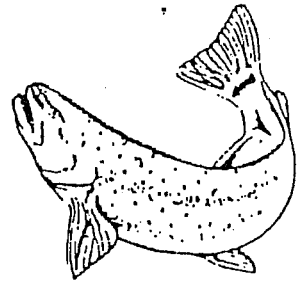


# AQUATIC RESOURCE CONSULTING



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## **ELECTROFISHING SURVEY OF SWIFTWATER CREEK**

Prepared for

**Paradise Township  
Supervisors**

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## INTRODUCTION

On 13 October 2000, Aquatic Resource Consulting (ARC) conducted an inventory of the fish community of Swiftwater Creek at the request of the Paradise Township Supervisors. In recent years, significant residential and commercial development has occurred in the watershed, and this trend is projected to continue. Increased surface runoff, groundwater depletion, and impacts from regulated discharges associated with these activities have the potential to degrade the existing water quality, habitat, and aquatic biota of the stream. This survey is designed to establish a database of information describing the present fishery. Future inventories will permit monitoring of changes that may occur related to impacts from land use. In conjunction with this survey, ARC also sampled the aquatic macroinvertebrate community at several sites on Swiftwater Creek. Those results are available in a separate report (Baylor 2000).

## STREAM DESCRIPTION

Swiftwater Creek is a second order tributary to Paradise Creek that originates on the Pocono Plateau adjacent the Rt. 380/Rt. 940 interchange approximately 3 miles west of Mt. Pocono, PA (Figure 1). A tributary, Indian Run, joins the main branch just upstream from Swiftwater, PA, along Route 611. From this point, the stream flows eastward through a relatively narrow, steep valley before its juncture with Forest Hills Run and Paradise Creek near Henryville, PA. The watershed is heavily forested, and the primary land use is residential housing with commercial development concentrated along the Rt. 611 corridor.

Water analyses conducted by the Monroe County Planning Commission indicate the water is slightly alkaline with relatively low nutrient (nitrate and phosphate) levels and low mineral content. Several sewage treatment plants discharge waste into Swiftwater Creek, including facilities at Pocono Manor, the Pocono Mountain School District, and Aventis-Pasteur (a vaccine production facility). Swiftwater Creek is classified by PA DEP as a High Quality Coldwater Fishery.

Figure 1. Swiftwater Creek watershed (outlined).



## METHODS

Portions of Swiftwater Creek were sampled using a Coffelt BP1C backpack variable-voltage electrofishing unit with handheld electrodes and nets. Three consecutive runs were made in an upstream direction at each station to permit estimates of trout abundance (numbers) and biomass (weight per unit area). All fish species were identified and released. Trout were also weighed and measured.

Sampling locations were as follows (Figure 2, and Figures 3a, 3b, and 3c.):

- (A) Upper – begin approximately 300 feet above Swiftwater Preserve property line (cable); end approximately 300 feet below Rt. 314 bridge (sampling distance = 295 feet).
- (B) Middle – adjacent open field along Rt. 314 beside Aventis stormwater detention pond; begin and end at riffle areas (sampling distance = 360 feet).
- (C) Lower – begin at riffle area approximately 150 feet above Rt. 314 bridge off Lower Swiftwater Rd.; end above pool area (sampling distance = 190 feet).

## RESULTS AND DISCUSSION

### Fish Species

Three species of salmonids – fish in the trout and salmon family – whose distribution is limited to relatively unpolluted, coldwater ecosystems, dominated in collections from Swiftwater Creek (Tables 1 and 2). Brown trout (*Salmo trutta*) was by far the predominant species. Next in abundance were wild rainbow trout (*Oncorhynchus mykiss*), a species recently reclassified as a salmon based upon its genetic makeup and original distribution (coastal streams of the western U.S.). Only a few wild brook trout (*Salvelinus fontinalis*), the only salmonid native to the Pocono area and the eastern U.S., were found. Three other species often associated with wild trout in Northeastern streams – slimy sculpin (*Cottus cognatus*), white sucker (*Catostomus commersoni*), and longnose dace (*Rhinichthys cataractae*) – were also collected. In addition, four stocked trout (three brown trout, one rainbow trout) were taken at the lower station and one stocked rainbow trout was recovered at the upper station. The criteria for identification of stocked (hatchery) trout were size, pigmentation, and fin condition (compared to wild trout, hatchery trout are generally larger, less colorful, and the fins are rounded from erosion caused by confinement in rearing ponds and raceways).

Figure 2. Sampling locations on Swiftwater Creek, 13 October 2000.

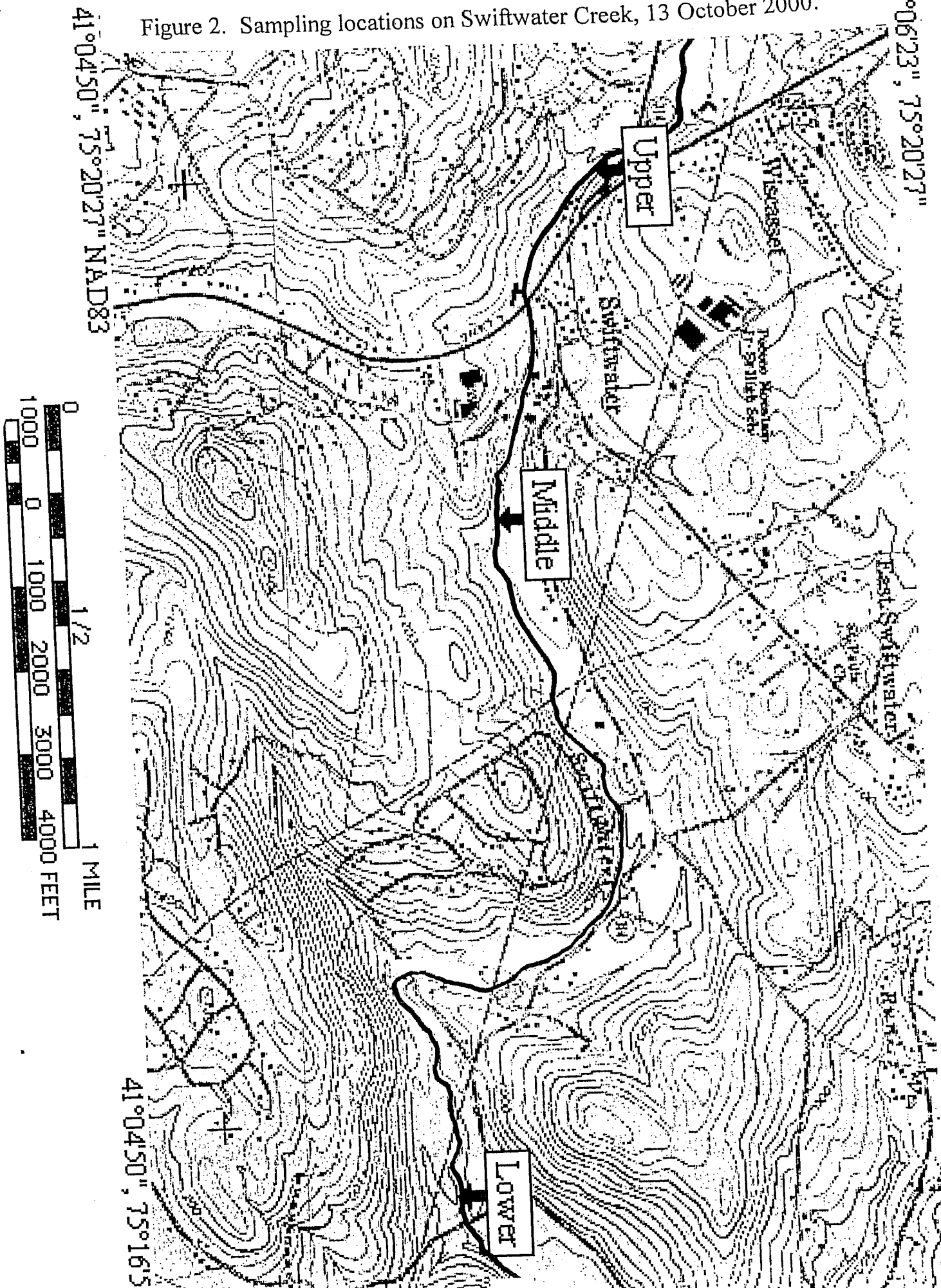




Figure 3a. Upper sampling location on Swiftwater Creek.

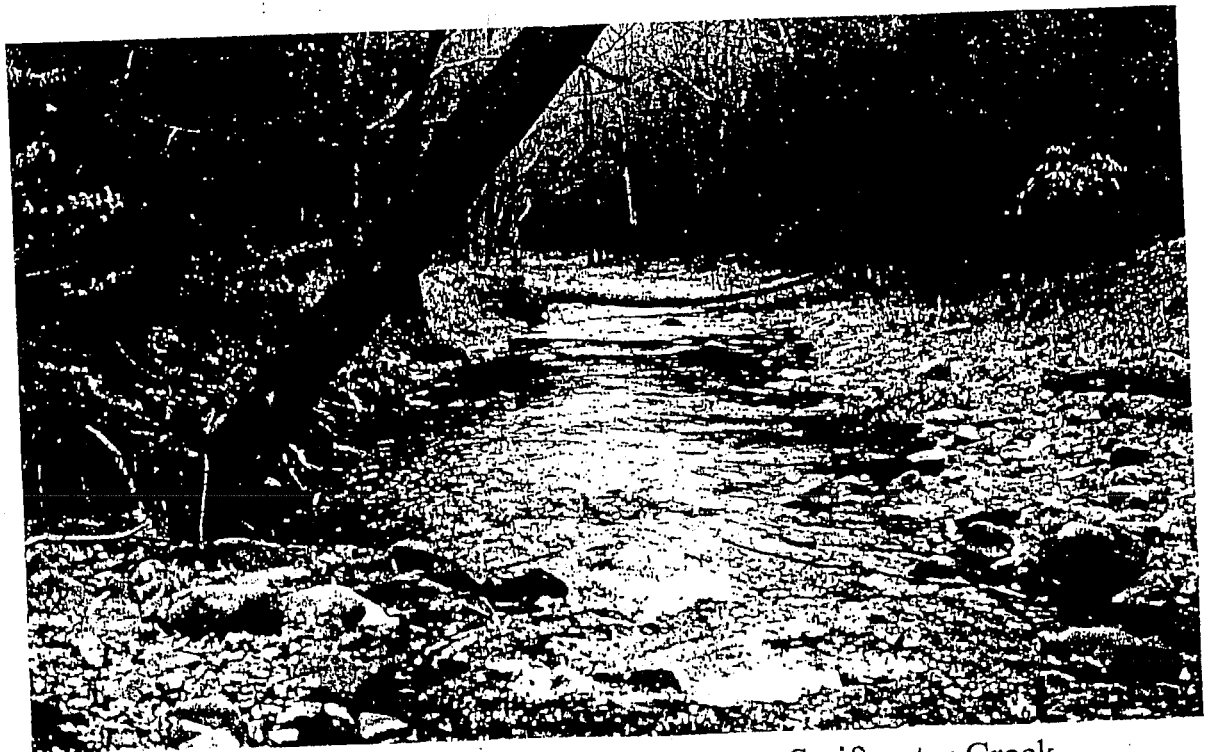


Figure 3b. Middle sampling location on Swiftwater Creek.



**Figure 3c.** Lower sampling location on Swiftwater Creek.

The four most abundant fish taxa in Swiftwater Creek - brook, brown and rainbow trout, and sculpins - are classified as coldwater species that subsist primarily on aquatic insects and fish, and are intolerant to environmental pollutants and habitat degradation (Table 2). Brook trout, the primary inhabitant of many headwater Pocono streams, are particularly sensitive to extremely low concentrations of heavy metals, chlorine (used to disinfect treated waste), and other dissolved contaminants. All salmonids require high dissolved oxygen levels and are stressed when concentrations of organic (=oxygen demanding) wastes are excessive. Most trout cannot survive temperatures above 20 degrees C (68 degrees F) for prolonged periods. In addition, dependence on aquatic macroinvertebrates, including many pollution intolerant mayfly, caddisfly, and stonefly species, as the primary food source makes resident fish species in Swiftwater Creek particularly vulnerable to even small changes in water quality and habitat disturbance. Sculpins, for example, reproduce by depositing adhesive eggs on the underside of cobble and boulders; siltation caused by sediment from surface runoff can lead to reproductive failure. Sedimentation can also suffocate trout eggs and fry that incubate for several months in gravel beds (redds) constructed by fish during reproduction. Catastrophic flows from excessive runoff during storm events can destroy redds by scouring.

**Table 1.** Summary of electrofishing data at three stations on Swiftwater Creek on 13 October 2000. A slash (-) indicates species was absent.

<u>STATION</u>	<u>Upper</u>	<u>Middle</u>	<u>Lower</u>
Length (feet)	295	360	190
Avg. width (feet)	18	19	13
Area – acres	0.121	0.158	0.056
Hectares	0.049	0.064	0.023

<u>FISH SPECIES</u>	<u>Number Collected</u>		
Brown trout ( <i>Salmo trutta</i> )			
Wild	90	206	243
Stocked	0	0	3
Rainbow trout ( <i>Oncorhynchus mykiss</i> )			
Wild	24	2	1
Stocked	1	-	1
Brook trout ( <i>Salvelinus fontinalis</i> )	3	6	-
Slimy sculpin ( <i>Cottus cognatus</i> )	abundant	abundant	abundant
White sucker ( <i>Catostomus commersoni</i> )	-	-	rare
Longnose dace ( <i>Rhinichthys cataractae</i> )	-	-	rare



**Table 2.** Classification of fish species collected at three stations on Swiftwater Creek on 13 October 2000.

<u>SPECIES</u>	<u>Distribution</u>	<u>Temperature Class</u>	<u>Tolerance</u>	<u>Trophic Class</u>
Brown trout	exotic	coldwater	intolerant	top carnivore
Rainbow trout	exotic	coldwater	intolerant	top carnivore
Brook trout	native	coldwater	intolerant	top carnivore
Slimy sculpin	native	coldwater	intolerant	benthic invertivore
White sucker	native	coolwater	tolerant	generalist feeder
Longnose dace	native	coolwater	moderate	benthic invertivore

**Key:**

**Distribution:** Exotic = introduced; native = indigenous to region.

**Temperature class:** Coldwater = <22 degrees F; coolwater = 22-24 degrees F; warmwater = >24 degrees F.

**Tolerance:** To environmental perturbation

**Trophic class:** Primary foraging strategy. For example, carnivores feed on other fish and insects. Invertivores feed primarily on aquatic insects. Generalist feeders are omnivores, i.e., feed on available forage (plants and animals).

The presence of a few dace and suckers in Swiftwater Creek, two groups which can tolerate warmer stream temperatures and are less sensitive to stream pollution, is not indicative of poor water quality. Such species often migrate from less pristine downstream areas. The distribution of longnose dace seems to be limited to small to medium-sized streams with torrential flows (steeper gradient). White suckers are considered a tolerant species that forages indiscriminately on bottom sediment (generalist feeder), but their distribution ranges from cold, mountainous brooks to warmer, lowland rivers.

### **Brown Trout**

Numbers and weight of wild brown trout at all three stations on Swiftwater Creek exceeded the PA Fish & Boat Commission's standard for Class A Wild Trout Waters (40 kg/hectare) – see Table 3. Estimated biomass at the lower site (246.8 kg/hectare) was more than 6 times the standard, and the value at the most upstream station above Swiftwater, PA, was more than double. These are extremely high values for a relatively infertile headwater stream. Both Devil's Hole Creek and the upper Paradise Creek in the nearby sub-watershed have trout biomass exceeding 120 kg/hectare (Hartzler 1999; Hartzler 2000). In the Pocono region, carrying capacities over 200 kg/hectare have been recorded on certain meadow portions of McMichael Creek (Hartzler 1990).

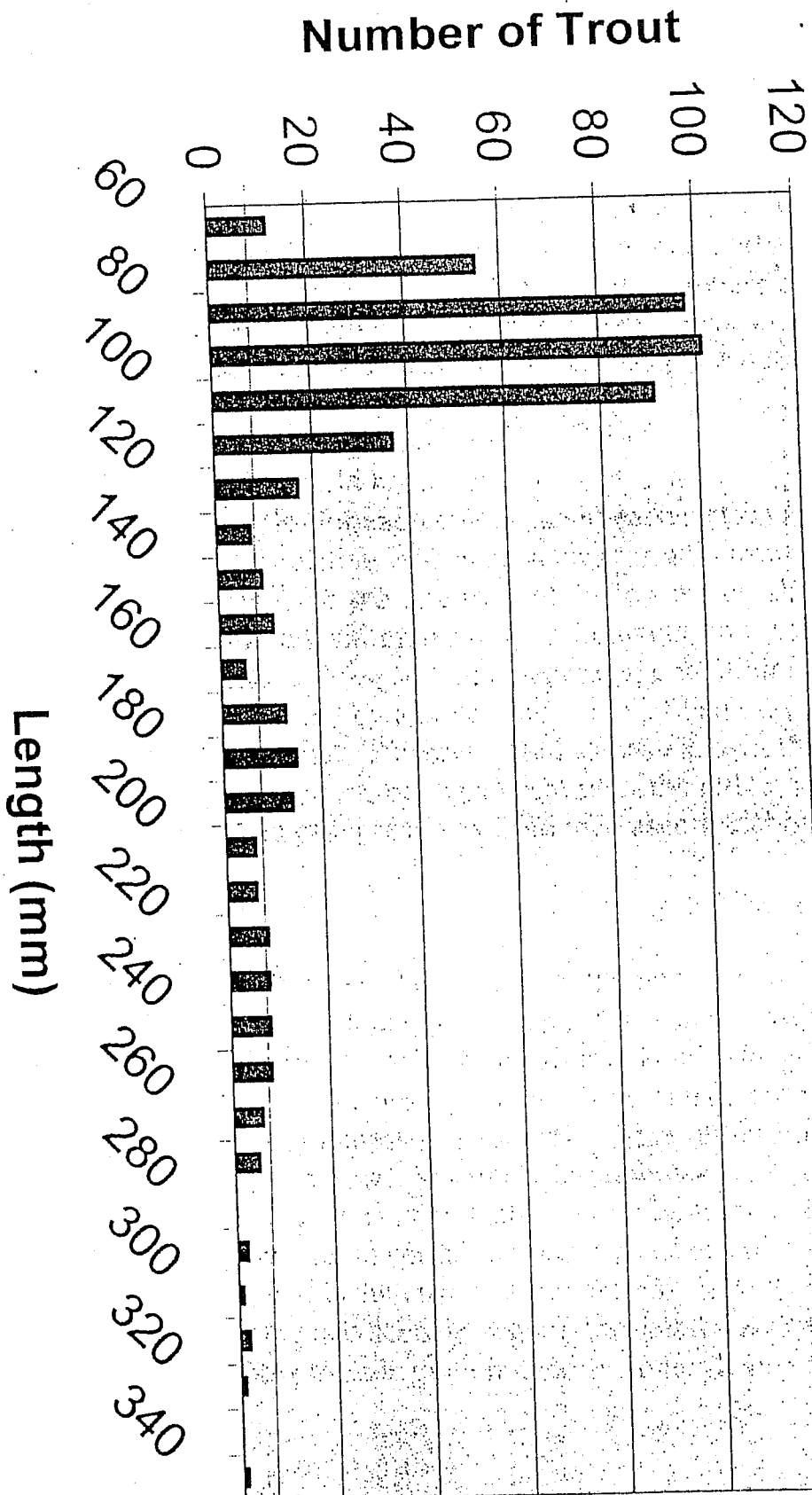
The large number of fingerling (<5 inches) trout collected at all sampling locations on Swiftwater Creek indicated excellent reproductive success and survival of age 0+ brown trout (Table 3). In fact, estimated numbers of this group – young-of-year brown trout (spawned in fall 1999) – averaged more than one fish per foot of stream at the lower station. Reproduction was lowest at the most upstream site. Several factors affect spawning success, including the number of mature fish, suitable substrate material (gravel and cobble), sediment load, stream gradient, and volume of flow.

Growth rates for wild brown trout are comparable to values found on other Pocono streams. Growth was estimated from a length-frequency (L-F) distribution, which graphs individual trout collected according to size (Figure 4). Peaks in the curve represent the average size of a particular age group, or cohort, of trout. For example, 0+ trout (young-of-year) averaged 90-100 mm in Swiftwater Creek at the time of sampling. Yearlings (1+) trout were 170-180 mm long at this time, with some variation above and below this value since all individuals do not grow at the same rate. Hence, the 60-120 mm and 121-200 mm groups in Table 3 correspond to the 0+ and 1+ age classes, respectively. Beyond 1+ years, the L-F distribution has limited value because of

**Table 3.** Data summary for wild brown trout collected by electrofishing survey of Swiftwater Creek on 13 October 2000.

		<b>STATION</b>		
		<u>Upper</u>	<u>Middle</u>	<u>Lower</u>
<b><u>BROWN TROUT</u></b>				
		<b>Number Collected</b>		
Size – mm	(inches)			
0-120	(0-4.7)	46	156	206
121-200	(4.8-7.9)	21	36	22
>200	(>7.9)	23	14	15
		<b>Population Estimate</b>		
Size – mm	(inches)			
0-120	(0-4.7)	62	173	224
121-200	(4.8-7.9)	22	40	23
>200	(>7.9)	24	14	15
		<b>Estimated biomass</b>		
Kg/hectare		105.1	77.8	246.8
(Pounds/acre)		93.8	69.5	220.4
		<b>Avg. Condition Factor (K)</b>		
Size – mm	(inches)			
0-120	(0-4.7)	0.99	0.94	0.97
121-200	(4.8-7.9)	0.92	0.93	0.84
>200	(>7.9)	1.03	0.95	0.91

# Length-Frequency Distribution for Wild Brown Trout on Swiftwater Creek



overlap in size among the ages classes. Larger fish must be aged from the microscopic examination of boney body parts (scales and otoliths).

A good balance exists among the different age (size) groups of trout in the wild brown trout population that helps to sustain the fishery. Young-of-year normally outnumber by several times the number of yearling fish, which in turn are more numerous than mature trout (2+ years and older), as natural mortality removes fish from the population. However, there are obviously sufficient numbers of older, spawning adults to assure good reproduction on Swiftwater Creek. Several wild brown trout over 305 mm (12 inches) were collected. The largest, at the upper station, measured 337 mm (13.3 inches).

In general, most of the wild brown trout collected were in good condition. Average condition factors (K) for each size group at each station are shown in Table 3. K measures a fish's weight relative to length; values for wild trout usually fall within the range 0.90-1.10. Except for yearling trout at the lower site, all groups of brown trout on Swiftwater Creek fell within this range. Competition for food and space among trout can affect weight gain or loss, so that a decline in condition could be attributed to intraspecific competition caused by an overabundance of fish rather than degradation of water quality or physical habitat. However, studies have shown that the condition of wild trout declines in late summer, perhaps because of the reduced biomass of aquatic insects larvae and depletion of fat reserves from increased metabolism due to higher water temperatures.

### Rainbow Trout

Rainbow trout may have established a reproducing population on Swiftwater Creek, particularly at the upper location. Twenty-four trout, mostly young-of-year, were collected at this site, and the average condition factor was good (Table 4). Two rainbow trout over 203 mm (8 inches), presumably yearling trout based upon a L-F distribution, were found. A biomass estimate for wild rainbow trout of 20 kg/hectare was calculated for this stream area. Several wild rainbows were also taken at the other two stations. The wild rainbow trout collected in Swiftwater Creek are undoubtedly the product of successful spawning in spring 2000 and 1999 by either mature stocked or wild trout. Unlike brook and brown trout, which reproduce in the fall, rainbows spawn in late winter or early spring and seem to require torrential flows to be successful. The distribution of wild rainbow trout is quite limited in Pennsylvania and other northeastern states.

Table. 4 Data summary for wild rainbow and brook trout collected by electrofishing survey of Swiftwater Creek on 13 October 2000. (A slash [-] indicates an insufficient number of fish were collected to perform the calculation.)

		<b>STATION</b>		
		<u>Upper</u>	<u>Middle</u>	<u>Lower</u>
<b><u>RAINBOW TROUT</u></b>				
<b>Number Collected</b>				
Size – mm	(inches)			
0-120	(0-4.7)	21	0	1
>120	(>4.7)	3	2	0
<b>Population Estimate</b>				
Size – mm	(inches)			
0-120	(0-4.7)	32	-	-
>120	(>4.7)	3	-	-
<b>Estimated biomass</b>				
Kg/hectare		20.0	-	-
(Pounds/acre)		17.9		
<b>Avg. Condition Factor (K)</b>				
Size – mm	(inches)			
0-120	(0-4.7)	1.00	-	0.96
>120	(>4.7)	0.90	0.88	-
<b><u>BROOK TROUT</u></b>				
<b>Number Collected</b>				
Size – mm	(inches)			
0-120	(0-4.7)	1	0	0
> 121	(>4.7)	2	6	0
<b>Avg. Condition Factor (K)</b>				
Size – mm	(inches)			
0-120	(0-4.7)	1.10	-	-
>120	(>4.7)	0.88	0.95	-

## Brook Trout

Brook trout, the only salmonid native to Pocono streams, were far less numerous on Swiftwater Creek than wild brown or rainbow trout. In fact, too few were taken to permit an estimate of biomass, although most individuals were in good condition (Table 4). Prior to the introduction of these two exotics – brown trout from Europe in the late 1800's and rainbow trout from the western U.S. shortly thereafter – brook trout were quite numerous in all coldwater streams in the Northeast, including the Poconos. Both brown and rainbow trout can tolerate warmer, more degraded conditions than brook trout. Not surprisingly, brown trout have supplanted brook trout on most warmer lowland waterways, and numbers of native brook trout in upstream reaches have diminished. The only areas where brook trout continue to thrive and resist this encroachment are more acid, headwater brooks which are sustained by upwelling groundwater (springs). However, in some Appalachian streams, rainbow trout have penetrated waterways where browns have failed, presenting a significant threat to the survival of native brook trout populations. This process may be occurring on Swiftwater Creek.

## SUMMARY

Swiftwater Creek has a fish community of relatively low diversity dominated by species intolerant to high water temperatures and environmental degradation. Wild brown trout (*Salmo trutta*) predominated in collections at the three locations electrofished. Biomass estimates for this species at all stations ranged from 2 to 6 times greater than the PA Fish & Boat Commission's standard (40 kg/hectare) for Class A Wild Trout Waters. Based upon the abundance of fingerling (<5 inches) trout, reproductive success at all stations was excellent. The wild brown trout populations at the three sampling areas were well balanced (all age groups well represented), and average condition factors for the various size groups of fish were good.

Wild rainbow trout (*Oncorhynchus mykiss*), whose distribution is quite limited in Pennsylvania and other Northeastern states, were also collected at all stations but were most numerous at the upper site. Only a few wild brook trout (*Salvelinus fontinalis*), the only salmonid native to the region, were found at the upper and middle sample areas; none were present at the lower site. Slimy sculpins (*Cottus cognatus*), another coldwater species restricted to undegraded headwater Pocono streams, were numerous at all stations. A few individuals of two taxa classified as coolwater species with a higher tolerance to environmental disturbance and pollutants - longnose dace (*Rhinichthys cataractae*) and white sucker (*Catostomus commersoni*) - were also collected at the lower site.

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