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SILVER CREEK FISHERY EVALUATION

by

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Annual Progress Report for 1986
Project No. F-71-R-11, Subproject III, Jobs 5a and 5b

A Cooperative project of:
Idaho Department of Fish and Game
Idaho State University
University of Idaho
The Nature Conservancy
Idaho Cooperative Fish and Wildlife Research Unit

Funding by:
Federal Aid in Fish Restoration
Idaho Department of Fish and Game
The Nature Conservancy

April 1987

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OBJECTIVES (all equal priority):

Overall Project Objective: Evaluate factors limiting trout production in Silver Creek

1. Assess species composition and abundance of yearling and older rainbow, brown and brook trout in both general regulations and catch and release sections. Estimate abundance of mountain whitefish. (Parker and Riehle)

2. Assess growth and condition of yearling and older rainbow, brown and brook trout (with and without hook scarring) throughout the Silver Creek system. (Parker and Riehle)

3. Evaluate movements of adult rainbow and brown trout throughout the Silver Creek system. (Parker and Riehle)

4. Estimate angler effort on different portions of the Silver Creek system. (Parker and Riehle)

5. Assess densities of juvenile rainbow and brown trout throughout the system. (Riehle)

6. Assess first-year growth of brown and rainbow trout at study sites throughout the system. (Riehle)

7. Assess habitat utilization by adult rainbow and brown trout, and evaluate possible changes in habitat utilization in response to human disturbances. (Parker)

8. Assess habitat utilization of age 0 brown and rainbow trout, and evaluate possible interspecific interaction regarding habitat utilization. (Riehle)

STUDY SITES

The section in Lower Stalker Creek was included to determine if it functions as a rearing area for trout and to assess movement (Fig.1). The section is located below Stalker Bridge, beginning at a stake midway to the confluence with Grove Creek and ending approximatly 200m above the confluence (Fig. 1, Table 1). The Cabin section is immediately below the tilted wooden bridge and ends at the last island past the TNC visitor center cabin. It represents a majority of the habitat within the catch and release area. The section from the lowest wooden bridge on Loving Creek down to Kilpatrick Bridge was sampled to assess the deeper habitat present there.

Within the general regulations area downstream, the Martin Bridge area contains a riparian zone with dense willow growth. The section extends from the bridge of the first IFG access for approximately 1 km. The Point of Rocks section begins 500m above the Point of Rocks Campground and extends to the Campground. Its riparian habitat represents the open, grass banked area present in the middle portion of Silver Creek. The section from the upper Priest Campground to the lower campground has a higher gradient, typical of the lower portion of the creek.

Three sites were used to assess juvenile densities and growth. These include the Stalker Creek site, 300m above the confluence with Grove Creek. The Stalker site is characteristically 0.5m in depth. It has a Chara bottom with gravel channels. The Pumphouse section of Silver Creek is immediately below the pumphouse within the catch and release area. Chara beds, greater depth and velocities are representative of the Pumphouse site. Also, the Pumphouse site includes three 1.5m pools. The Cabin site is just below the outlet of Sullivan's Slough. As compared to the other sites, the Cabin site has stronger velocities, with only one third of the channel with Chara.

METHODS

Adult Trout Abundance, Growth, and Movement

The equipment used to assess fish populations was a raft-mounted electrofishing unit. The unit consists of a 2000 watt generator, Coffelt VVP, A 4.3 m-long rubber raft and multiple negative cable and a single boom-mounted positive electrode. The electroshocking unit is fitted with two 150 watt outdoor flood lamps to provide illumination for night sampling. The captured fish are held in an aerated livewell until they are processed. The sampling runs typically start at dusk and continue for 4-5 hours. In short sites (e.g. Priest), multiple marking runs are done in a single night. The procedure for longer sites is to sample different sides of the site in successive nights. Recapture runs typically are completed in a single pass, sampling as much of the stream as possible.

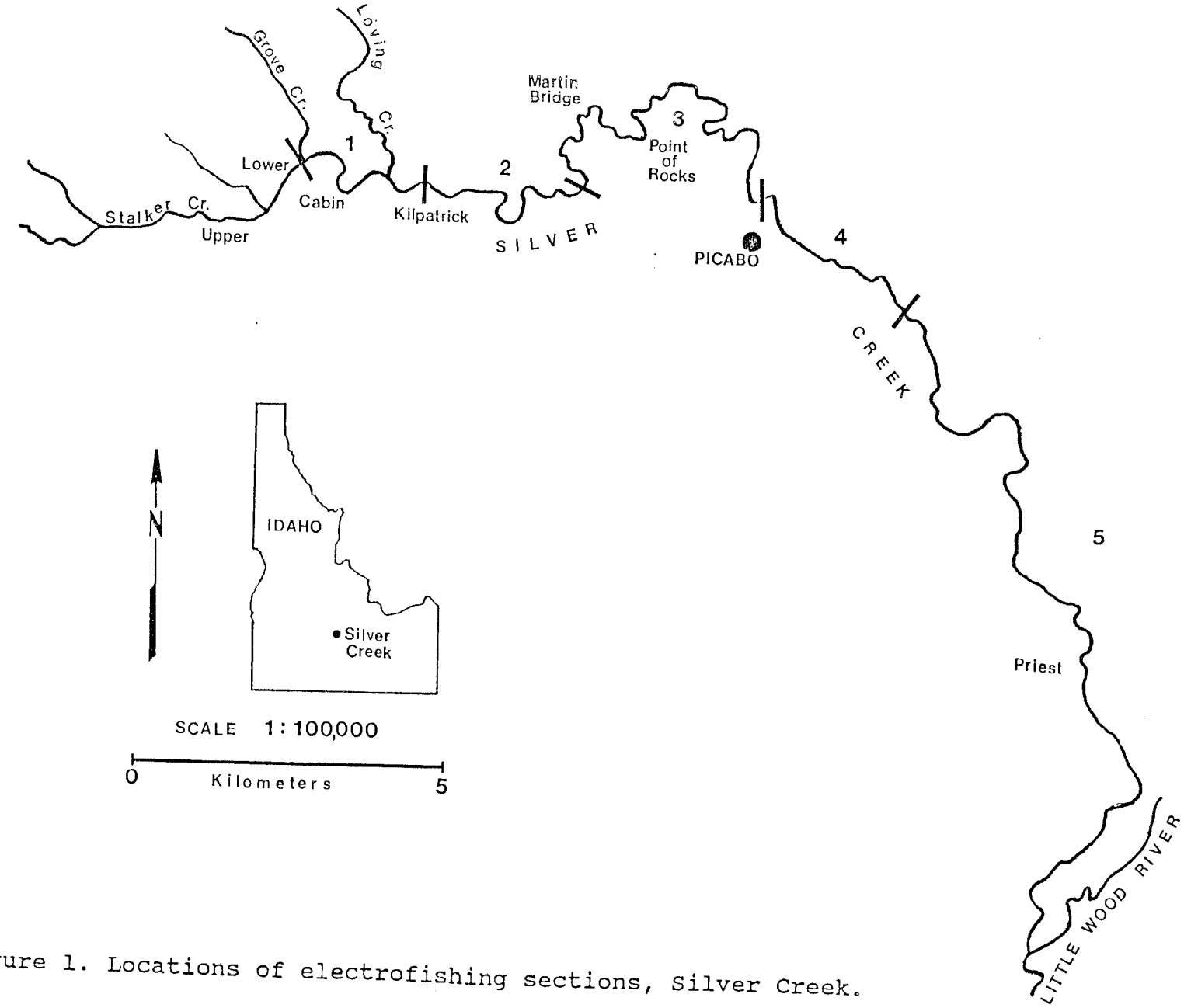

Figure 1. Locations of electrofishing sections, Silver Creek.

Table 1. Dimensions of electroshocking sites on Silver Creek and Stalker Creek.

Site	Sampling Period	Length, m	$\bar{x}$ Width, m	area, m^2
Lower Stalker	19 June-18 July	950	9.3	8,835
Cabin	16-29 July	958	30.4	29,085
Loving Creek to Kilpatrick	4 June-8 July	1,477	17.5-59.7	66,452
Martin Bridge	25 June-22 July	998	19.8	19,760
Point of Rocks	25 June-22 July	489	29.0	14.181
Priest	2-20 July	465	12.8	5,965

Scales were collected from all trout captured and the fish were marked with a combination of fin clips and punches.

Juvenile Densities and Growth

Counts were made of age 0 and age I trout and whitefish. Sampling began in July and will be continued through the winter. Permanant sections 10m x 5m within each site are snorkeled every 2 weeks and numbers of age 0 and age I trout and whitefish are recorded.

Juvenile trout were collected for growth analysis with a backpack electroshocker in the area just above and below the tilted wooden bridge in the catch and release area. Lengths of the fish were recorded and a sample of scales was taken.

Angler Effort

Angler counts within the catch and release section of Silver Creek (TNC) were initiated on May 24, 1986 and will continue through 30 November 1986. The count area was divided into a series of seven different sections. The numerous sections were choosen to follow change in angler densities from section to section. A description of each section is as follows:

Section 1: Upstream from Stalker Creek Bridge to power line boundary of TNC.

Section 2: Downstream from Stalker Creek Bridge to the old pumphouse tower.

Section 3: The old pumphouse tower downstream to the outlet of Sullivan's slough.

Section 4: Sullivan's slough outlet to the peninsula.

Section 5: From the peninsula to the mouth of Loving Creek.

Section 6: The mouth of Loving Creek upstream to Stock Bridge.

Section 7: The mouth of Loving Creek downstream to Kilpatrick Bridge.

Counts of anglers within Sullivan's Slough were also incorporated into the census effort. Float tubers in section 7 were counted separately from waders.

In addition to angler counts, vehicle counts were also included in the census effort. Vehicles were counted at the following locations:

- Stalker Bridge Access

- Stalker Ranch Access

- Conservancy Cabin Parking Lot

- Kilpatrick Bridge Road between the cabin and Kilpatrick Bridge

- Kilpatrick Bridge

The vehicle counts are made to gain a more accurate range of use in areas that are difficult to count, particularly Section 1 and 2. Counts made in the rest of the sections appear to be quite accurate, due to the high observation point above the Conservancy Cabin aided by the use of binoculars to spot anglers. The counts are being continued this fall by TNC personnel.

The census is based upon 14 day intervals, with 3 counts daily. Each interval includes 2 week days, 2 weekend days, and all holidays. The count days and times were selected by random number generation. The estimation of angler effort is based upon the following equation: $xWD(H) + xWE(H)$, where:

$\bar{x}$ = mean number of anglers counted for all weekdays during an interval, computed by: $\frac{\text{anglers counted}}{\text{Number of counts}}$

$\bar{x}$, = mean number of anglers counted for all weekend days and holidays during an interval, computed by: $\frac{\text{anglers counted}}{\text{Number of counts}}$

WD = total number of weekdays per interval
WI = total number of weekend days and holidays per interval.
H = mean daylight hours per interval.

Total angler effort was calculated by combining the total estimated hours fished during each interval.

Angler counts were made in the general regulation portion of Silver Creek at the Priest Campground. The section counted extends 1 km upstream from the lower campground. The count procedures are the same as described for the catch and release sections.

Habitat Utilization by Adult and Juvenile Trout

Data were gathered on adult rainbow trout holding areas with respect to the following variables: area of holding site, mean and maximum depths, water velocities, and relative percentages of substrate and macrophytes. The holding areas sampled were located from the visitors center upstream to the old Terens's footbridge.

The boundaries for width and length measurements were determined by changes in depth. Length and width measurements were made to the nearest cm. The velocities were measured at 6/10 depth at the head, middle, and tail of each site. A Swoffer Model 2200 velocity meter measured the velocites to the nearest hundredth of a meter per second. The percent composition of substrate and macrophytes were determined emperically by the same observer for all sites. Fish in the sites were counted by a

snorkeler 2 days later. A single observer floated downstream through each site emumerating all salmonids by species and into two size classes, 20-30cm and >30cm.

Tower observations were also made in conjunction with the habitat utilization measurements. The primary intent was to establish similar sites along physical parameters such as; stream depth, water velocity and substrate macrophyte species. Two sites were chosen, one in Stalker Creek and one in Silver Creek. The towers are step ladders approximately 3 meters and 2.4 meters high. The towers are equipped with stadium chairs on the top to serve as a seat. The towers were secured to the substrate with the use of wire guidelines and steel stakes. The observation method is:

- Climb into the tower
- Sit for a 15 minute period to allow for renewal of fish activity prior to disturbance.
- Begin at the lower end of the study site and record the activity of an individual fish for approximately 2 minutes and then go to the next individual subject.
- Sit in the tower for one hour observation periods or until all subjects have been observed at least once.
- Randomize the choosing of the observation time, observation site, and the date of observation.
- Record the following data: size of fish within 4 cm (if possible identify that particular fish), type of activity, and duration of that activity.
- also as general data: water temperature, air temperature, weather, insect hatches, presence of anglers.

The times and days were randomized according to a random number generator. The location of individual fish were noted on study site maps that depicted the macrophyte and substrate patterns on the streambed. This was done to provide information on fish movements within the pool.

Data on microhabitat utilization were gathered in the Pumphouse, Priest, and Stalker Creek sites by snorkeling on three dates in July and early August. Focal point depth, velocity, distance to nearest fish, distance to cover, and type of substrate were recorded for each fish.

RESULTS AND DISCUSSION

Species Composition

In 1977, Thurow had not found brown trout above the Picabo Bridge of Silver creek. In November, 1981, ISU snorkelers found a single large brown trout at the Stalker Creek confluence. In 1984, Griffith (1985)

found browns up to Martin Bridge but not in a section just below Kilpatrick pond. Currently browns are present throughout Silver Creek and Stalker Creek, being more abundant in the Priest area than other sections.

Of the total biomass of the system, brown trout represented the greatest percentage of the biomass in the Martin Bridge (51%) and Priest sections (59%, Table 2). However, the percent of browns by number (0-19%) are below that of rainbow (81-98%) in all sections. Rainbow make up the highest percentage of trout numbers present in Stalker Creek, 98% percent, and the lowest percentage in the Priest area, 81%, of those sections calculated. The Cabin and Point of Rocks sections may have had the highest percentage of rainbow since brown numbers were too low to be calculated.

Mountain whitefish represented 28% of the total biomass as compared to 66% for rainbow and 6% for the brown trout within a sample taken in the Loving to Kilpatrick section.

Growth of Juveniles and Adults

The difference in emergence time between fall spawned brown trout and largely spring spawned rainbow is reflected in a size differential between species for age 0+ fish (Fig 2). Brown trout hold a 40 to 50 mm size advantage.

For older trout, a greater average length and weight of browns age I and older was found when compared to the rainbow. Browns averaged from 8 to 75 percent larger than rainbow. In most sections, individual weights of browns averaged over 3 times that of rainbow trout (Table 3).

For older trout, there is a weak representation of age II or age III (1983-1984) classes of rainbow in the sample of yearlings and older (Fig 3, Table 4). Since age I and age IV rainbow were collected in good number, the vulnerability of the intermediate ages should be consistent. The weak middle age class occurs in both the catch and release and the general regulations areas. Thurow (1987) showed a similar dip in the length frequency (Figs 3 & 4). Also, Griffith in 1984 showed a similar poor representation of age I, the same 1983 age class missing in the 1986 sampling. This would suggest that there is some variability in year-class strength. Flow data are being examined to determine if low flow years are related.

With brown trout, the weak representation is more porominent throughout early year classes below age IV (Fig 5). Although sample size is small in other sections, there is a definite weaker representation in the Martin Bridge section (N=46). The Priest section, however, displays a normal distribution of age classes (Fig 6).

Adult Population Estimates

Calculation of population estimates were completed in all sections with the exception of brown trout estimates in the Cabin and Point of Rock sections. In those sections, brown trout numbers were too low for

Table 2. Species composition by percent number and percent weight of yearling and older trout based on population estimates in Silver Creek and Stalker Creek, Idaho, summer 1986.

Site	Rainbow		Brown	
	No.	Wt.,g	No.	Wt.,g
Lower Stalker	98	92	2	8
Cabin	-	-	-	-
Loving to Bridge	98	96	2	4
Martin Bridge	84	49	16	51
Point of Rocks	-	-	-	-
Priest	81	41	19	59

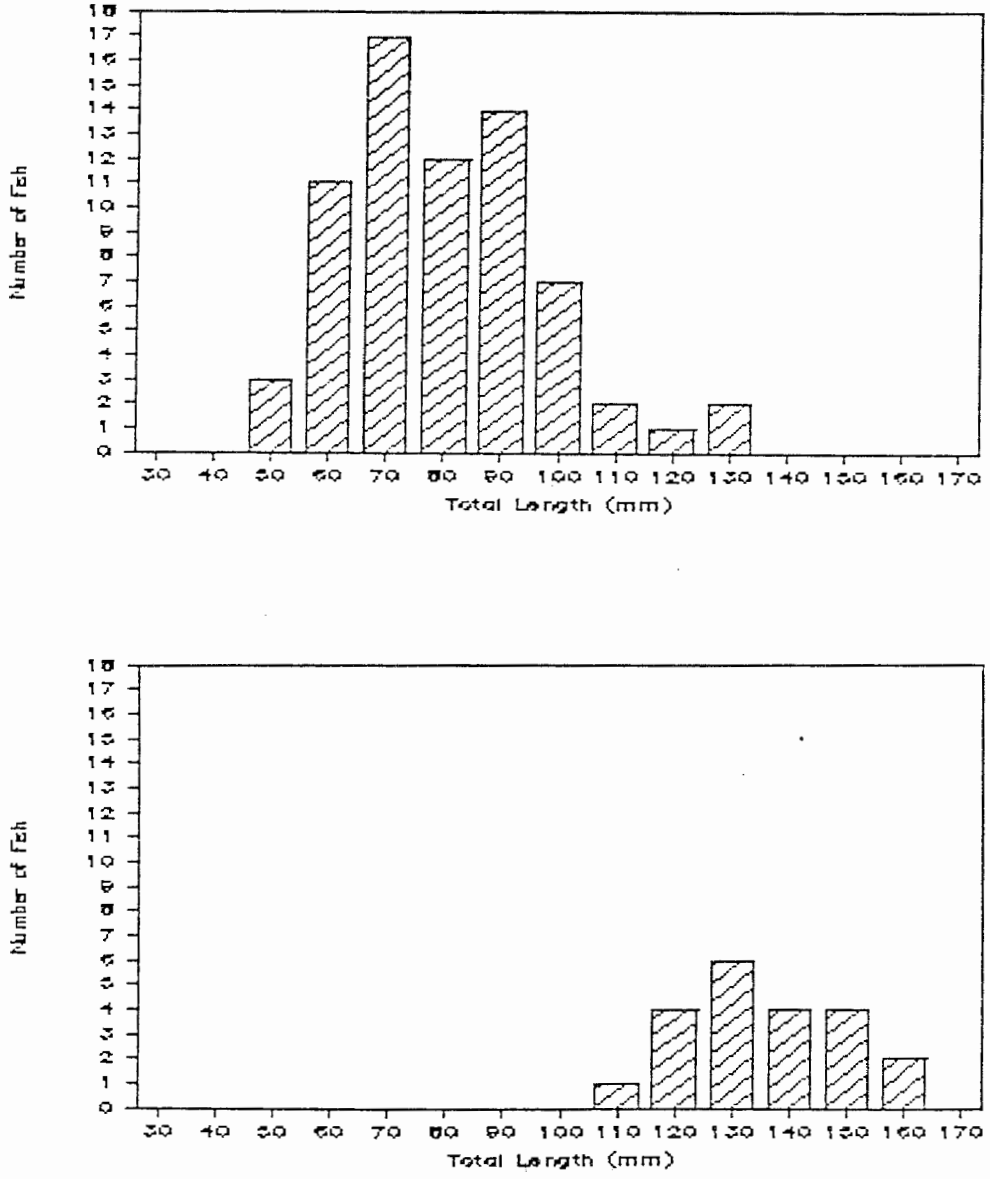

Figure 2. Length frequencies of rainbow age 0 (top) and brown age 0 (bottom) captured by backpack electrofishing August, 1986, within the catch and release section.

Table 3. Mean length and weight of yearling and older trout captured by electrofishing, summer 1986.

Site	Rainbow			Brown			Brook		
	N	x Length	x Weight	N	x Length	x Weight	N	x Length	x Weight
Lower Stalker	263	225	162	26	265	888	9	265	261
Cabin	242	251	260	16	273	-	10	177	136
Loving to Bridge	138	345	418	20	433	947	1	349	490
Martin Bridge	89	230	180	46	389	970	2	234	136
Point of Rocks	90	237	173	4	378	920	-	-	-
Priest	77	184	68	41	323	426	-	-	-

Table 4. Percentages of wild rainbow trout captured in 100mm size intervals.

Site	N	Total Length (mm) 150-249	250-349	350-449	>450
Catch and Release Section (TNC)	802	49	12	37	2
General Regulation Section (combined)	205	76	13	11	0
Martin Bridge	86	69	13	18	0
Point of Rocks	94	69	18	13	0
Priest	70	94	6	0	0

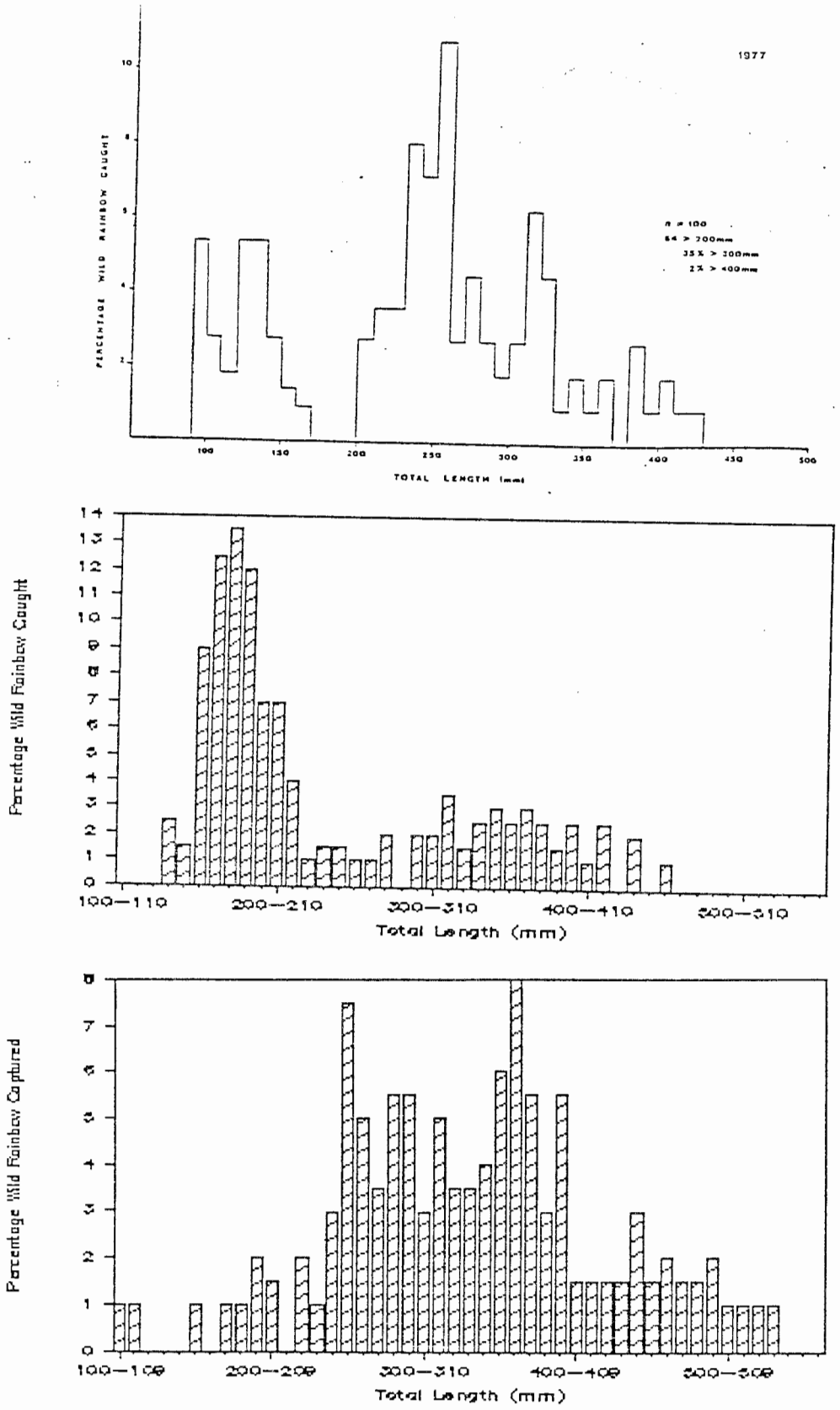

Figure 4. Length frequencies of rainbow trout captured by electrofishing in 1977(top), 1984(middle), and 1986(bottom), section 3, general regulations.

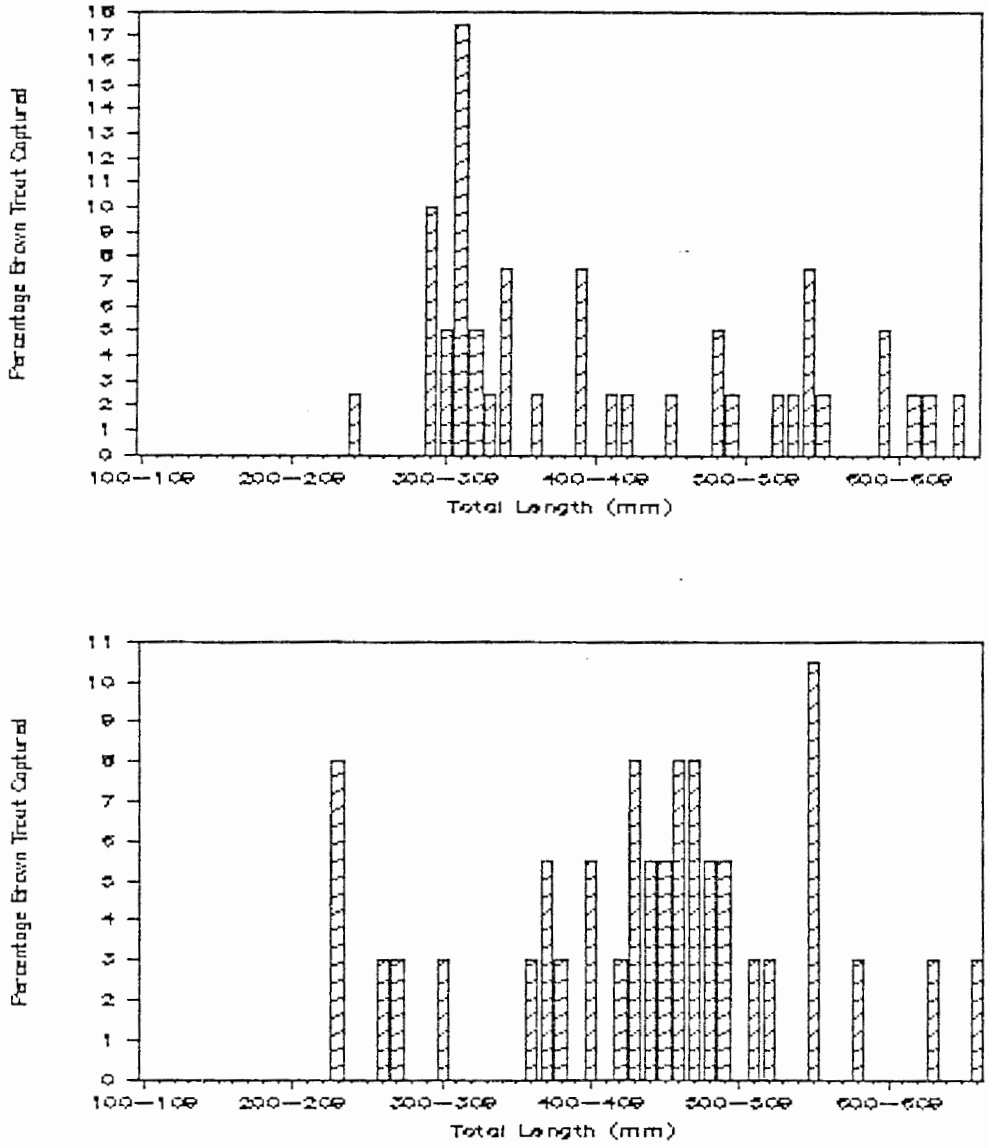

Figure 5. Length frequencies of brown trout captured by electrofishing in 1984(top) and 1986(bottom) in section 3, general regulations.

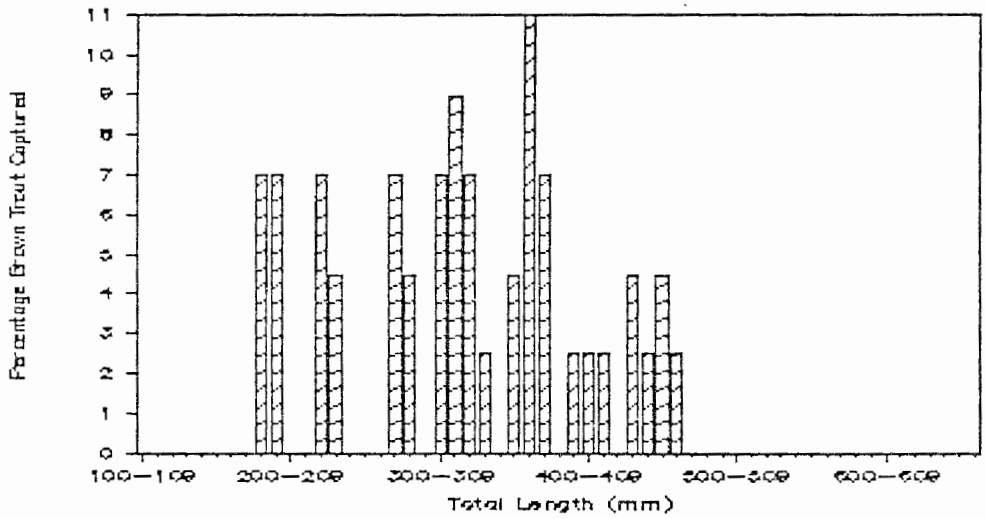

Figure 6. Length frequencies of brown trout captured by electrofishing in Priest section, 1986.

Table 5. Population estimates and 95 percent confidence intervals of rainbow and brown trout. Brook trout population estimates were not calculated because of low numbers in the sample.

	Rainbow trout			Brown trout			Brook Trout
Site	No.	Pop. Est.	CI	No.	Pop. Est.	CI	No.
Lower Stalker	263	1340	885-2133	26	21	10-45	9
Cabin	242	920	595-1494	12	-	-	10
Loving Creek to Kilpatrick	138	1721	1098-2841	20	33	18-66	1
Martin Bridge	89	357	202-689	49	70	45-115	2
Point of Rocks	90	546	244-1365	4	-	-	0
Priest	77	192	122-361	41	44	26-80	6

estimates (Table 5).

Lower Stalker had the highest density of rainbow trout (15.1 fish/100m^2) (Table 6). This high density may be a reflection of the deeper habitat found there as well as a greater percentage of younger aged rainbow. Of the other catch and release sections, the Cabin and Loving to Kilpatrick, had lower densities of rainbow, 3.2 fish/100m^2 and 2.6/100m^2 respectively, than Stalker Creek.

In the general regulation portion of Silver Creek, the highest density of rainbow (3.9 fish/100m^2) was present in the Point of Rocks area, where there were too few browns to estimated the brown population. In the Priest area, the rainbow density was similar, 3.2 fish/100^2. The Priest area was a higher gradient and had a high proportion of yearling rainbow (Table 3). Brown trout were most abundant in that area (0.74 fish/100m^2). Martin Bridge had the lowest rainbow density, 1.81/100m^2, with a brown trout density of 0.35 fish/100m^2.

Juvenile Densities

When sampling was initiated in July, the Pumphouse site had the highest densities of age 0 and age I brown, 2.5/100m^2 and 4.5/100m^2, respectively (Table 7). At that time, the Cabin site showed the highest densities of age 0 whitefish (44.3/100m^2) and rainbow (46.7/100m^2). The higher velocity areas such as those of the Cabin site were areas where whitefish concentrated. Also young browns may not choose the higher velocities which would account for the lower densities of browns in the Cabin site (0.3-0.7/100m^2). Brook trout densities were lowest in the Stalker site (0-0.5/100m^2) and were the highest in the Pumphouse site (3.8/100m^2).

Other areas were investigated downstream but densities were too low for the sampling method to be effective. In the Martin Bridge area, less than 5 age 0 browns were observed by a 3-person snorkel count in a 1 km length of stream. The Priest area showed similar, low densities when snorkeled.

As the summer progressed all juvenile rainbow densities increased in the sampling. In the last sampling, rainbow age 0 densities dropped drastically in the Stalker site (9.0/100m^2 to 2.0/100m^2) and in the Cabin site (100.0/100m^2 to 12.0/100m^2). Whether this decline in the sampling sites is in response to a movement to winter habitat is not known at this time.

Angler Effort

The amount of angling effort varied considerably during the first four months of the angling season. The lowest for a two week interval was 415 hrs/km between June 23 and July 6. Conversely, a high of over 943 hrs/km was recorded during the interval from May 24 to June 5. Angling effort was also noted on lower Silver Creek, specifically the area above and below the Priest Campground. From June 23 to August 3, the catch and release section had a total of 2916 hrs/km as compared to 734 hrs/km for lower Silver Creek. The data were not available from the 1977

Table 6. Densities and 95 percent confidence intervals of rainbow and brown trout based on population estimates from summer 1986 electrofishing on Silver Creek and Stalker Creek. Densities are not given for the brown trout of the Cabin and Point of Rocks sections because of insufficient numbers in the sample to calculate population estimates.

	Rainbow			Brown		
Site	No. Fish/100m^2	CI	g/100m^2	No. Fish/100m^2	CI	g/100m^2
Lower Stalker	15.1	10.0-24.1	2449	.2	0.1-0.5	213
Cabin	3.2	2.1-5.1	822	-	-	-
Loving Creek to Kilpatrick	2.6	1.7-4.3	1083	0.1	0.03-0.1	47
Martin Bridge	1.8	1.3-3.5	326	0.4	0.2-0.6	340
Point of Rocks	3.9	1.7-9.6	666	-	-	-
Priest	3.2	1.9-6.1	219	0.7	0.4-1.3	315

Table 7. Densities (fish/100m^2) of age 0, and age I trout and mountain whitefish within three sections of the catch and release area of Silver Creek and Stalker Creek, 1986.

Pumphouse Site		Rainbow		Brown		Brook		Whitefish	
	Date	age 0	age I	age 0	age I	age 0	age I	age 0	age I
	17 July	39.0	8.3	2.5	4.5	0.3	0.5	11.3	0
	20 Aug.	76.5	3.8	4.8	1.5	2.3	1.8	10.0	0
	9 Sept.	89.5	4.0	7.3	0.3	3.8	0.3	11.3	0

Stalker Site		Rainbow		Brown		Brook		Whitefish	
	Date	age 0	age I	age 0	age I	age 0	age I	age 0	age I
	25 July	1.0	0.5	0	1.0	0	0	0	0
	5 Aug.	7.5	1.5	6.5	4.0	0	0	0	0
	20 Aug.	9.0	0	6.5	0	0	0.5	0	0
	9 Sept.	2.0	1.0	1.0	0	0.5	0	0	0

Cabin Site		Rainbow		Brown		Brook		Whitefish	
	Date	age 0	age I	age 0	age I	age 0	age I	age 0	age I
	25 July	46.7	10.0	0.3	0.7	0.3	2.0	44.3	0
	5 Aug.	63.0	5.3	0.3	0.3	2.0	2.0	26.0	0
	20 Aug.	100.0	0.6	0	0	2.7	0	11.0	0
	9 Sept.	12.0	0	0	0	1.0	0	0.3	0

study to make a direct comparison with my data at this time. The data at the end of the 1977 angling season was 7772 angling hours on the catch and release section, as compared with 4813 angling hours by September 21 of this year.

Habitat Utilization by Adult and Juvenile Trout

Initial observations were madefrom towers to qualify behavior of adult rainbow throughout the summer. The rainbows within the study sites proved to be elusive for observational purposes. The larger fish (>300mm) proved to be shy and retiring, holding close to the edge of macrophyte beds or in some cases underneath riparian cover. The younger fish, particularily 0+ and 1+ age fish tended to spend considerable amounts of time in random movements throughout the study sites and also in and out of the site itself.

As the observation periods progressed into the month of August, the water levels in the stream increased upwards of 20-25 cm. The macrophytes reached maximum growth, with mats of vegetation on the surface of the water in numberous areas. The rainbow trout in two study pools showed a marked decline in both size and numbers of fish from the previous numbers. A number of interesting observations were noted within the behavior of the remaining trout. The study pools appeared to serve only as refuges for holding or hiding cover. The feeding behavior particularily of large trout (>300mm), took place in shallow riffles and glides sometimes 30 meters away from the original holding area. Because of this phenomena it was not possible to observe the same fish after it left the pool. Often the fish remained in the feeding area through the observation period as they were not observed returning to the study pools.

The end of August essentially was the peak of fish migration out of the study pools and away from the observation tower. Some differences about general reactions to distrubances was noted between fish of the Stalker Creek site and the Silver Creek site. The rainbow within the Stalker Creek site tended to be easily alarmed and a long (>20 minutes) waiting period was required to allow the trout to resume previous positions However, the rainbows in the Silver Creek site would continue to feed even while I approached the tower. This may be a reflection of the marked differences in angler densities, between the low densities in Stalker Creek site and the high densities in the Silver Creek site. The rainbow in the Silver Creek site may have become accustomed to the presence of high angler densities within their habitat, while the Stalker Creek fish are generally not exposed to this degree of pressure.

The basis for this investigation is to utilize what we learned from fish observations to quantify habitat requirements. The data suggests that rainbow trout prefer certain habitat requirements; water depth, area of holding pools and the change of water velocities from holding to feeding areas.

The data on utilization of pool habitat by adult rainbow suggest a degree of association between maximum depth and fish numbers, as well as surface area and fish numbers (Figs. 7 and 8). These preliminary data, combined with data from previous studies (Glennon unpub. report, 1984;

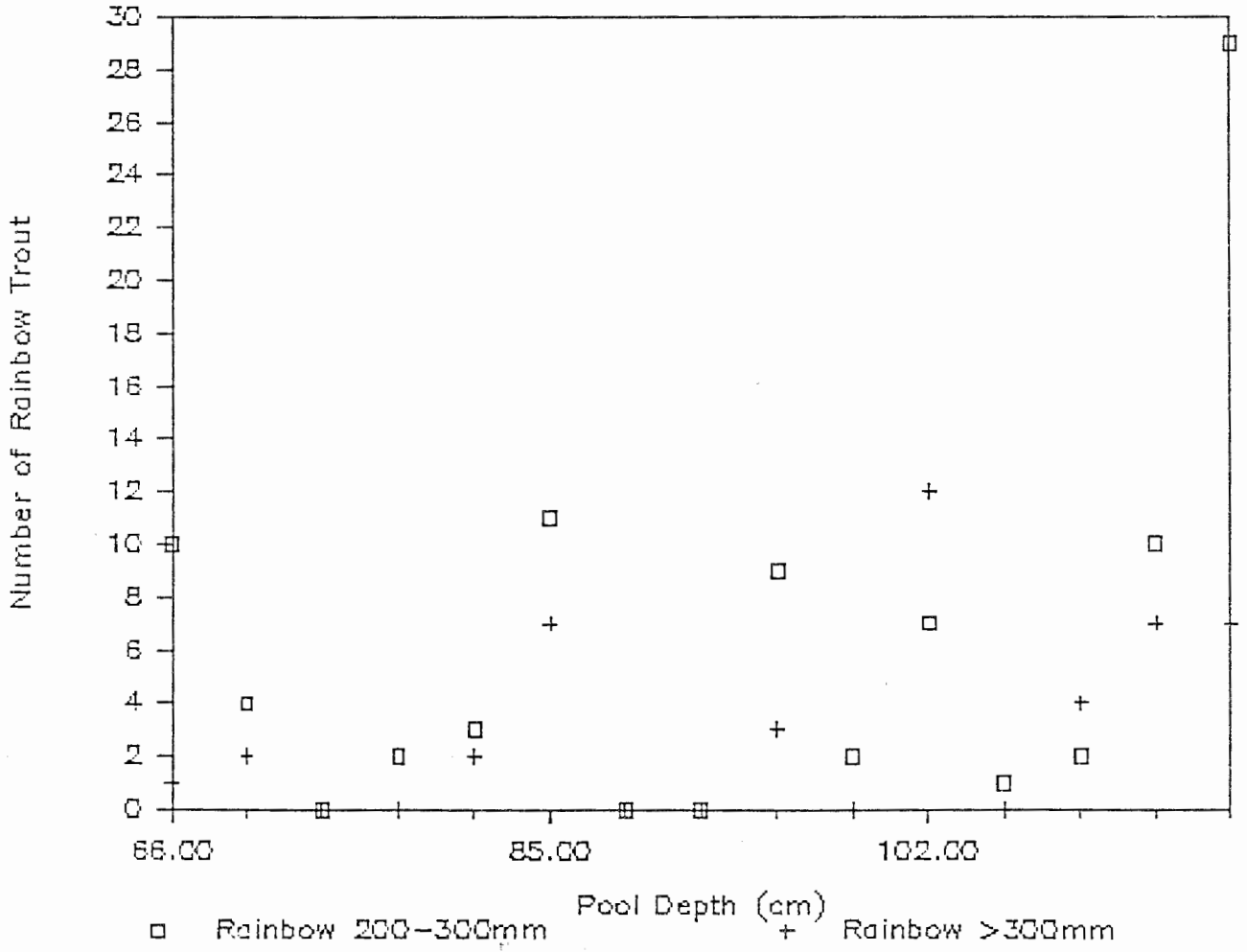

Figure 7. Scattergram of number of trout in pools as related to pool depth.

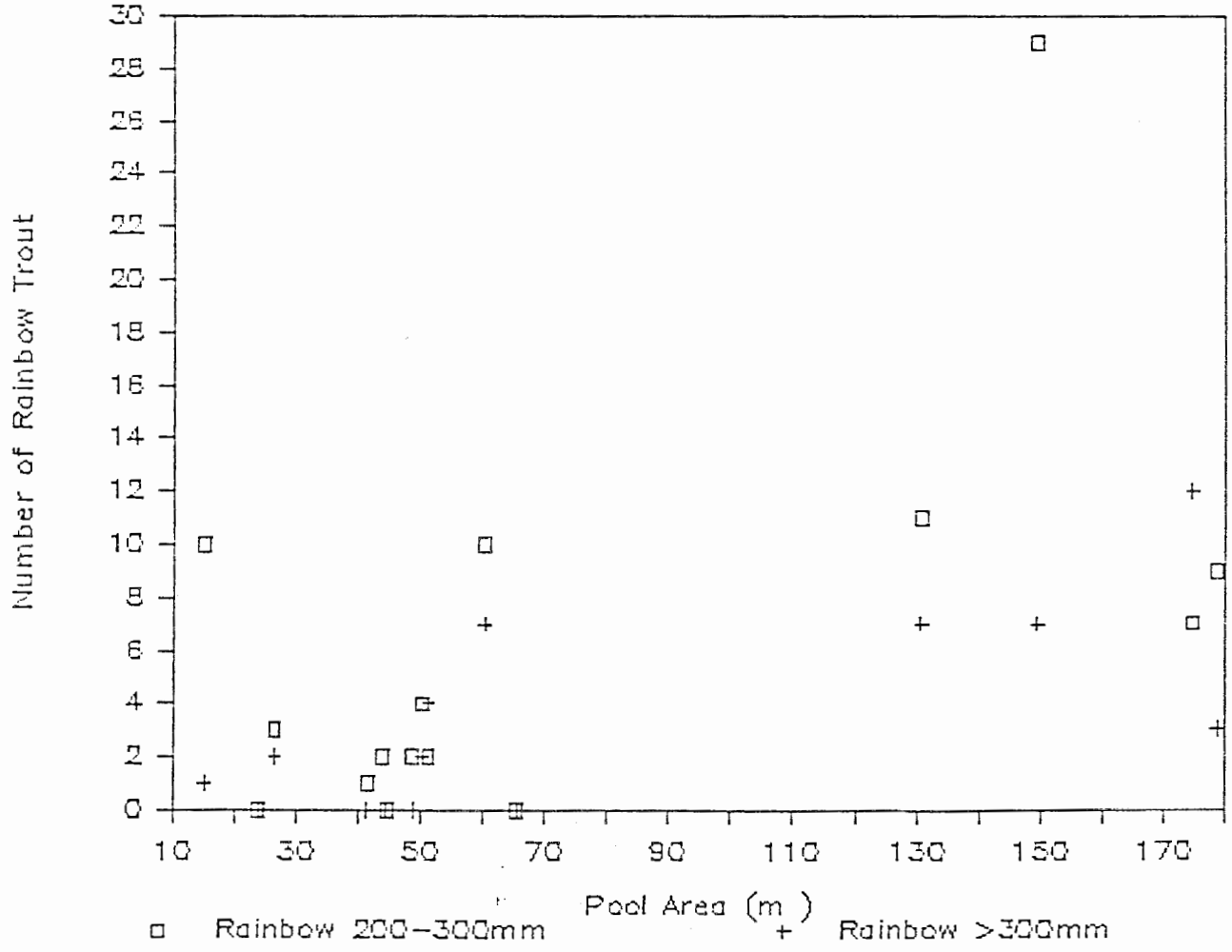

Figure 8. Scattergram of number of trout in pools as related to pool area.

Lewis, 1969), suggest that a viable alternative to study rainbow habitat preferences exists. Tentatively, a series of fall and winter counts of the fifteen holding areas is planned, with the possible addition of more sites to be added in the spring.

Microhabitat was measured for fish to compare position choice of juvenile rainbow and of brown trout. The younger (0-199m) browns and rainbow appear to be choosing similar focal point velocities(0.15-0.20 cm/sec) and similar total depth (57.5-78.9) (Table 8). The younger browns tend to hold nearer to cover than do the rainbow (up to a 20 cm difference). Gravel is the most frequently preferred substrate where it is present.

Table 8. Microhabitat parameters for juvenile rainbow and brown trout in Stalker Creek and Silver Creek, late July-early August 1986.

	Silver Creek				Stalker Creek	
	Pumphouse		Priest			
	Rainbow	Brown	Rainbow	Brown	Rainbow	Brown
Focal depth	5.0	2.0	11.8	6.3	7.0	16.5
Total depth	78.6	72.2	57.5	59.7	76.0	78.9
Dist. to nearest fish	9.1	12.9	12.3	14.0	17.1	78.9
Dist. to nearest cover	31.5	12.6	68.8	43.9	69.0	49.2
Focal vel.	0.15	0.11	0.17	0.20	0.34	0.10
Greatest vel. w/in 60 cm	0.49	0.49	0.38	0.83	0.40	0.37
Substrate	gravel	gravel	gravel	gravel	gravel	Chara
Cover type	Chara	Chara	rock	rock	algae mat, bank	Chara
Sample size	8	9	5	7	2	14

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