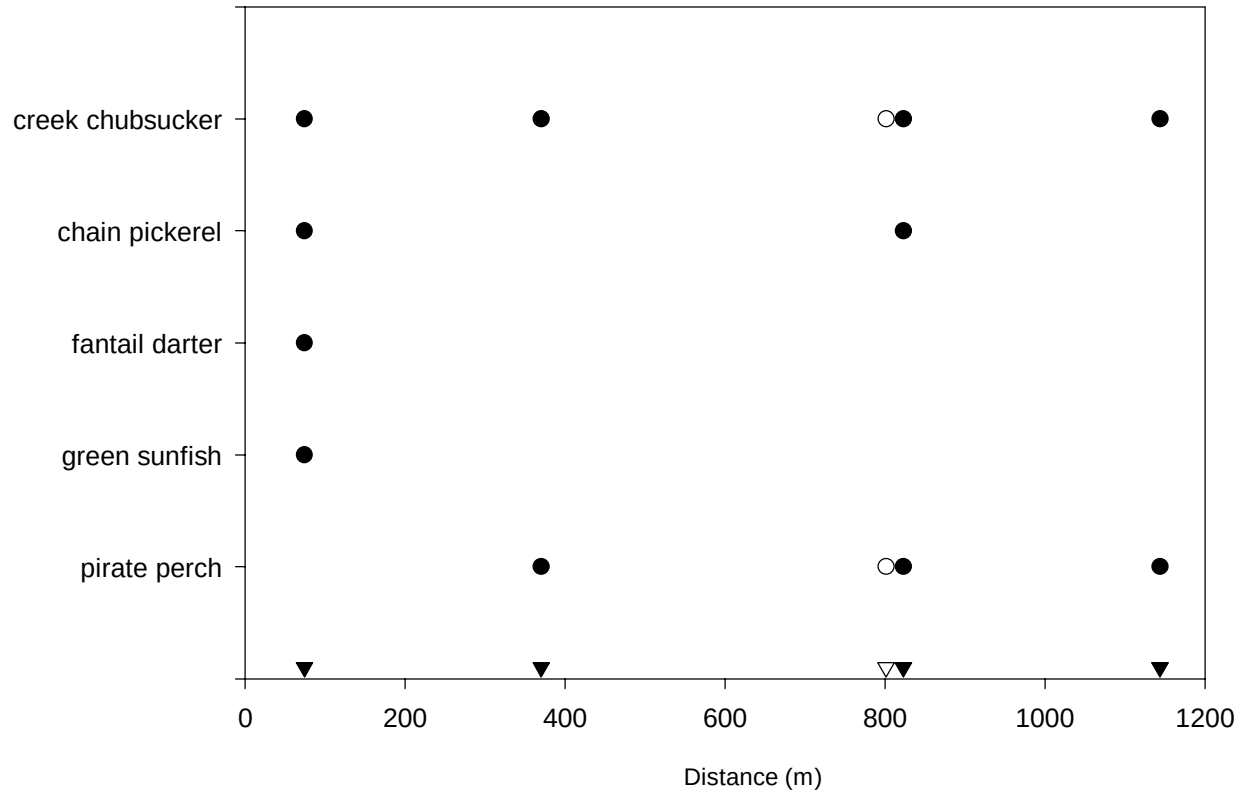

Figure B2. Location of fish captured during 3-pass electrofishing in Barnes Hollow. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B4. Total number and relative abundance of each species captured during 3-pass electrofishing in Crooked Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P10**	**P20**	**R10**	**P30**	**P40**	**R20**	**P50**	**P60**	**P70**	**R30**	**P80**	**P90**	**totals**
distance from start (m):		579	1109	1123	1648	2190	2675	2692	3052	3438	3700	3993	4563	
surface area (m^2):		59	308	16	46	28	13	40	26	84	5	78	31	
blackspotted topminnow	(n)	2	43	19	-	-	-	-	-	-	-	-	-	64
	(%)	2	12	13	-	-	-	-	-	-	-	-	-	3
creek chub	(n)	19	35	19	54	32	4	82	30	33	3	109	51	471
	(%)	16	10	13	16	13	14	26	41	29	23	28	70	21
creek chubsucker	(n)	4	38	-	16	7	-	1	-	8	-	5	-	79
	(%)	3	11	-	5	3	-	0	-	7	-	1	-	4
fantail darter	(n)	2	11	27	14	14	3	38	1	-	2	25	3	140
	(%)	2	3	19	4	6	11	12	1	-	15	6	4	6
longear sunfish	(n)	6	9	-	1	-	-	-	-	-	-	-	-	16
	(%)	5	2	-	0	-	-	-	-	-	-	-	-	1
orangespotted sunfish	(n)	1	18	-	-	2	-	-	-	-	-	-	-	21
	(%)	1	5	-	-	1	-	-	-	-	-	-	-	1
redear sunfish	(n)	12	25	-	2	1	-	-	-	-	-	-	-	40
	(%)	10	7	-	1	0	-	-	-	-	-	-	-	2
central stoneroller	(n)	50	177	78	259	187	21	198	42	70	8	252	19	1361
	(%)	43	49	54	74	77	75	62	58	63	62	64	26	61
yellow bullhead	(n)	7	-	-	-	-	-	-	-	-	-	-	-	7
	(%)	6	-	-	-	-	-	-	-	-	-	-	-	0.3
chain pickerel	(n)	13	-	1	2	-	-	-	-	-	-	-	-	16
	(%)	11	-	1	1	-	-	-	-	-	-	-	-	1
silver lamprey	(n)	-	1	-	-	-	-	-	-	-	-	-	-	1
	(%)	-	0	-	-	-	-	-	-	-	-	-	-	0.1
pirate perch	(n)	-	4	-	-	-	-	-	-	1	-	-	-	5
	(%)	-	1	-	-	-	-	-	-	1	-	-	-	0.2

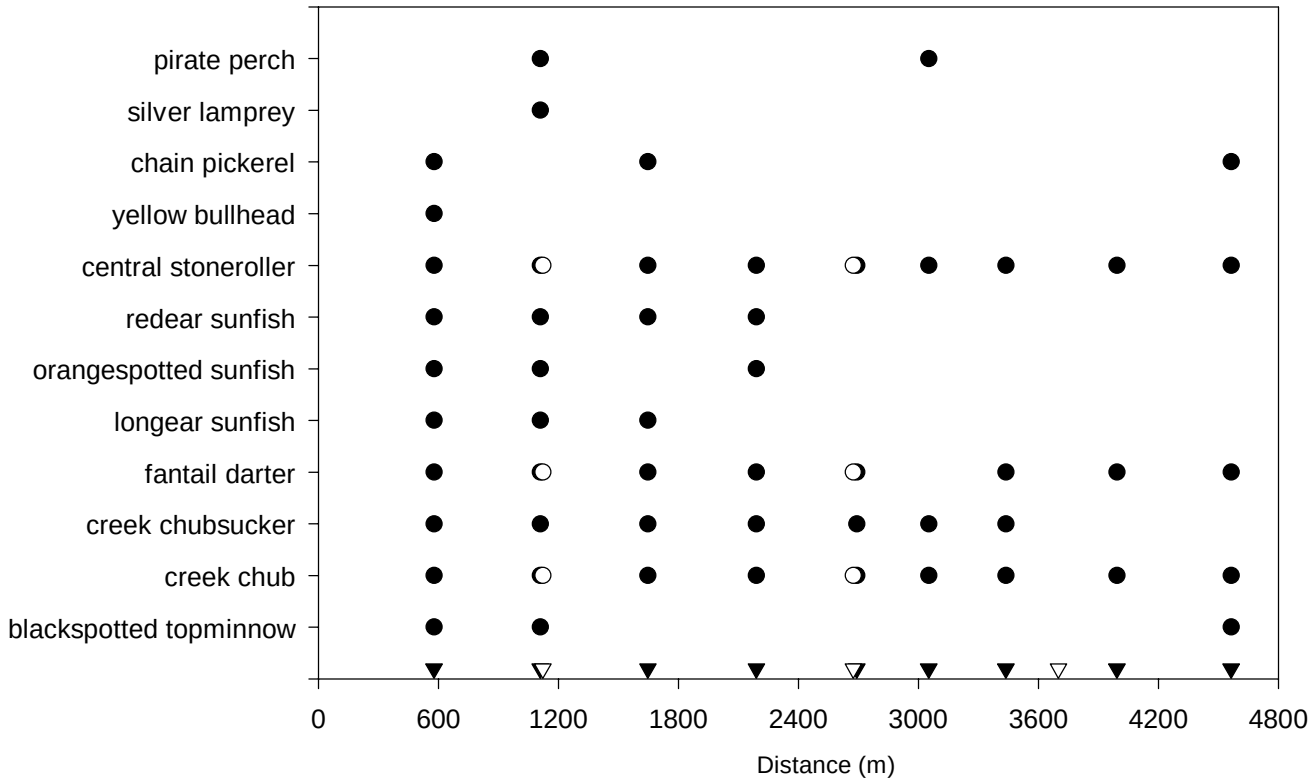

Figure B3. Location of fish captured during 3-pass electrofishing in Crooked Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B5. Total number and relative abundance of each species captured during 3-pass electrofishing in Prior Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P7**	**P17**	**P27**	**R7**	**P37**	**total**
distance from start (m):		384	794	1233	1445	1662	
surface area (m^2):		116	91	153	106	70	
bluegill	(n)	1	-	-	-	-	1
	(%)	2	-	-	-	-	0.1
blackspotted topminnow	(n)	11	9	2	-	9	31
	(%)	20	4	1	-	8	3
creek chub	(n)	-	-	-	-	9	9
	(%)	-	-	-	-	8	1
creek chubsucker	(n)	-	-	-	-	12	12
	(%)	-	-	-	-	11	1
chain pickerel	(n)	1	-	-	-	-	1
	(%)	2	-	-	-	-	0.1
dollar sunfish	(n)	8	-	-	-	-	8
	(%)	15	-	-	-	-	1
green sunfish	(n)	2	-	-	-	-	2
	(%)	4	-	-	-	-	0.2
chestnut lamprey	(n)	1	-	3	-	-	4
	(%)	2	-	1	-	-	0
largemouth bass	(n)	2	-	-	-	-	2
	(%)	4	-	-	-	-	0.2
orangethroated darter	(n)	-	26	160	30	14	230
	(%)	-	12	52	8	13	21
pirate perch	(n)	1	-	2	-	8	11
	(%)	2	-	1	-	7	1
rainbow darter	(n)	1	-	3	-	-	4
	(%)	2	-	1	-	-	0.4
sculpin spp.	(n)	8	24	72	354	3	461
	(%)	15	11	23	89	3	42
southern redbelly dace	(n)	-	-	-	-	4	4
	(%)	-	-	-	-	4	0.4
central stoneroller	(n)	19	154	68	15	53	309
	(%)	35	72	22	4	47	28

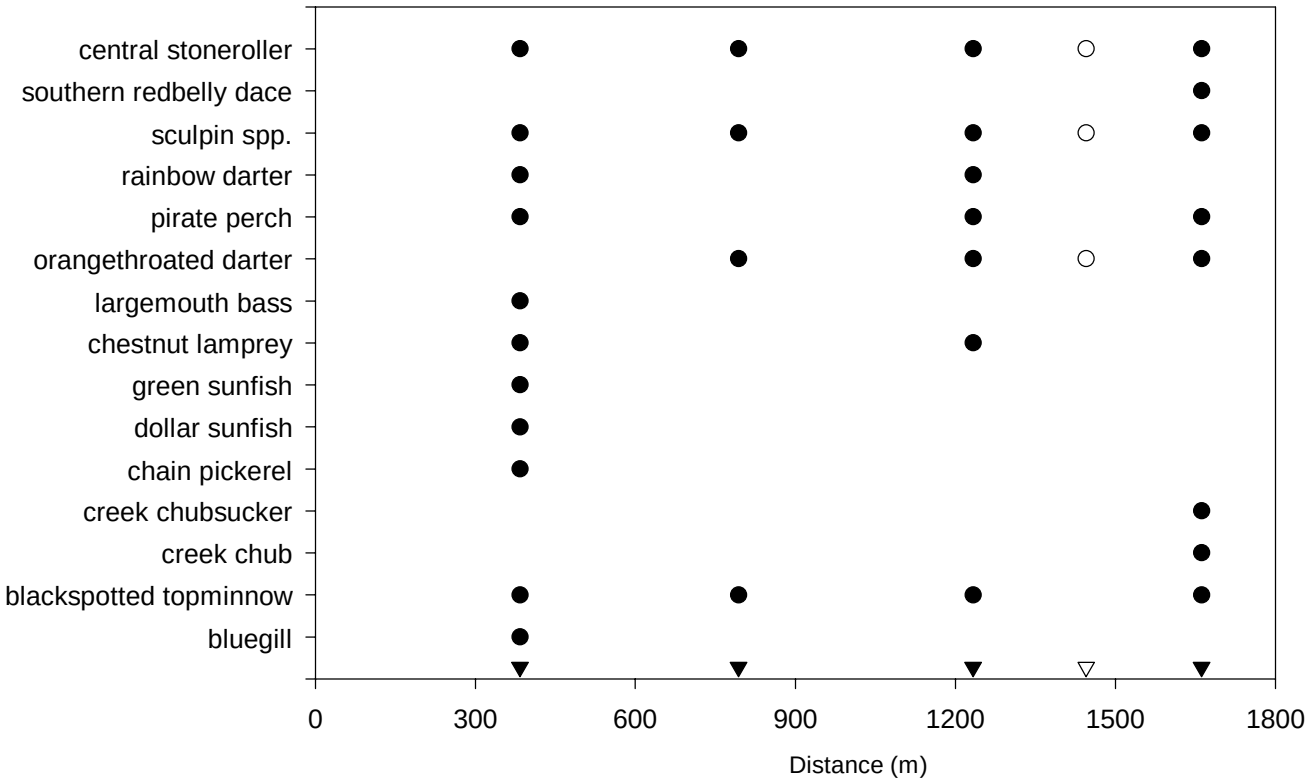

Figure B4. Location of fish captured during 3-pass electrofishing in Prior Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B6. Total number and relative abundance of each species captured during 3-pass electrofishing in Crockett Creek, LBL, July 2001. P=pool, R=riffle, G=glide, n=number captured, %=relative abundance

habitat unit ID:		**P9**	**R10**	**P19**	**G29**	**P39**	**R20**	**P49**	**P59**	**R30**	**P70**	**G79**	**total**
distance from start (m):		474	669	687	1011	1424	1483	1663	1869	2014	2068	2262	
surface area (m^2):		48	1	31	16	6	2	22	58	9	16	23	
blackspotted topminnow	(n)	2	-	5	-	5	-	2	12	-	-	-	26
	(%)	5	-	7	-	42	-	15	26	-	-	-	6
creek chubsucker	(n)	3	-	6	-	-	-	-	3	-	-	-	12
	(%)	7	-	8	-	-	-	-	6	-	-	-	3
dollar sunfish	(n)	2	-	3	-	-	-	-	-	-	-	-	5
	(%)	5	-	4	-	-	-	-	-	-	-	-	1
fantail darter	(n)	6	2	4	4	-	-	-	1	-	4	-	21
	(%)	14	50	6	2	-	-	-	2	-	13	-	4
green sunfish	(n)	9	1	17	-	-	-	-	-	-	-	-	27
	(%)	20	25	24	-	-	-	-	-	-	-	-	6
chestnut lamprey	(n)	7	-	-	-	-	-	-	-	-	-	-	7
	(%)	16	-	-	-	-	-	-	-	-	-	-	1
pirate perch	(n)	9	-	7	-	1	-	-	9	-	1	-	27
	(%)	20	-	10	-	8	-	-	19	-	3	-	6
sculpin spp.	(n)	2	-	-	50	-	-	-	-	-	-	1	53
	(%)	5	-	-	23	-	-	-	-	-	-	8	11
yellow bullhead	(n)	4	-	2	-	-	-	-	-	-	-	-	6
	(%)	9	-	3	-	-	-	-	-	-	-	-	1
orangethroated darter	(n)	-	1	24	159	-	-	5	-	17	25	7	238
	(%)	-	25	34	73	-	-	38	-	100	78	58	51
central stoneroller	(n)	-	-	3	-	-	-	-	-	-	-	-	3
	(%)	-	-	4	-	-	-	-	-	-	-	-	1
chain pickerel	(n)	-	-	-	1	6	-	6	22	-	2	4	41
	(%)	-	-	-	0	50	-	46	47	-	6	33	9
rainbow darter	(n)	-	-	-	4	-	-	-	-	-	-	-	4
	(%)	-	-	-	2	-	-	-	-	-	-	-	1

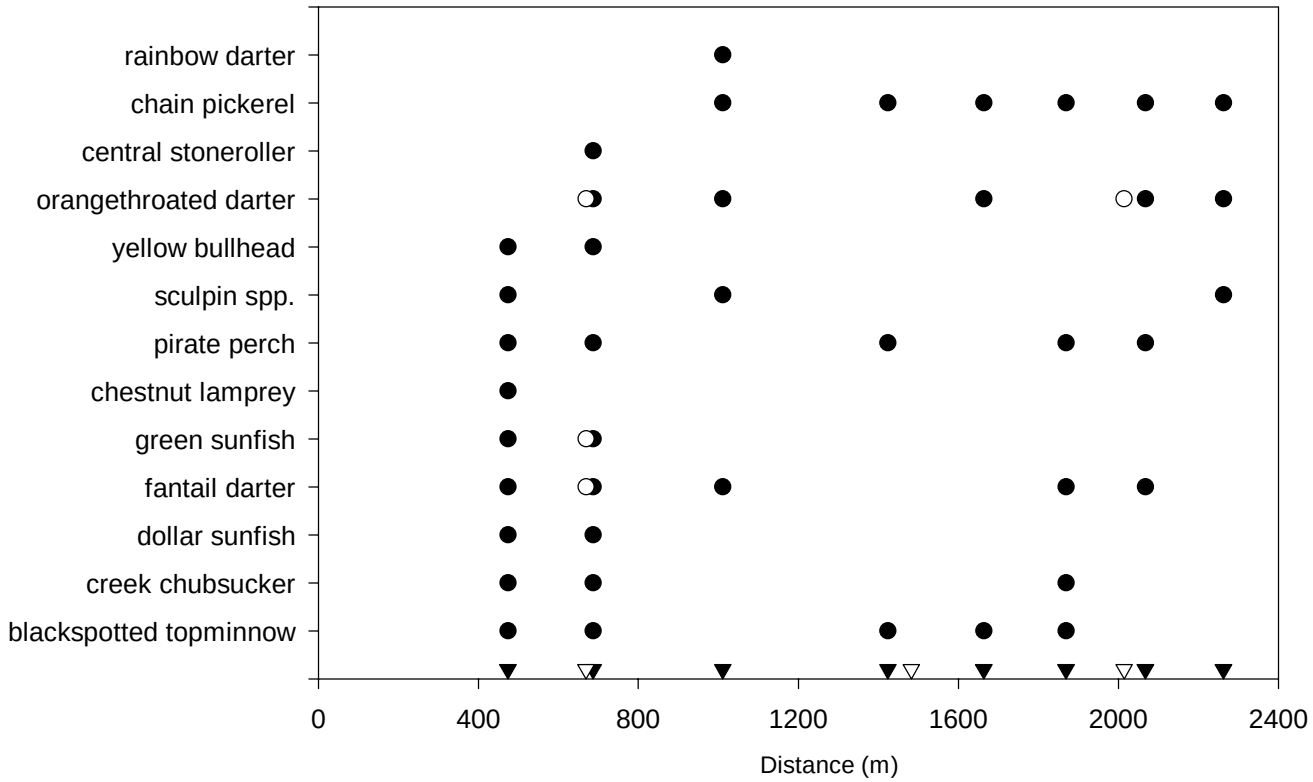

Figure B5. Location of fish captured during 3-pass electrofishing in Crockett Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B7. Total number and relative abundance of each species captured during 3-pass electrofishing in Barrett Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P1**	**R1**	**P11**	**R11**	**P21**	**P25**	**totals**
distance from start (m):		88	93	471	559	850	1239	
surface area (m^2):		353	5	60	16	101	1246	
bluegill	(n)	231	2	-	-	15	28	276
	(%)	37	6	-	-	7	12	25
brook silverside	(n)	4	-	-	-	-	-	4
	(%)	1	-	-	-	-	-	0.4
blackspotted topminnow	(n)	56	3	12	-	29	13	113
	(%)	9	9	50	-	14	5	10
chain pickerel	(n)	8	1	-	-	1	4	14
	(%)	1	3	-	-	0	2	1
dollar sunfish	(n)	113	-	-	-	1	1	115
	(%)	18	-	-	-	0	0	10
green sunfish	(n)	39	-	7	-	6	84	136
	(%)	6	-	29	-	3	35	12
spotted bass	(n)	1	-	-	-	-	-	1
	(%)	0	-	-	-	-	-	0.1
longear sunfish	(n)	45	-	-	-	30	4	79
	(%)	7	-	-	-	15	2	7
largemouth bass	(n)	5	-	-	-	-	-	5
	(%)	0	-	-	-	-	-	0.4
orangespotted sunfish	(n)	7	-	-	-	13	8	28
	(%)	1	-	-	-	6	3	2
orangethroated darter	(n)	2	28	1	2	15	22	70
	(%)	0	80	4	100	7	9	6
redear sunfish	(n)	91	-	-	-	30	-	121
	(%)	15	-	-	-	15	-	11
western mosquito fish	(n)	2	-	-	-	1	9	12
	(%)	0	-	-	-	0	4	1
warmouth	(n)	13	-	-	-	3	12	28
	(%)	2	-	-	-	1	5	2
creek chubsucker	(n)	-	-	1	-	8	19	28
	(%)	-	-	4	-	4	8	2
logperch	(n)	-	-	2	-	-	-	2
	(%)	-	-	8	-	-	-	0.2
yellow bullhead	(n)	-	1	1	-	1	2	5
	(%)	-	3	4	-	0	1	0.4
creek chub	(n)	-	-	-	-	45	7	52
	(%)	-	-	-	-	22	3	5
pirate perch	(n)	-	-	-	-	2	19	21
	(%)	-	-	-	-	1	8	2
rainbow darter	(n)	-	-	-	-	5	10	15
	(%)	-	-	-	-	2	4	1

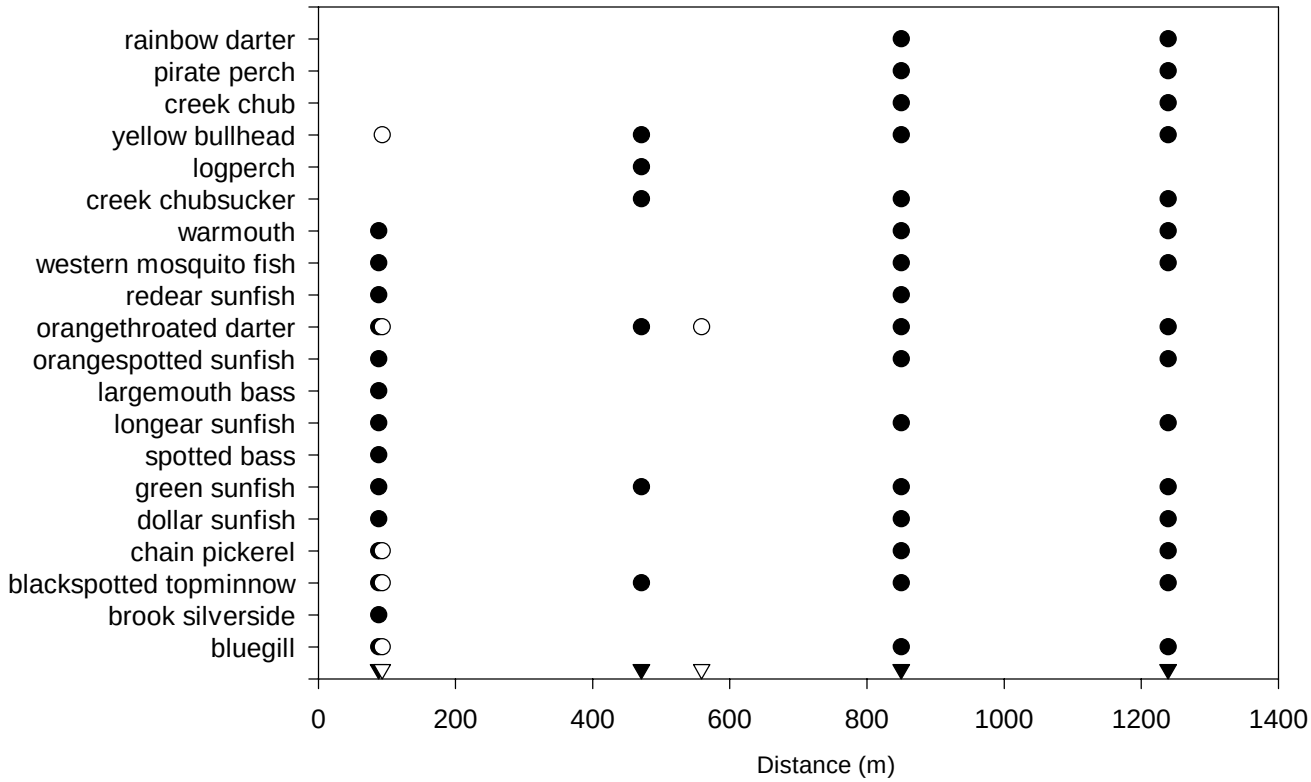

Figure B6. Location of fish captured during 3-pass electrofishing in Barrett Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B8. Total number and relative abundance of each species captured during 3-pass electrofishing in Brandon Spring Branch, LBL, July 2001. P=pool, n=number captured, %=relative abundance

habitat unit ID:		**P5**	**total**
distance from start (m):		243	
surface area (m^2):		6	
blackspotted topminnow	(n)	1	1
	(%)	33	33
redear sunfish	(n)	2	2
	(%)	67	67

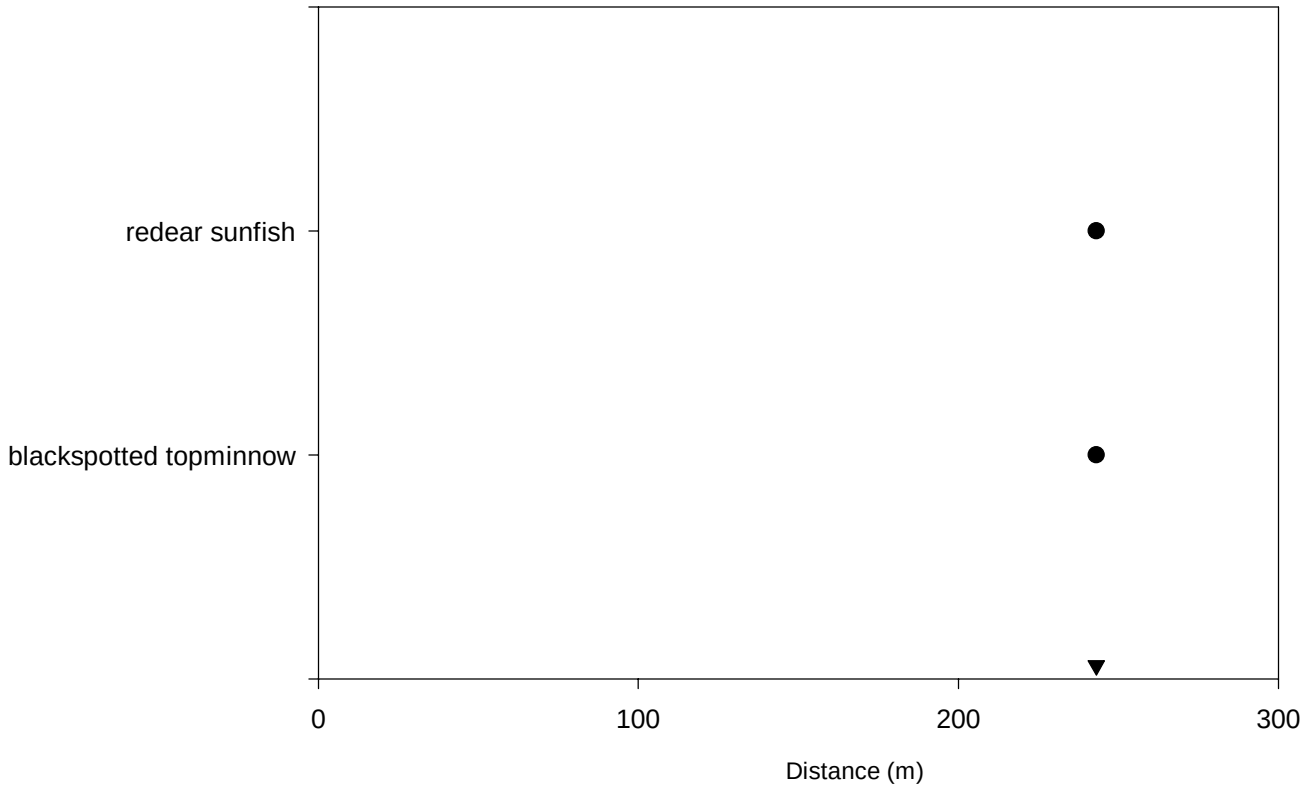

Figure B7. Location of fish captured during 3-pass electrofishing in Brandon Spring Branch. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B9. Total number and relative abundance of each species captured during 3-pass electrofishing in Bear Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P9**	**P19**	**P29**	**R9**	**P40**	**P49**	**R19**	**P59**	**P69**	**totals**
distance from start (m):		307	623	1105	1269	1543	2100	2266	2338	2638	
surface area (m^2):		138	23	81	11	214	32	9	24	49	
black darter	(n)	8	1	-	-	25	-	-	-	-	34
	(%)	11	1	-	-	21	-	-	-	-	5
blackspotted topminnow	(n)	1	-	-	-	8	-	-	-	13	22
	(%)	1	-	-	-	7	-	-	-	23	3
creek chub	(n)	27	105	105	9	1	-	-	-	3	250
	(%)	38	56	48	29	1	-	-	-	5	36
chain pickerel	(n)	1	-	1	-	7	-	-	6	1	16
	(%)	1	-	0	-	6	-	-	86	2	2
fantail darter	(n)	6	5	4	10	1	-	-	-	-	26
	(%)	8	3	2	32	1	-	-	-	-	4
orangethroated darter	(n)	18	2	36	5	46	-	-	1	2	110
	(%)	25	1	16	16	38	-	-	14	4	16
pirate perch	(n)	1	4	-	-	5	-	-	-	-	10
	(%)	1	2	-	-	4	-	-	-	-	1
rainbow darter	(n)	6	-	3	7	6	-	-	-	-	22
	(%)	8	-	1	23	5	-	-	-	-	3
central stoneroller	(n)	3	66	61	-	-	-	-	-	-	130
	(%)	4	35	28	-	-	-	-	-	-	19
slough darter	(n)	-	3	-	-	11	-	-	-	-	14
	(%)	-	2	-	-	9	-	-	-	-	2
creek chubsucker	(n)	-	-	1	-	-	-	-	-	6	7
	(%)	-	-	0	-	-	-	-	-	11	1
souther redbelly dace	(n)	-	-	8	-	-	-	-	-	-	8
	(%)	-	-	4	-	-	-	-	-	-	1
green sunfish	(n)	-	-	-	-	8	-	-	-	21	29
	(%)	-	-	-	-	7	-	-	-	38	4
redear sunfish	(n)	-	-	-	-	2	-	-	-	-	2
	(%)	-	-	-	-	2	-	-	-	-	0.3
western mosquito fish	(n)	-	-	-	-	1	-	-	-	-	1
	(%)	-	-	-	-	1	-	-	-	-	0.1
dollar sunfish	(n)	-	-	-	-	-	-	-	-	8	8
	(%)	-	-	-	-	-	-	-	-	14	1
longear sunfish	(n)	-	-	-	-	-	-	-	-	1	1
	(%)	-	-	-	-	-	-	-	-	2	0.1
yellow bullhead	(n)	-	-	-	-	-	-	-	-	1	1
	(%)	-	-	-	-	-	-	-	-	2	0.1

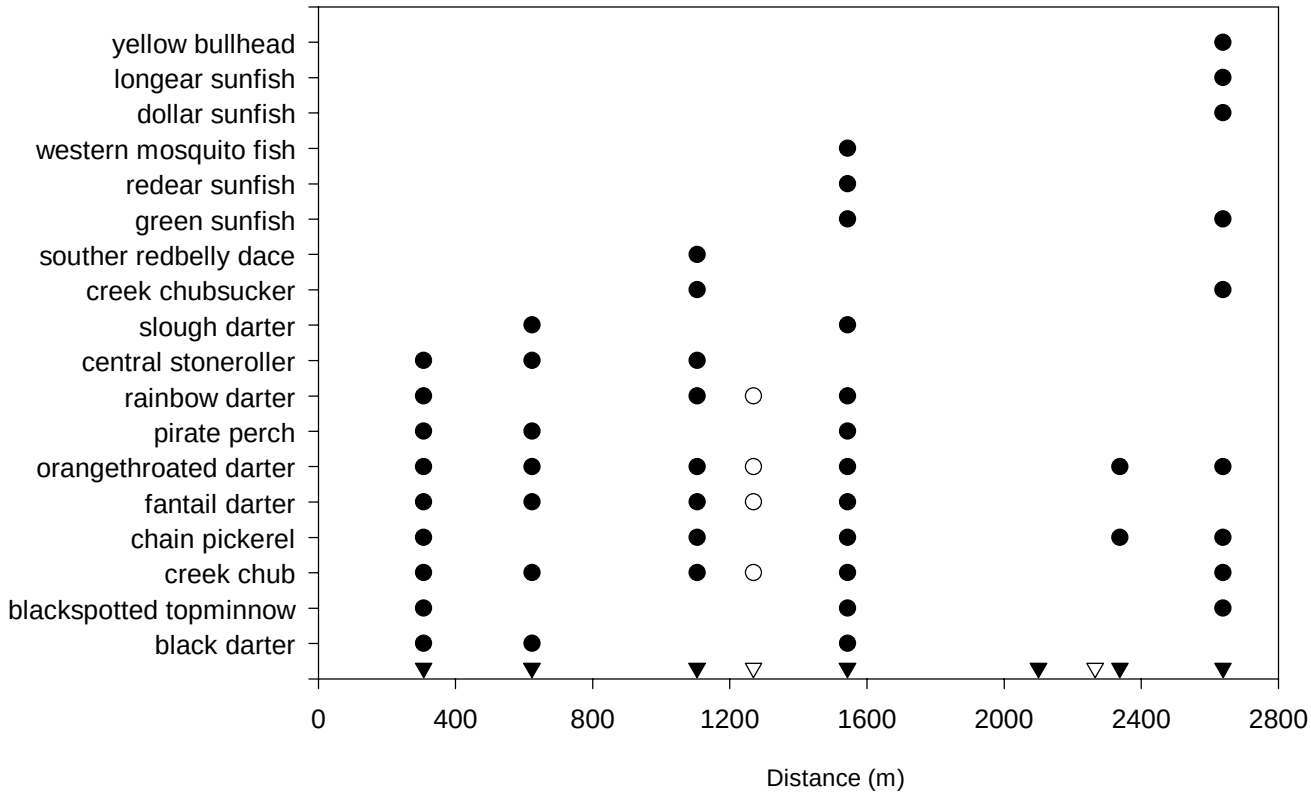

Figure B8. Location of fish captured during 3-pass electrofishing in Bear Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B10. Total number and relative abundance of each species captured during 3-pass electrofishing in Byrd Creek, LBL, July 2001. P=pool, n=number captured, %=relative abundance

habitat unit ID:		**P5**	**P10**	**P20**	**totals**
distance from start (m):		328	377	869	
surface area (m^2):		56	14	17	
blackspotted topminnow	(n)	14	-	-	14
	(%)	5	-	-	3
fantail darter	(n)	199	70	14	283
	(%)	71	69	64	70
green sunfish	(n)	12	6	6	24
	(%)	4	6	27	6
spotted bass	(n)	9	-	-	9
	(%)	3	-	-	2
orangespotted sunfish	(n)	1	-	-	1
	(%)	0	-	-	0.2
orangethroated darter	(n)	1	-	-	1
	(%)	0	-	-	0.2
rainbow darter	(n)	1	-	-	1
	(%)	0	-	-	0.2
smallmouth bass	(n)	1	-	-	1
	(%)	0	-	-	0.2
central stoneroller	(n)	6	2	-	8
	(%)	2	2	-	2
western mosquito fish	(n)	21	-	-	21
	(%)	8	-	-	5
yellow bullhead	(n)	10	24	-	34
	(%)	4	24	-	8
creek chub	(n)	4	-	2	6
	(%)	1	-	9	1

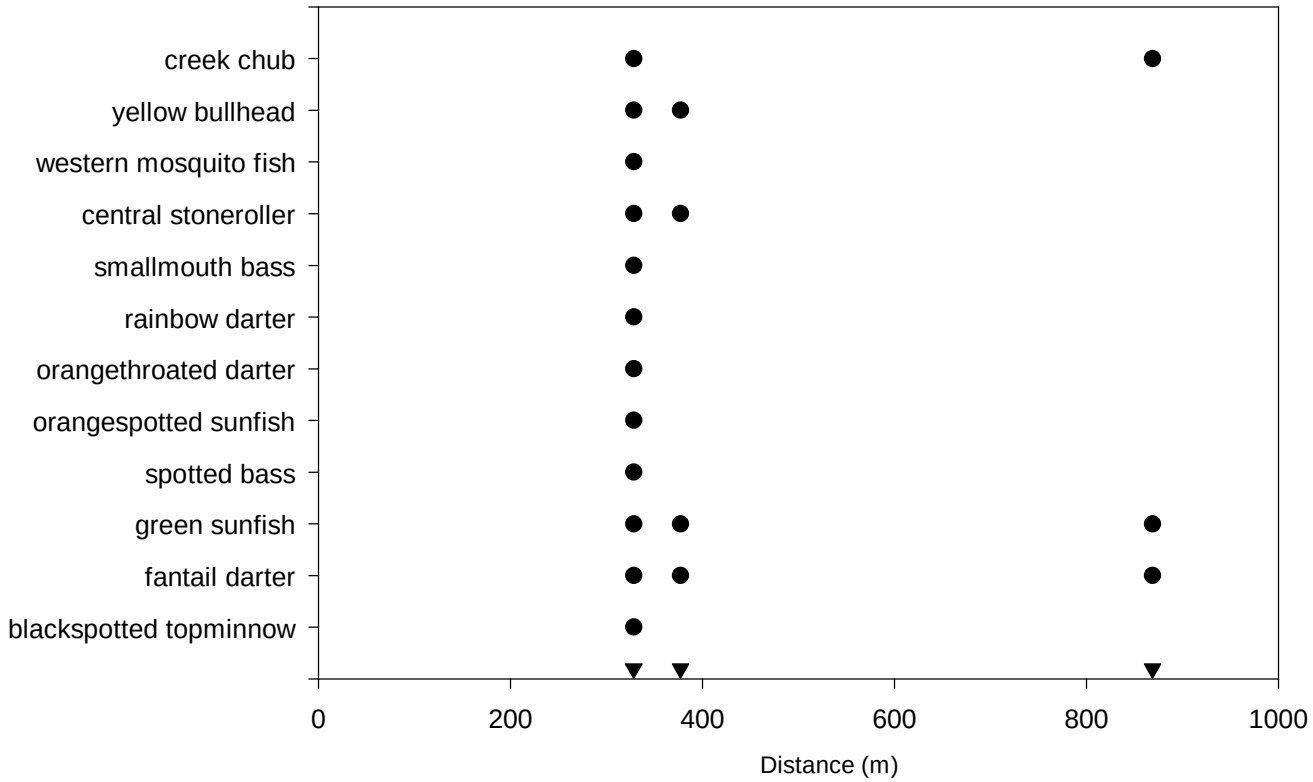

Figure B9. Location of fish captured during 3-pass electrofishing in Byrd Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B11. Total number and relative abundance of each species captured during 3-pass electrofishing in Panther Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P8**	**R8**	**P18**	**R18**	**P28**	**R28**	**P38**	**R38**	**P48**	**P58**	**R48**	**P68**	**R58**	**P78**	**P88**	**R68**	**P98**	**totals**
meters from start:		256	261	520	584	823	882	1053	1112	1500	1845	1919	2131	2233	2333	2586	2761	2800	
surface area (m^2):		57	8	179	17	113	43	271	22	81	131	73	319	11	74	25	13	53	
black darter	(n)	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1
	(%)	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-	-	-	0.1
bigeye shiner	(n)	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
	(%)	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-	-	-	0
blackspotted	(n)	-	-	1	-	1	-	4	-	-	-	-	5	-	-	-	-	-	11
topminnow	(%)	-	-	1	-	0	-	7	-	-	-	-	2	-	-	-	-	-	1
creek chub	(n)	-	-	1	-	5	-	12	-	10	10	-	25	-	8	2	-	10	83
	(%)	-	-	1	-	2	-	21	-	30	18	-	11	-	8	15	-	22	8
creek chubsucker	(n)	-	-	-	-	7	-	6	-	-	-	-	2	-	4	-	-	1	20
	(%)	-	-	-	-	3	-	11	-	-	-	-	1	-	4	-	-	2	2
chain pickerel	(n)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1
	(%)	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	0.1
dollar sunfish	(n)	-	-	-	-	3	-	1	-	-	-	-	-	-	-	-	-	-	4
	(%)	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	-	-	0.4
fantail darter	(n)	-	6	10	-	-	2	2	10	4	14	14	17	1	5	6	-	-	91
	(%)	-	33	8	-	-	20	4	37	12	25	37	7	17	5	46	-	-	9
green sunfish	(n)	5	-	14	-	6	-	4	-	-	-	-	3	-	2	-	-	-	34
	(%)	25	-	11	-	2	-	7	-	-	-	-	1	-	2	-	-	-	3
spotted bass	(n)	1	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	5
	(%)	5	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	0.5
longear sunfish	(n)	1	-	19	-	4	-	3	-	-	1	-	2	-	1	-	-	1	32
	(%)	5	-	15	-	2	-	5	-	-	2	-	1	-	1	-	-	2	3
largemouth bass	(n)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
	(%)	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1
logperch	(n)	-	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-	-	2
	(%)	-	-	1	-	0	-	-	-	-	-	-	-	-	-	-	-	-	0.2
orangespotted	(n)	-	-	17	-	7	-	10	-	-	1	-	6	-	1	-	-	-	42
sunfish	(%)	-	-	14	-	3	-	18	-	-	2	-	3	-	1	-	-	-	4
orangethroated	(n)	-	5	5	14	24	6	1	9	4	8	11	18	5	2	-	-	1	113
darter	(%)	-	28	4	100	10	60	2	33	12	14	29	8	83	2	-	-	2	11
rainbow darter	(n)	2	7	8	-	19	2	2	3	2	12	7	5	-	5	-	-	-	74
	(%)	10	39	6	-	8	20	4	11	6	21	18	2	-	5	-	-	-	7
redear sunfish	(n)	6	-	24	-	45	-	9	-	-	1	-	2	-	1	-	-	-	88
	(%)	30	-	19	-	18	-	16	-	-	2	-	1	-	1	-	-	-	8
roseyside dace	(n)	2	-	-	-	54	-	-	1	7	2	-	69	-	21	-	-	28	184
	(%)	10	-	-	-	22	-	-	4	21	4	-	30	-	21	-	-	61	18
smallmouth bass	(n)	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2
	(%)	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.2
central stoneroller	(n)	3	-	18	-	69	-	3	4	6	7	6	74	-	49	5	-	5	249
	(%)	15	-	14	-	28	-	5	15	18	13	16	32	-	49	38	-	11	24
yellow bullhead	(n)	-	-	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3
	(%)	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.3

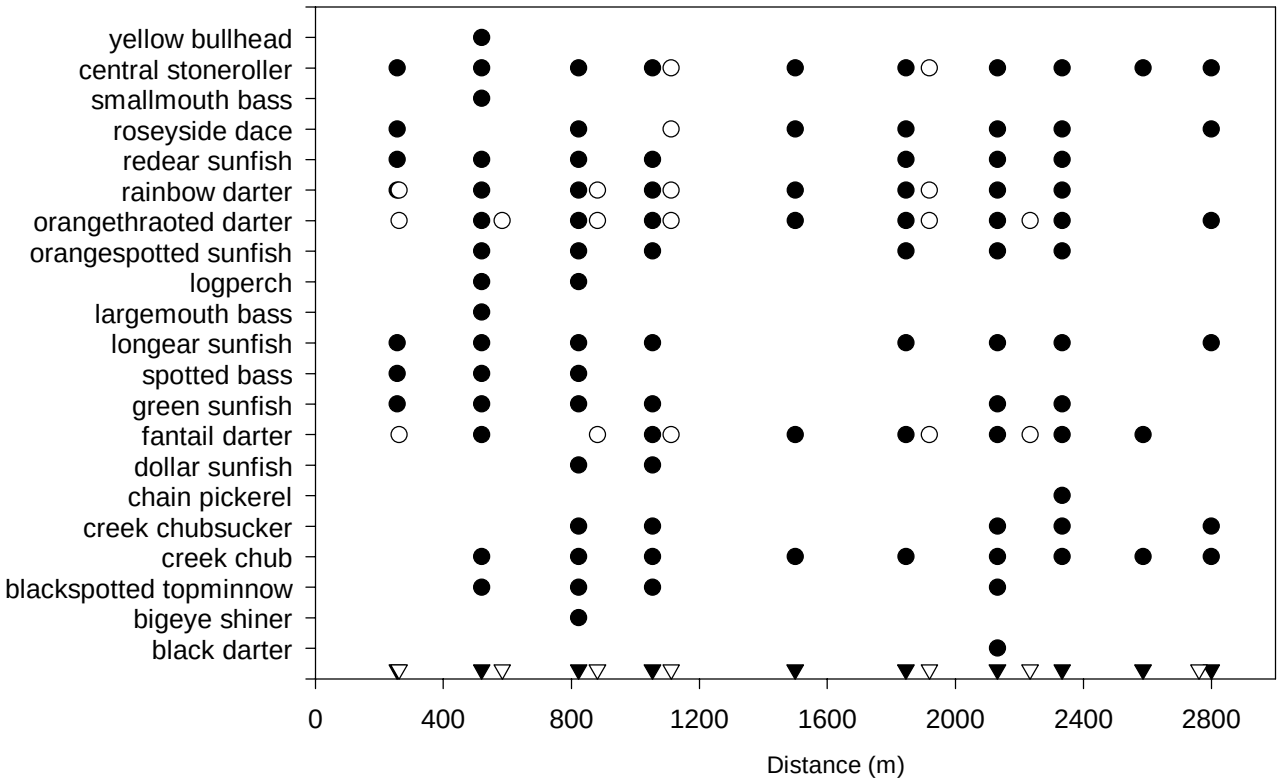

Figure B10. Location of fish captured during 3-pass electrofishing in Panther Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.

Table B12. Total number and relative abundance of each species captured during 3-pass electrofishing in Lost Creek, LBL, July 2001. P=pool, R=riffle, n=number captured, %=relative abundance

habitat unit ID:		**P5**	**R5**	**P25**	**R25**	**P35**	**R35**	**P45**	**R45**	**P55**	**P65**	**R55**	**P75**	**P85**	**totals**
distance from start (m):		444	458	1238	1267	1554	1710	1809	2049	2145	2436	2526	2561	2775	
surface area (m^2):		148	34	180	103	71	28	95	47	165	47	7	12	29	
black darter	(n)	3	-	1	-	-	-	-	-	-	-	-	-	-	4
	(%)	1	-	3	-	-	-	-	-	-	-	-	-	-	0.3
creek chub	(n)	10	-	4	-	9	-	2	-	22	19	-	4	33	103
	(%)	3	-	10	-	18	-	9	-	15	10	-	27	36	8
creek chubsucker	(n)	-	-	-	-	1	-	-	-	3	-	-	-	-	4
	(%)	-	-	-	-	2	-	-	-	2	-	-	-	-	0.3
chain pickerel	(n)	1	-	1	-	-	-	-	-	2	-	-	-	-	4
	(%)	0	-	3	-	-	-	-	-	1	-	-	-	-	0.3
dollar sunfish	(n)	-	-	-	-	-	-	-	-	15	7	-	-	-	22
	(%)	-	-	-	-	-	-	-	-	10	4	-	-	-	2
fantail darter	(n)	15	2	1	1	3	-	3	4	6	12	2	7	45	101
	(%)	5	0	3	2	6	-	13	15	4	7	40	47	49	8
green sunfish	(n)	1	-	1	-	-	-	2	-	8	6	-	-	-	18
	(%)	0	-	3	-	-	-	9	-	5	3	-	-	-	1
spotted bass	(n)	1	-	-	-	-	-	-	-	-	-	-	-	-	1
	(%)	0	-	-	-	-	-	-	-	-	-	-	-	-	0.1
chestnut lamprey	(n)	-	-	-	-	-	-	-	-	4	1	-	-	-	5
	(%)	-	-	-	-	-	-	-	-	3	1	-	-	-	0.4
longear sunfish	(n)	-	-	3	-	-	-	-	-	-	-	-	-	-	3
	(%)	-	-	8	-	-	-	-	-	-	-	-	-	-	0.2
largemouth bass	(n)	1	-	-	-	-	-	-	-	-	-	-	-	-	1
	(%)	0	-	-	-	-	-	-	-	-	-	-	-	-	0.1
logperch	(n)	-	-	2	-	-	-	-	-	-	-	-	-	-	2
	(%)	-	-	5	-	-	-	-	-	-	-	-	-	-	0.1
orangespotted sunfish	(n)	1	-	-	-	-	-	1	-	-	1	-	-	-	3
	(%)	0	-	-	-	-	-	4	-	-	1	-	-	-	0.2
orangethroated darter	(n)	7	62	8	27	11	-	6	-	-	1	-	-	1	123
	(%)	2	15	20	60	22	-	26	-	-	1	-	-	1	9
rainbow darter	(n)	-	1	3	2	-	-	-	12	19	7	-	2	-	46
	(%)	-	0	8	4	-	-	-	46	13	4	-	13	-	3
redear sunfish	(n)	5	-	4	-	1	-	-	-	-	-	-	-	-	10
	(%)	2	-	10	-	2	-	-	-	-	-	-	-	-	1
roseyside dace	(n)	32	14	-	-	9	-	8	-	33	81	-	1	-	178
	(%)	10	3	-	-	18	-	35	-	22	45	-	7	-	13
sculpin spp.	(n)	16	26	9	3	7	2	-	10	28	24	3	1	12	141
	(%)	5	6	23	7	14	100	-	38	19	13	60	7	13	10
smouthmouth bass	(n)	1	-	2	-	-	-	-	-	1	-	-	-	-	4
	(%)	0	-	5	-	-	-	-	-	1	-	-	-	-	0.3
central stoneroller	(n)	209	309	1	12	8	-	1	-	6	21	-	-	1	568
	(%)	68	75	3	27	16	-	4	-	4	12	-	-	1	42
yellow bullhead	(n)	3	-	-	-	-	-	-	-	-	2	-	-	-	5
	(%)	1	-	-	-	-	-	-	-	-	1	-	-	-	0.4

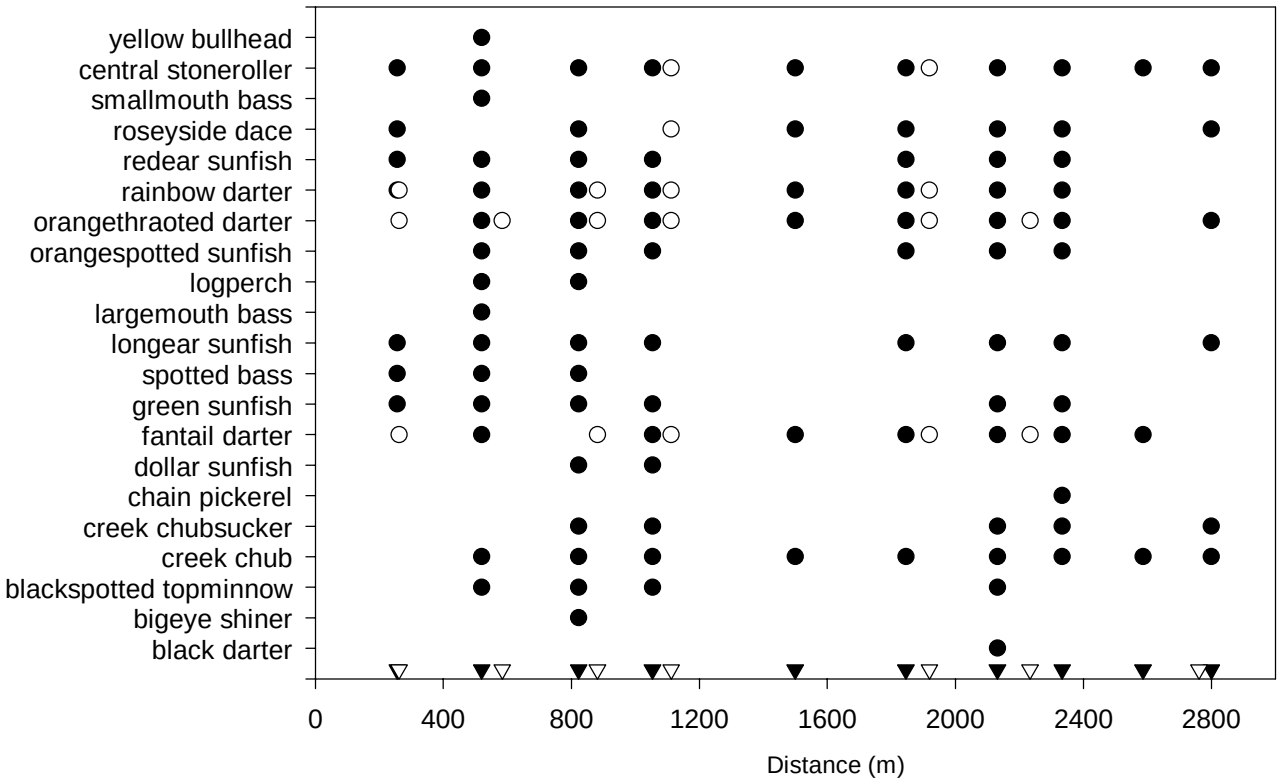

Figure B11. Location of fish captured during 3-pass electrofishing in Lost Creek. Open symbols represent riffles, closed symbols represent pools. Triangles show where electrofishing passes were made and circles indicate that a species was captured.