

## ABUNDANCE AND DIVERSITY OF MACROINVERTEBRATES IN TROUT STREAMS

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### ABSTRACT

A previous study showed no evidence for competition between brook trout and brown trout in streams of central Pennsylvania. To explain this result, we hypothesized that streams containing both trout species should have a larger diversity and abundance of macroinvertebrates than streams with only one species. We found significant differences in macroinvertebrate abundance and diversity between the four streams used in the previous study, though these differences did not conclusively support our hypothesis.

*Keywords: Abundance, diversity, macroinvertebrates, streams, trout*

### INTRODUCTION

Brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*) are both found in Pennsylvania streams, where they may compete for common resources, such as food and habitat. Because both species occupy similar niches in the stream community, there should be a high level of competition. However, contrary to expectation, Humenay et al. (2000) found no differences in body size of brook and brown trout between Pennsylvanian streams with both species and those with only one species. They suggested that a larger food supply in two-trout streams may have prevented effects of competition on body size in these fishes. As a follow-up study, we hypothesized that Tipton Run and Big Fill, the streams containing both species of trout should have a larger abundance and diversity of macroinvertebrates, than Piney Creek and Three Springs Run, streams with only one species of trout.

### FIELD SITES

We collected macroinvertebrate samples from four Blair County streams in Central Pennsylvania. Piney Creek contains wild brown trout (Humenay et al. 2000). We sampled approximately 150 yards downstream from where T431 crosses Piney Creek. The substrate of this creek varied from cobblestone to sand and silt. Within our 100-yard sample site, there were riffles and pools in relatively even numbers and size (Fig. 1).

Tipton Run contains both native brook trout and wild brown trout (Humenay et al. 2000). We sampled  $\frac{3}{4}$  mile below the Tipton Reservoir. The substrate at this creek

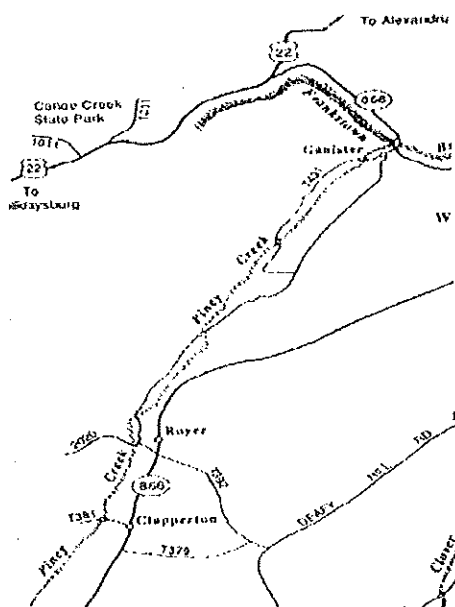


Figure 1. Map showing the location of Piney Creek in Blair County, Pennsylvania

was primarily boulders with some cobbles. The riffles outnumbered the pools, as the stream is rather fast moving through out the 100-yard sample site (Fig. 2).

Three Springs Run, which runs into the Tipton Reservoir, also contained only brook trout (Humenay et al. 2000). We sampled where road 4023 crosses Three Springs Run, about a ¼ mile from where Three Springs Run flows into Tipton Run. The substrate was a mixture of cobbles and boulders. Three Springs Run had a substantial number of riffles in the 100-yard sampling area (Fig. 2).

Big Fill contained both brook and brown trout (Humenay et al. 2000). We sampled where Big Fill runs parallel with Route 350. Big Fill was deeper than the other streams thus creating deep holes as well as fast moving riffles in our 100 yard sampling sight (Fig. 2).

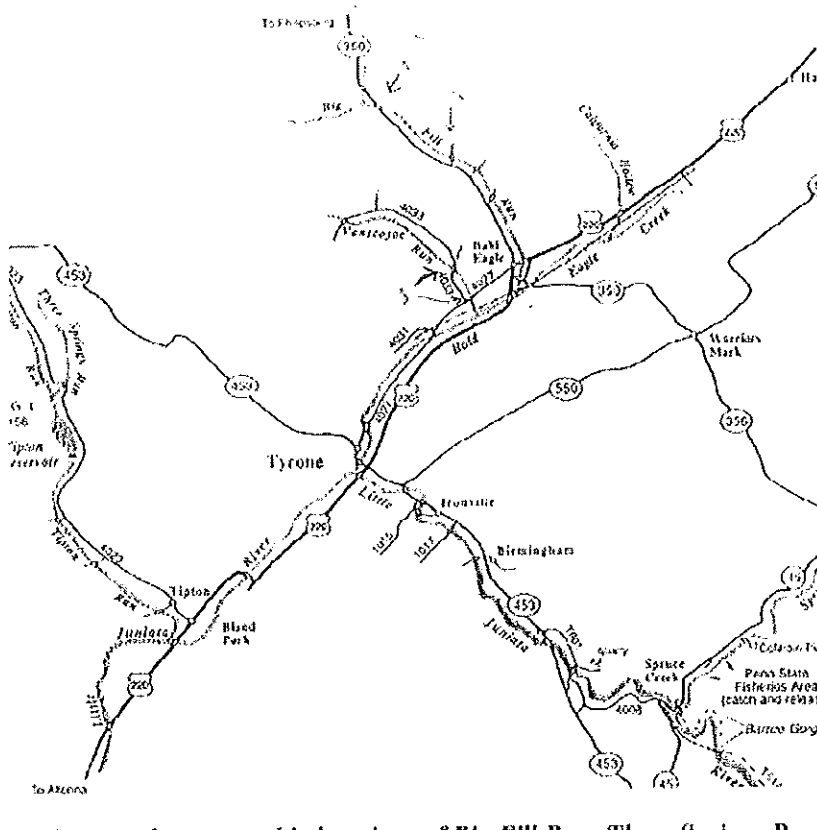


Figure 2. Map showing the locations of Tipton Run, Three Springs Run and Big Fill in Blair County, Pennsylvania.

## METHODS AND MATERIALS

Five macroinvertebrate samples were collected from 100-yard riffle sections in each stream using D-nets (height = 27.5 cm, width = 33 cm). For each sample, the substrate was kicked within 1 m of the net for 1 minute. The total number of macroinvertebrates collected in a stream were compared among streams using a Chi-square test. Taxic richness, Simpson's Diversity Index, and taxic equitability were also compare among streams.

In each stream, water temperature and conductivity were measured with a conductivity meter, pH with a pH meter, and dissolved oxygen with an oxygen meter. Flow rate was estimated by recording the time it took a leaf to move 1 m.

## RESULTS

Macroinvertebrate abundance differed significantly among the four streams ( $\chi^2 = 544.32$ ,  $df = 3$ ,  $P < 0.01$ ) (Table 1). Several pairwise comparisons among the streams were also significant (Tipton vs. Piney:  $\chi^2 = 292.43$ ,  $df = 1$ ,  $P < 0.01$ ; Tipton vs. Three Springs:  $\chi^2 = 31.87$ ,  $df = 1$ ,  $P < 0.01$ ; Big Fill vs. Piney:  $\chi^2 = 152.27$ ,  $df = 1$ ,  $P < 0.01$ ; and Big Fill vs. Three Springs:  $\chi^2 = 109.12$ ,  $df = 1$ ,  $P < 0.01$ ).

Table 1. Number of macroinvertebrates of various taxa collected in 4 Pennsylvania trout streams.

Species Found	Piney Creek	Big Fill	Tipton Run	Three Springs	Total
Diptera	4	7	2	1	14
Plecoptera	21	38	25	11	95
Ephemeroptera	316	72	20	19	427
Decapoda	1	4	2	3	10
Trichoptera	210	130	88	16	444
Annelida	19	19	32		70
Anisoptera		54		5	59
Simuliidae			1		1
<i>Gammarus</i>	350				350
Megaloptera	1		1		2
<b>Total Collected</b>	<b>922</b>	<b>324</b>	<b>171</b>	<b>55</b>	<b>1472</b>

Table 2. Species richness, diversity and equitability of macroinvertebrates in 4 Pennsylvania streams.

	Piney Creek	Big Fill	Tipton Run	Three Springs
Taxic diversity	3.17	3.91	2.98	3.92
Taxic equitability	0.396	0.559	0.373	0.653
Taxic richness	8	7	8	6

Table 3. Physical and chemical features of 4 Pennsylvania streams.

Physical and chemical factors	Piney Creek (3/28/2001)	Tipton Run (4/4/2001)	3 Springs (4/4/2001)	Big Fill (4/10/2001)
Mean pH	8.33	5.72	5.69	5.89
Temperature (°C)	9.5	7.6	8	9.6
Conductivity (mS/cm)	0.362	0.059	0.054	0.049
Flow Rate (m/s)	0.79	0.83	0.65	0.42
Dissolved oxygen (ppm)		11.7	12	12

Macroinvertebrate abundance appeared to vary independently of whether a stream had one or two species of trout. The highest abundance occurred in Piney Creek, which had the highest pH and conductivity (Tables 1 & 3). Taxic richness and diversity were broadly similar among the four streams (Table 2).

## DISCUSSION

Contrary to expectation, the highest macroinvertebrate abundance was found in the stream (Piney Creek) with only one trout species. On the other hand, the other 1-trout stream, Three Springs, had the lowest abundance of macroinvertebrates, as expected. The 2-trout streams, Tipton Run and Big Fill, had intermediate macroinvertebrate abundances. Perhaps, Piney Run had the highest macroinvertebrate abundance because it runs over limestone and thus has a higher pH and conductivity than the other three streams. Limestone streams are nutrient-rich and can support more life than acidic, softwater streams (Shultz 1999). If only the 3 acidic streams are compared, it can be seen that the 2-trout streams, Tipton Run and Big Fill, had higher macroinvertebrate abundances than the 1-trout stream, Three Springs Run, as expected.

However, no consistent differences in taxic richness and diversity were observed among the 4 streams. Further work should only compare streams with similar water chemistry and other environmental features, and should estimate biodiversity based on taxonomic identifications at the species level rather than higher levels. To permit more rigorous statistical analyses, further work should also not lump together macroinvertebrate samples from each stream, as was done here.

## ACKNOWLEDGMENTS

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