

**An Inventory of Stream Habitat and Blackside Dace *Phoxinus
cumberlandensis* in North Fork and Little Dog Slaughter Creek,
Daniel Boone National Forest, Kentucky**



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Introduction

To meet their responsibilities under the Endangered Species Act, managers of the Daniel Boone National Forest (DBNF) require information on the distribution and abundance of all Threatened, Endangered, and Sensitive species. Biologists in the Center for Aquatic Technology Transfer (CATT) are working with the DBNF to meet the goal of obtaining population abundance and distribution information and related physical habitat features of every stream that may contain the federally threatened blackside dace *Phoxinus cumberlandensis*. During the summer of 1999, Biologists from the CATT used the Basinwide Visual Estimation Technique (BVET) (Hankin and Reeves 1988; Dolloff, et al. 1993) to survey and inventory two streams that may support blackside dace.

We surveyed habitat and fish populations in two major tributaries of Dog Slaughter Creek: North Fork and Little Dog Slaughter Creek (Figure 1). We began our survey of North Fork, a small third-order tributary at its confluence with South Fork. This survey ended about 500 m upstream at the confluence of Little Dog Slaughter Creek and North Fork. We also surveyed about 3 km of second-order Little Dog Slaughter Creek, from the confluence upstream to where the habitat became unsuitable to support fish (Figure 1).

Methods

Habitat

Habitat in both streams was stratified into similar groups based on naturally occurring habitat units including pools (areas in the stream with low water velocity, streambed gradient near zero, and a smooth water surface), and riffles (areas in the stream with relatively steep gradient, shallow water, relatively high velocity, and turbulent surface).

We used two-stage visual estimation techniques to quantify habitat in the study stream. During the first stage, all habitat units were classified and the surface area and maximum and average depth were estimated. Habitat was classified and inventoried by

a two-person crew. One crew member identified each habitat unit by type, estimated wetted stream width, and classified the dominant and subdominant substrata particle size (Modified Wentworth scale). The remaining crew member classified and inventoried LWD within the active stream channel, estimated the maximum and average depth of each habitat unit, and measured depth at riffle crest for each riffle. LWD greater than 1 meter long and greater than 10 centimeters in diameter was divided into four classes: 1) less than 5 m long, less than 55 cm in diameter, 2) less than 5 m long, greater than 55 cm in diameter, 3) greater than 5 m long, less than 55 cm in diameter, and 4) greater than 5 m long, greater than 55 cm in diameter. 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. The length (0.1 m) of each habitat unit was measured with a hip chain, and data were recorded on a Husky Hunter field data logger.

The first unit of each habitat type selected for intensive sampling (accurate measurement of surface area, second stage sampling and calibration) was determined randomly. Additional units were selected systematically (about one unit out of 5 for each habitat type).

BVET calculations were computed using a Microsoft Excel macro based on calculations found in Dolloff et al. 1993. Data were summarized using a Microsoft Excel spreadsheet, Microsoft PowerPoint, and SigmaPlot graphics software.

Fish

Underwater observation was used to estimate the distribution and relative abundance of blackside dace in each of the habitat units selected for intensive sampling in the Little Dog Slaughter Creek study section. When a sample unit was encountered, a diver entered at the downstream end and proceeded slowly upstream to the head of the unit while searching for and counting all fish. When a fish was sighted, it was directed out of the line of travel by the diver's hand to prevent double counting. We selected about 21% of the total number of pools and 18% of the total number of riffles snorkeled in the Little Dog Slaughter Creek study section for multiple-pass removal census (Zippen 1958), using a 700V AC backpack electrofisher, to verify species

identification and diver counts.

Due to low visibility, only electrofishing was used to sample fish in the North Fork study section. We used a multiple-pass depletion census to survey 7 pools North Fork study section.

In both electrofishing surveys, all fish were identified before being returned to their approximate location of capture. Blackside dace were measured for fork length (FL; mm) and total length (TL; mm), and weighed (0.1 g). All fish captured were released immediately after handling.

Results

Habitat

Little Dog Slaughter Creek -We identified 185 pools and 122 riffles in the 3.1-kilometer-long study section of Little Dog Slaughter Creek. Visual estimates of habitat areas were paired with measured habitat area for 39 (21%) pools, and 22 (18%) riffles. We estimated that the study section of Little Dog Slaughter Creek contained 70% pool habitat ($7,088.1 \pm 645.2\text{m}^2$) and 30% riffle habitat ($3,043.7 \pm 130.3\text{m}^2$) (Figure 2). Total area was estimated for each habitat type using correction factors (Q) that ranged from 1.04 to 1.05.

Mean maximum depth in the Little Dog Slaughter Creek study section ranged from 11.7cm in riffles to 28.7cm in pools (Figure 3). Likewise, mean average depth ranged from 5.5cm in riffles to 16.0cm in pools (Figure 3). The mean average residual depth was 13.3cm (Figure 3).

We identified bedrock and sand as the most common (modal) dominant and subdominant substratum, respectively, for pools in the Little Dog Slaughter Creek study section (Figure 4). In riffles, the most common (modal) dominant and subdominant substrata were bedrock and organic matter (vegetation), respectively, but large boulder and cobble were also well represented (Figure 5).

Little Dog Slaughter Creek contained 126 pieces of LWD per kilometer, which meets the recommended desired future condition (DFC) for large woody debris on the

DBNF as stated in the revised Forest Plan (Figures 6 and 7). This section contained over 48 pieces per kilometer of the smallest size class, which is suitable for this and other *Phoxinus* species (Etnier and Starnes 1993; Jenkins and Burkhead 1994) (Figure 6).

North Fork -We identified 21 pools and 17 riffles in the 0.5-kilometer- long study section of North Fork. Visual estimates of habitat areas were paired with measured habitat area for 6 (29%) pools, and 4 (24%) riffles. We estimated that the North Fork study section contained 74.3% pool habitat ($1,799.7 \pm 107.6\text{m}^2$) and 25.7% riffle habitat ($623.8 \pm 51.8\text{m}^2$) (Figure 8). Total area was estimated for each habitat type using correction factors (Q) that ranged from 0.94 to 0.98.

Mean maximum depth in the North Fork study section ranged from 20.0cm in riffles to 64.0cm in pools (Figure 9). Likewise, mean average depth ranged from 9.4cm in riffles to 38.3cm in pools (Figure 9). The mean average residual depth was 35.7cm (Figure 9).

We identified sand as the most common (modal) dominant substratum for pools in the North Fork study section, but the remainder of pool stream bottom also contained a large amount of organic matter and bedrock (Figure 10). In riffles, the most common (modal) dominant and subdominant substrata were cobble and small gravel, respectively (Figure 11).

The total of 172 pieces of LWD per kilometer in the North Fork study section more than meets the recommended DFCs (Figures 12 and 13). This section contained about 92 pieces per kilometer of the larger size classes, which are the most stable and most capable of forming instream habitat and providing cover for fishes (Sullivan et al., 1987) (Figure 13).

Fish

Little Dog Slaughter Creek - Only 2 species of fish were either seen or captured while sampling 43 pools and 22 riffles during the BVET fish survey of the Little Dog Slaughter Creek study section (Figure 14). Creek chub *Semotilus atromaculatus* were the most

abundant species (present in nearly every habitat unit), while blackside dace were only found in one habitat unit (Pool 6), where 4 adults were captured (Figure 14). We did not calculate a population estimate for blackside dace because too few individuals were observed and captured in Little Dog Slaughter Creek.

North Fork - During the electrofishing survey in the North Fork study section we again only captured 2 species of fish. Creek chubs were common throughout the study section while only a few blackside dace were found in two of the seven pools sampled (Figure 14).

Discussion and Recommendations

Blackside dace were uncommon and localized in both the North Fork and Little Dog Slaughter study sections. Blackside dace have historically been found in both streams but little information was known about distribution and abundance. Populations of this species in other DBNF streams are known to fluctuate dramatically from year to year (Pers comm. Victoria Bishop, Fisheries Biologist-DBNF).

We do not have any explanation for why this species apparently was present in such low numbers. Possible explanations for low apparent abundance include both sampling error and habitat impairment. Some of the larger pools, especially in North Fork, may have been too large for effective electrofishing. North Fork and Little Dog Slaughter Creek both contain a layer of silt that covers large amounts of substrate in pools. Off Highway Vehicle (OHV) use in the area could be the cause for the silt load in both streams. We also observed bait fisherman seining just upstream of the Forest Service Rt. 195 culvert within the North Fork study section. Both of these activities can be detrimental to fish populations and are common in the DBNF. Bait seining also occurs in Big Lick Branch and Ned Branch, which are blackside dace streams found within the DBNF. The Bunches Creek's watershed and the Forest Service section of Ryans Creek showed evidence of high OHV use with numerous trails and stream crossings.

Creek chubs were ubiquitous throughout both study sections. Their range in Little Dog Slaughter Creek extended nearly to where the stream dried up completely. This ability to support fish suggests that Little Dog Slaughter Creek could be a candidate to receive transplants of additional blackside dace. A potential fish barrier exists 1.6 kilometers above the confluence of North Fork on Little Dog Slaughter Creek. In the future, we would recommend that the remaining headwaters of North Fork be surveyed to complete our knowledge of blackside dace distribution and relative abundance in this system.

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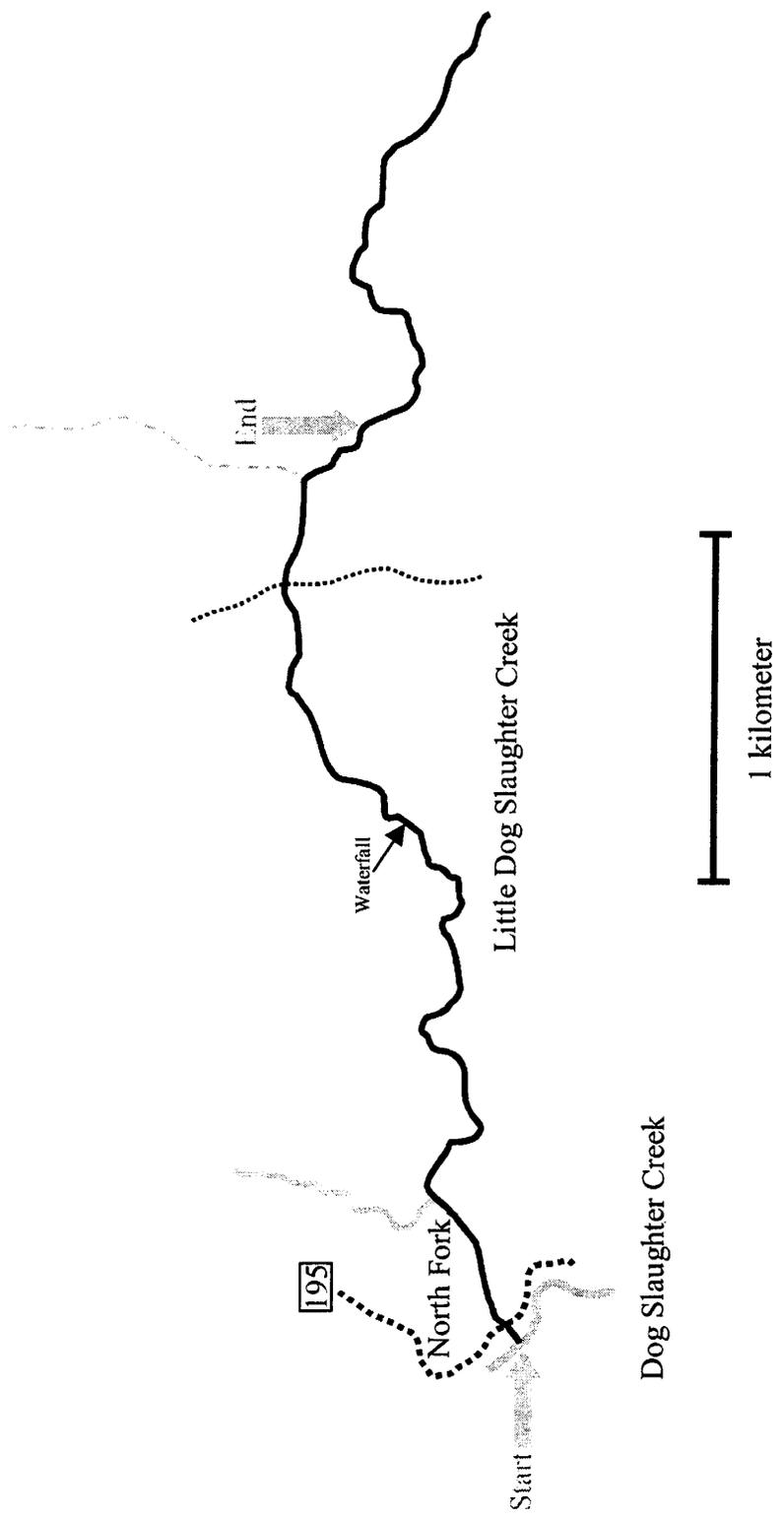


Figure 1. Map showing the North Fork and Little Dog Slaughter Creek study sections, Daniel Boone National Forest, KY. The gray lines show streams not surveyed, the dashed line is Forest Service Rt. 195, and the dotted line is an Off Highway Vehicle trail.

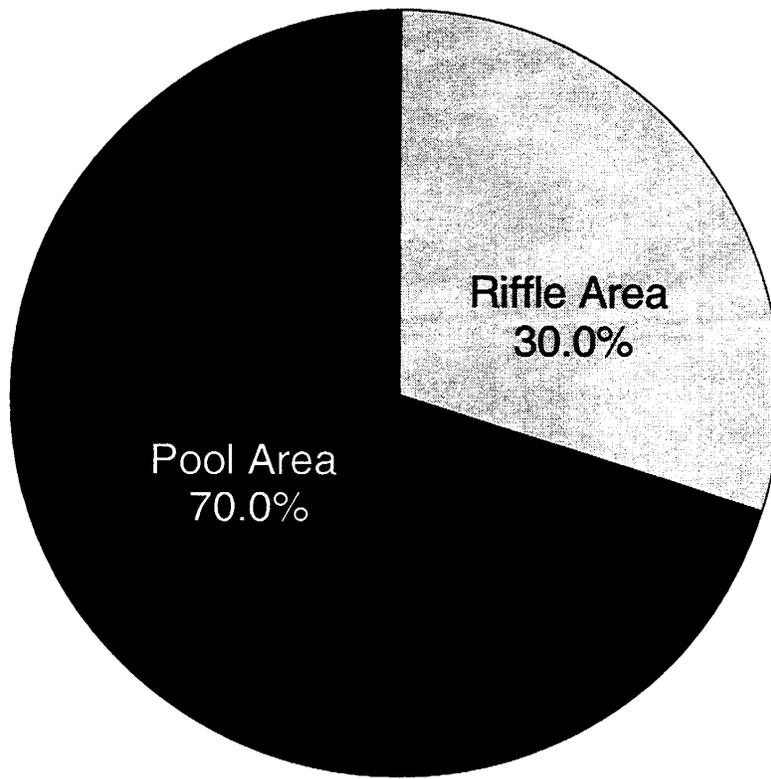


Figure 2. Percent pool and riffle surface area present in the Little Dog Slaughter Creek study section.

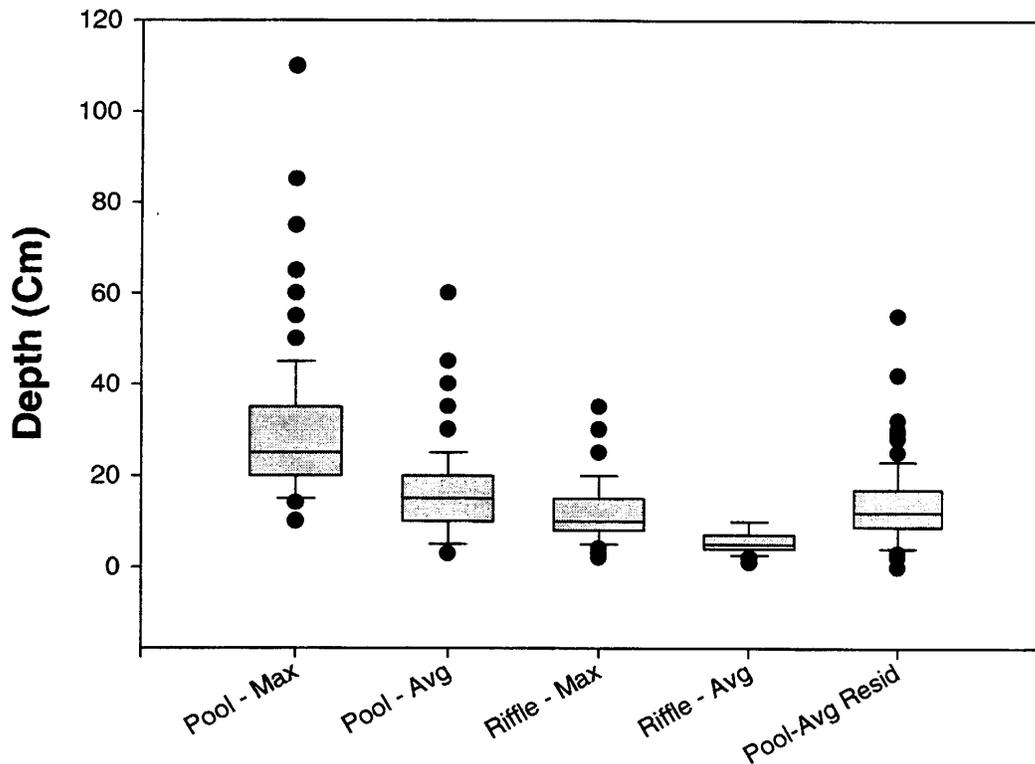


Figure 3. Box plots representing maximum and average depths for pools and riffles, and average residual pool depths for the Little Dog Slaughter Creek study section. The boxes enclose the middle 50% of the observations, the bar in the center of the boxes represent the median, and the capped lines extending above and below the boxes represent the 90% and 10% quartiles.

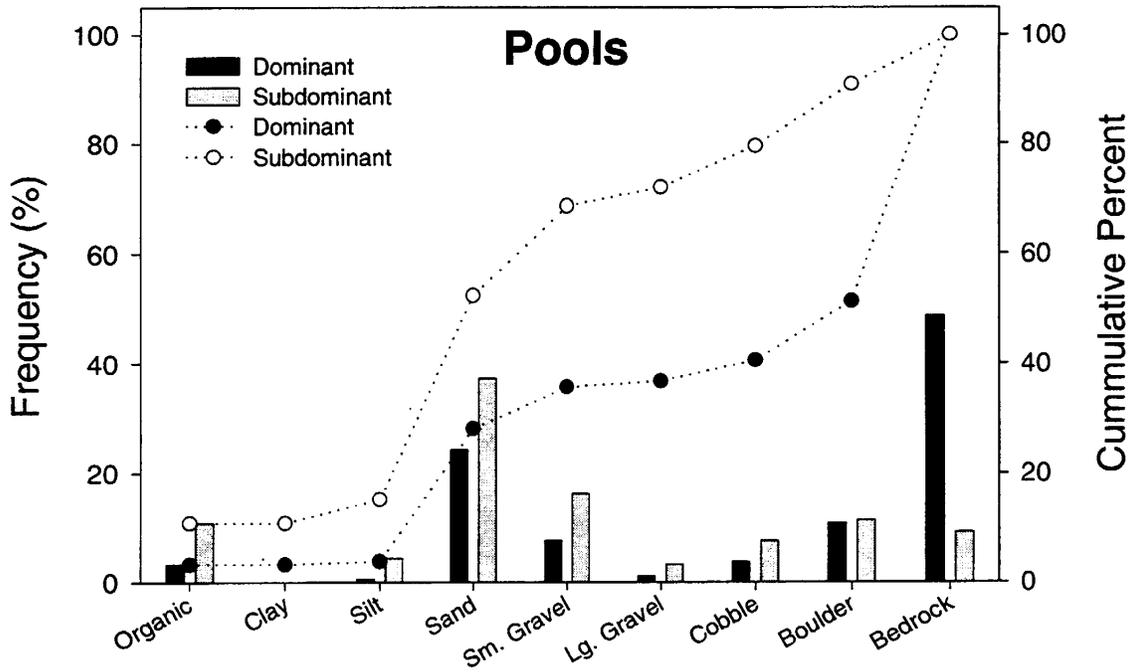


Figure 4. Substrate composition for pools in the Little Dog Slaughter Creek study section. The bars represent the percent of stream bottom covered with substrate type. The line graph represents cumulative percent.

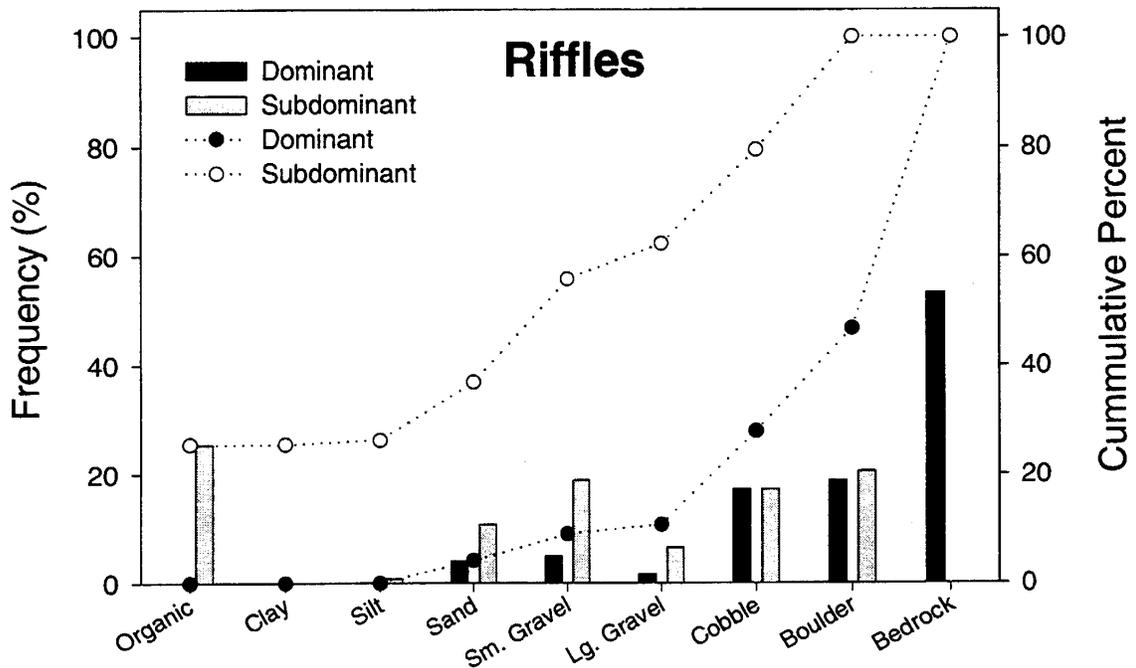


Figure 5. Substrate composition for riffles in the Little Dog Slaughter Creek study section. The bars represent the percent of stream bottom covered with substrate type. The line graph represents cumulative percent.

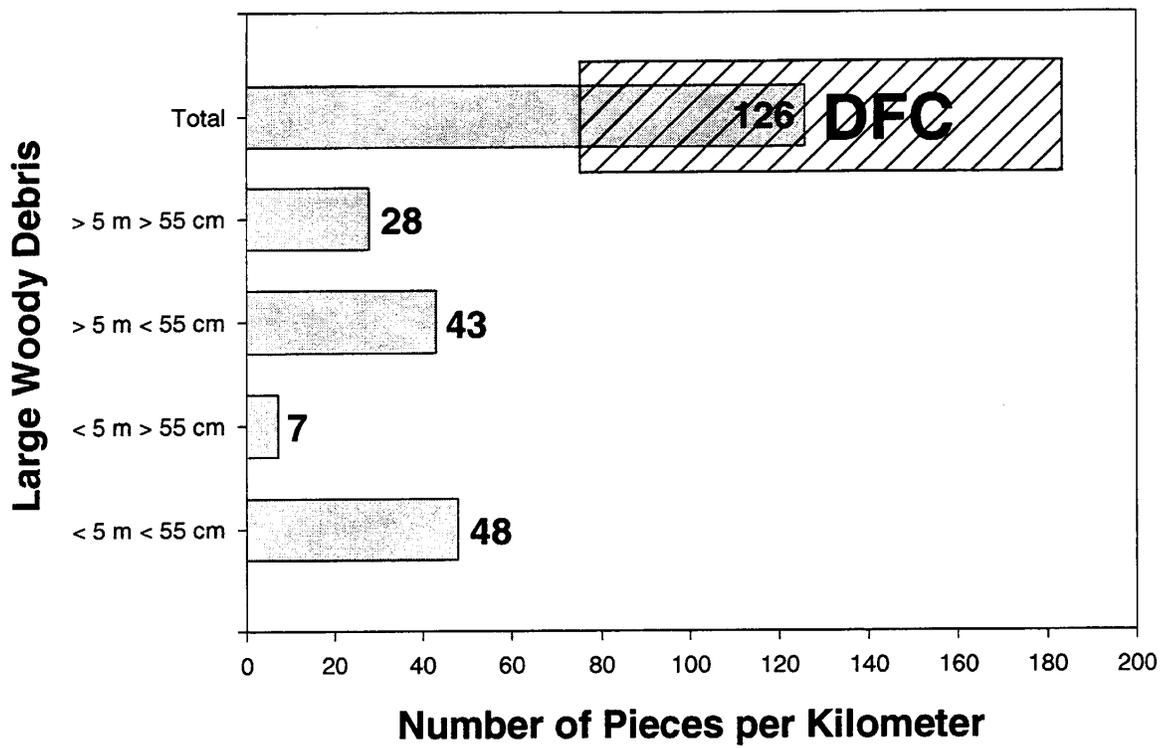


Figure 6. Pieces of large woody debris per kilometer in the Little Dog Slaughter Creek study section.

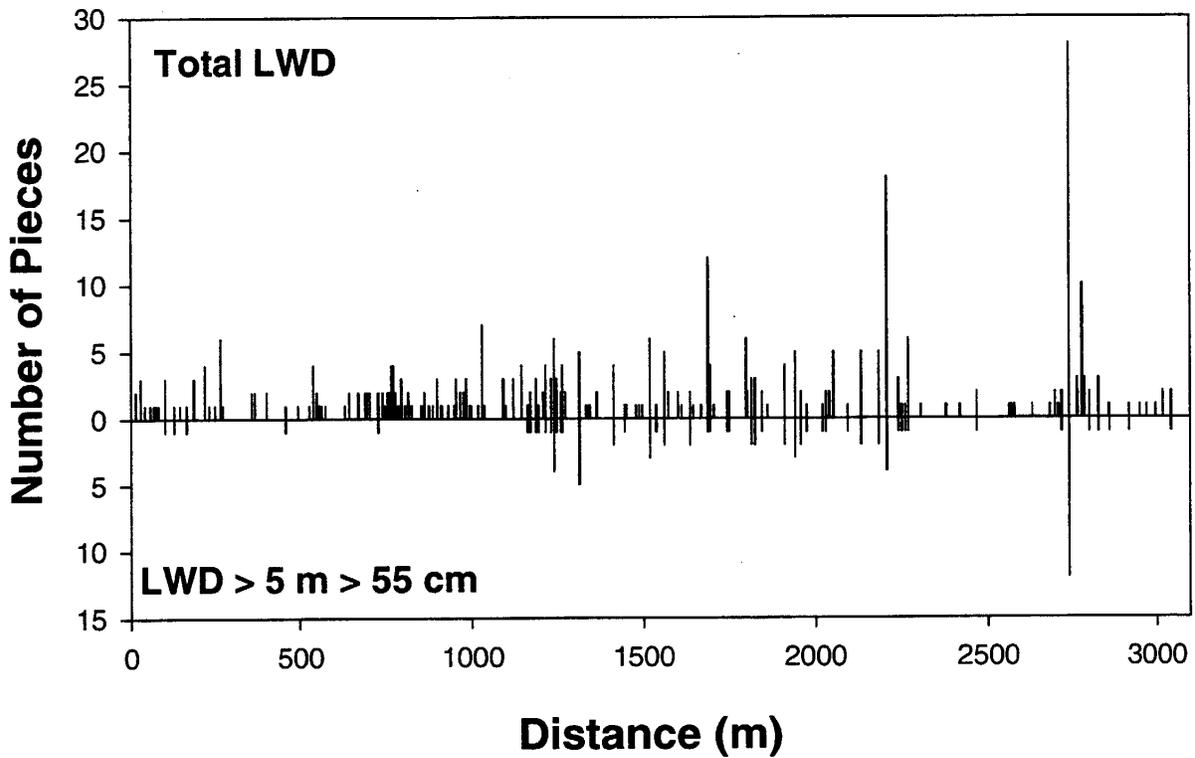


Figure 7. Distribution and total abundance of large woody debris in the Little Dog Slaughter Creek study section.

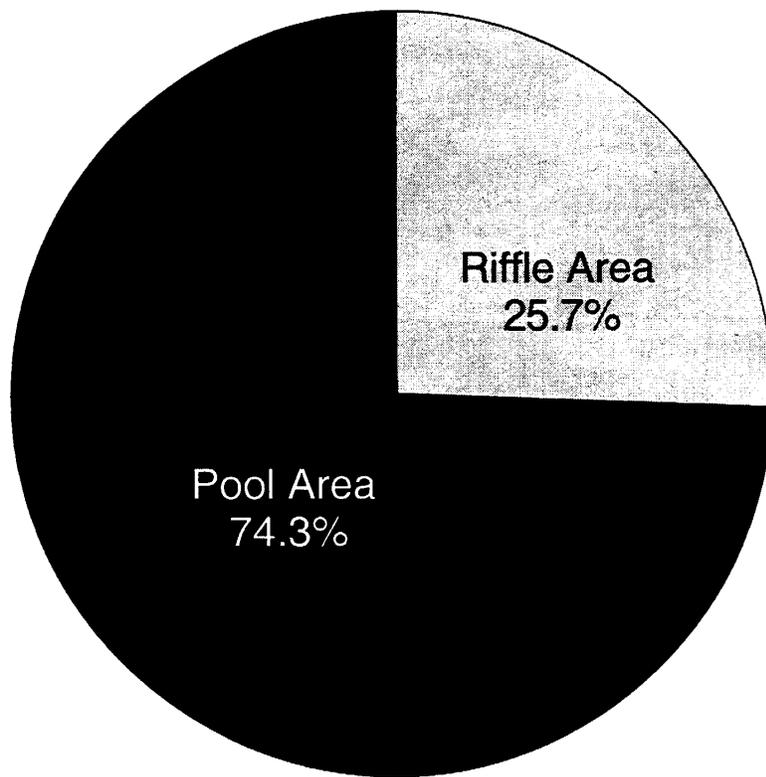


Figure 8. Percent pool and riffle surface area present in the North Fork study section.

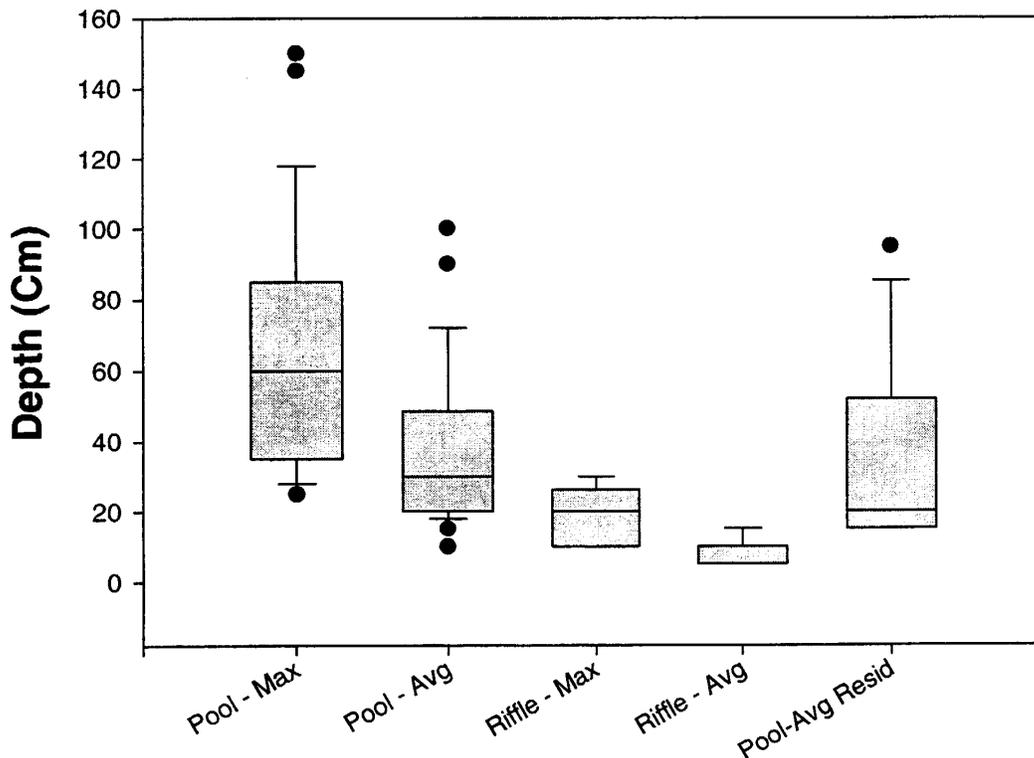


Figure 9. Box plots representing maximum and average depths for pools and riffles, and average residual pool depths for the North Fork study section. The boxes enclose the middle 50% of the observations, the bar in the center of the boxes represent the median, and the capped lines extending above and below the boxes represent the 90% and 10% quartiles.

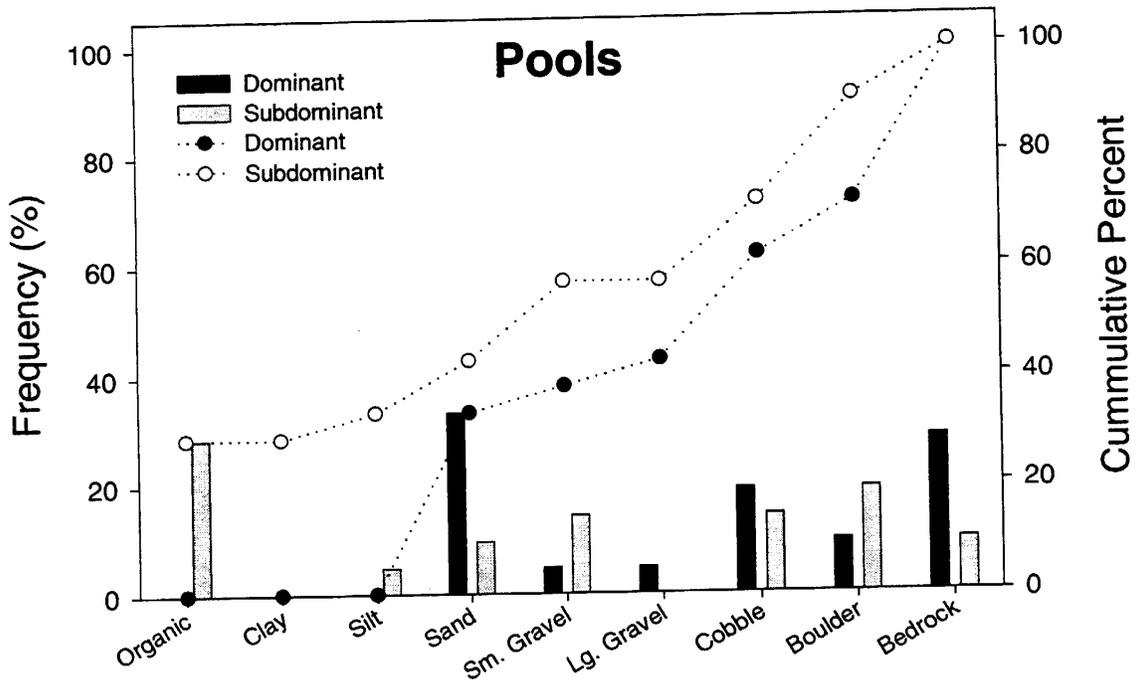


Figure 10. Substrate composition for pools in the North Fork study section. The bars represent the percent of stream bottom covered with substrate type. The line graph represents cumulative percent.

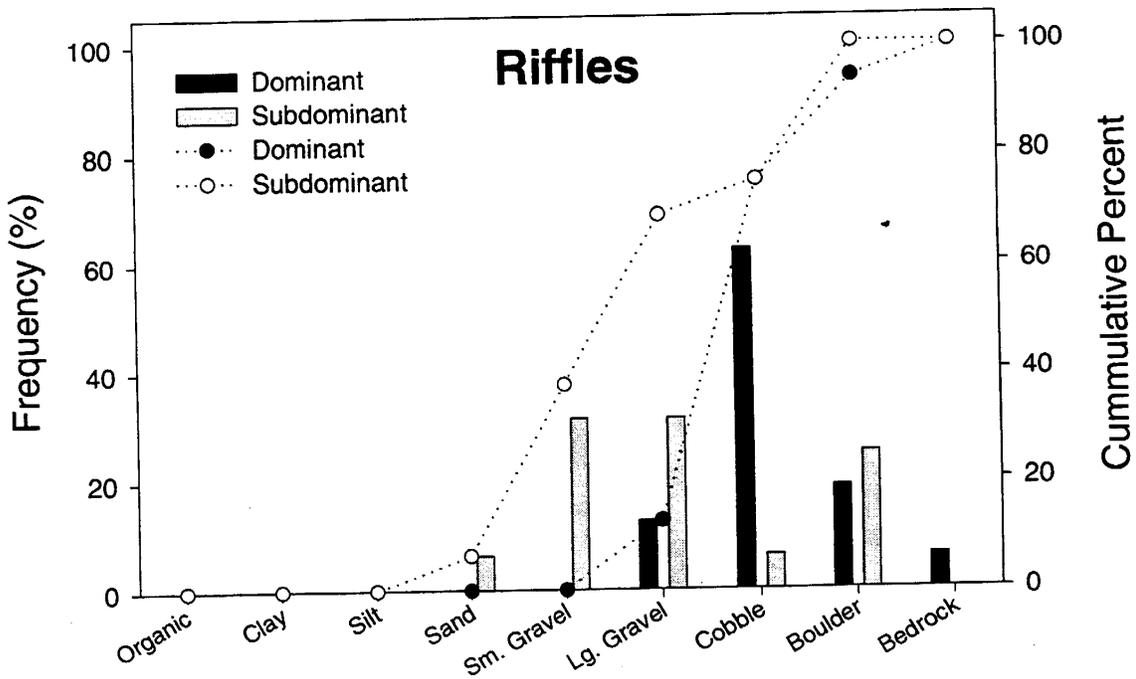


Figure 11. Substrate composition for riffles in the North Fork study section. The bars represent the percent of stream bottom covered with substrate type. The line graph represents cumulative percent.

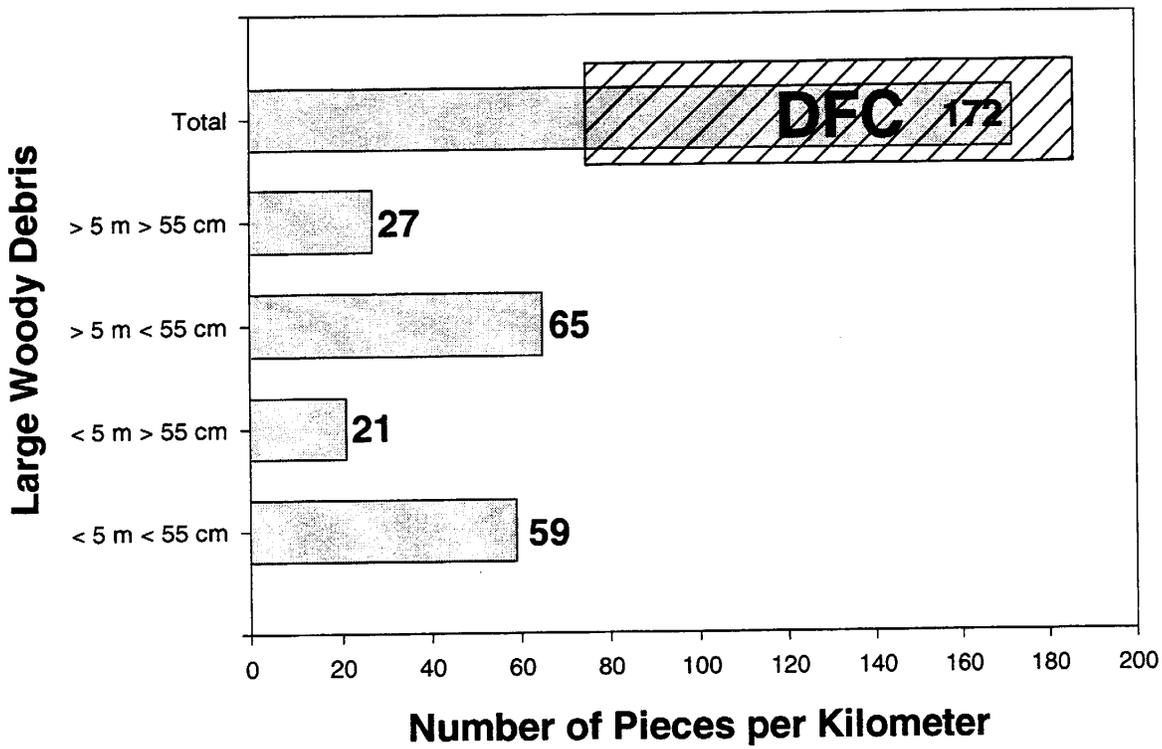


Figure 12. Pieces of large woody debris per kilometer in the North Fork study section.

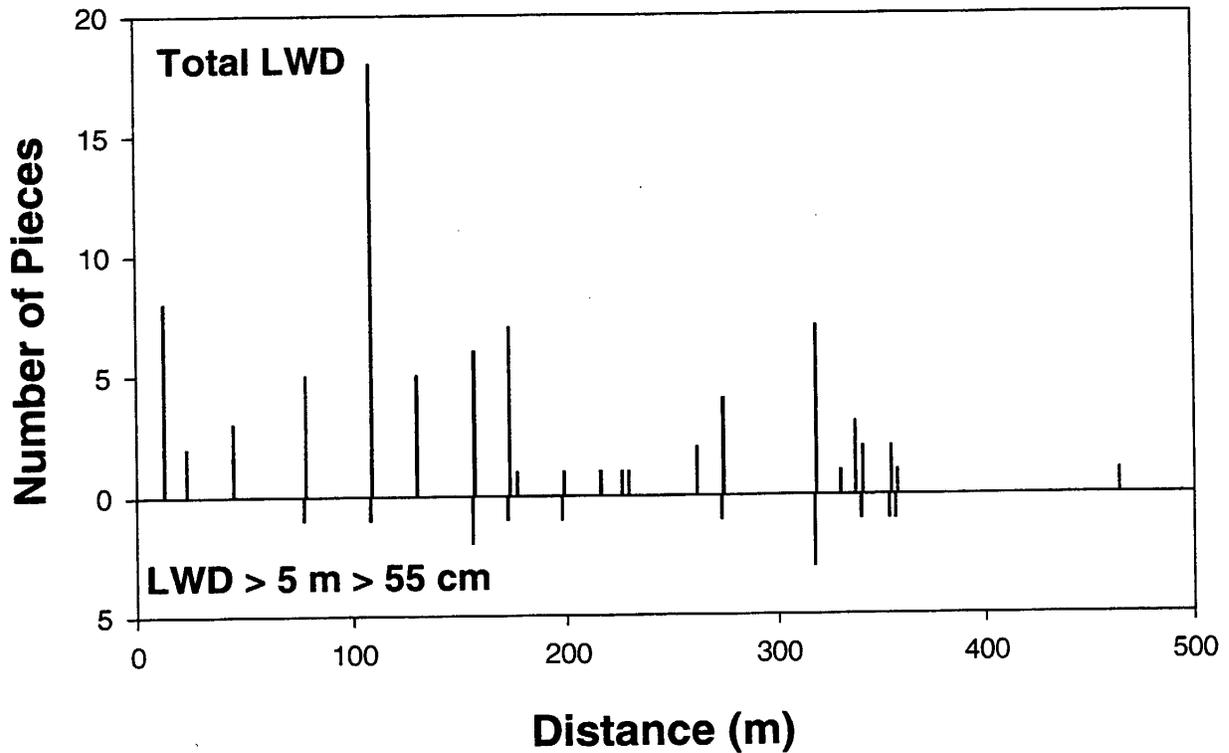


Figure 13. Distribution and total abundance of large woody debris in the North Fork study section.

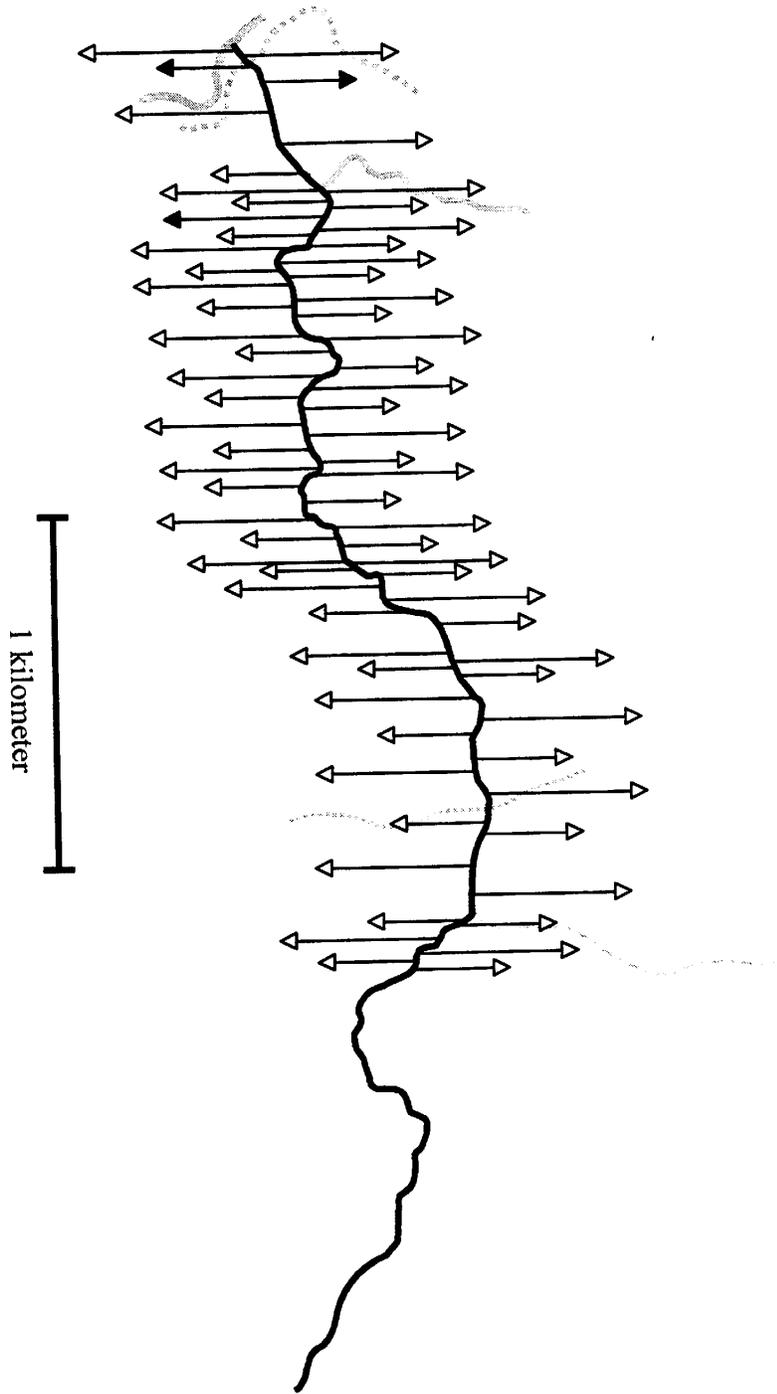


Figure 14. Distribution of blackside dace in the North Fork and Little Dog Slaughter Creek study sections. Filled triangles represent presence while open triangles represent absence. The North Fork study section is based on only electrofished pools, while the Little Dog Slaughter study section includes snorkeling and electrofishing for both pools and riffles.

Appendix 1a. Substrate classification criteria.

SUBSTRATE CLASSES

1	organic debris
2	clay
3	silt
4 silt- 2mm	sand
5 2-10mm	small gravel
6 1-10cm	large gravel
7 11-30cm	cobble
8 30cm	boulder
9	bedrock

Appendix 1b. Large woody debris (LWD) classification criteria.

LWD SIZE CLASSES

- Size 1) <5 m in length and < 55cm in diameter
- Size 2) <5 m in length and > 55cm in diameter
- Size 3) >5 m in length and < 55cm in diameter
- Size 4) >5 m in length and < 55cm in diameter