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HENRY'S FORK FISHERIES INVESTIGATIONS

Job Completion Report For 1986-1987
Project No. F-71-R-12
Subproject III, Jobs 7a and 713

by

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Idaho State University

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Idaho Department of Fish and Game
Idaho State University
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The Henry's Fork Foundation
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JOB COMPLETION REPORT

State of: Idaho **Name: River & Stream Investigations**

Project No. F-71-R-12 **Title: Henry's Fork Fisheries Investigations**

Subproject: II

Job No. 7a and 7b

Period Covered: May 1986 to May 1988

ABSTRACT

Box Canyon held an estimated population of 13,400 to 16,600 rainbow trout larger than 175 mm in the summer of 1987. Estimates were also completed for other river sections downstream to Hatchery Ford.

Brook trout are abundant enough to contribute to the fishery in Box Canyon, but are insignificant elsewhere. Mountain whitefish are most abundant on the Railroad Ranch and at Pinehaven.

With the exception of Box Canyon, size-class distributions are similar for all sections. Most fish were in the 150-250 size classes. In Box Canyon 21% of the fish caught by electrofishing were larger than 350 mm. Electrofishing probably consistently underestimates the percentage of large fish in non-canyon sections.

Growth of rainbow trout was fastest in Box **Canyon** and similar among other sections. Near optimum year-around temperatures probably account for the high relative rate of growth in Box Canyon. Total annual mortality (A) was lowest in Box Canyon (53%), followed by the Railroad Ranch (68%), and the Lower Canyon (82%).

All but one tagged fish was recaptured in the vicinity of tagging. Two percent of the fish caught in the Cardiac Canyon had old marks from Box Canyon or the Railroad Ranch indicating downstream recruitment from these areas may be important to the Lower Canyon fishery.Large trout were often caught more than once during the season, indicating the high value to the fishery of individual large fish.

In July 1987, shoreline fry densities were highest at Last Chance (9.4 fry/m), followed by Box Canyon (0.9 fry/m), and Harriman East (0.6 fry/m). No fry were found at Riverside Campground. Young-of-the-year rainbow trout were not strongly associated with escape cover at Harriman East during July or August. Shallow, zero-velocity areas were most important, and are lacking in this reach of the river.

In winter, no fish were observed at night in non-bank areas in the Last Chance, Harriman Ranch, Osborne Bridge, and Pinehaven reaches. We observed almost no juvenile rainbow trout in non-bank mesohabitat habitat in all intermediate-and low-gradient sites. No juveniles were observed in or near large aquatic macrophytes beds in non-bank areas. Low densities were found at several non-bank locations in Box Canyon where fish were observed in protected areas among large boulders (diameter > 1 m) in slow water velocities near and within the boulder matrix.

A total of 96% of the 1,531 fish observed during the night were near boulder clusters along the bank. However, this habitat represented only 35% of the bank habitat surveyed$_2$ We observed juvenile rainbow trout densities of 5 to 100 fish/100 m^2 in the high-ranked bank habitat which consisting of boulder clusters and developed undercut banks. Medium- and low-ranked banks had densities of 0 to 5 fish/100 m and 0 to 1 fish/ 100 m^2, respectively. Without exception, where we observed potential concealment cover along the bank, we found abundant juvenile rainbow trout at night.

Winter daytime microhabitat utilized by juvenile rainbow trout in the Henry's Fork consisted of the interstitial spaces between and under boulders along the bank. Undercut banks with dense root wads or dense woody debris were also utilized. Single logs with few branches were not utilized as daytime concealment cover. Many of the undercut banks that provided winter habitat earlier in the winter were dewatered when flows were reduced below Island Park Dam in February. Only deep and well developed undercut banks continued to provide concealment cover at lower flows. These banks were only found in areas absent of cattle grazing such as on islands and within fenced areas.

Winter nighttime microhabitat utilized by juvenile rainbow trout in the Henry's Fork consisted of the slow velocity areas near the bank that were closely associated with daytime concealment cover.

Dusk emergence of juvenile rainbow trout began 25-35 minutes after real sunset time with light intensities near 0.40 X^{-2} 10 Watts/m^2. Densities increased until they stabilized about 180 minutes after real sunset time with light intensities of about 0.50 X 10^{-5} Watts/m^2 Moonlight or the addition of constant artificial light decreased nighttime trout densities.

Of the anglers contacted in the angler opinion survey, 55% were nonresidents and 45% were Idaho residents. Of the Idaho anglers surveyed, 91% were from counties in southeastern Idaho. Flies were the preferred terminal gear in both survey reaches. Since 1977 there has a been an increase in the percentage of anglers using flies relative to bait fishing between Riverside Campground and Mesa Falls.

Most (63%) anglers fishing between Island Park Dam and Riverside Campground indicated that the quality of the fishing met their expectations for quality trout fishing. Fifty percent of the anglers fishing between Riverside and Mesa Falls indicated that the quality of the fishing met their expectations for quality trout fishing.

Most (67%) anglers fishing between Island Park Dam and Riverside Campground were in favor of catch-and-release from the dam to Mesa Falls. Most (51%) of the anglers fishing below Riverside Campground were in favor of maintaining current regulations with no changes. Most (>73%) anglers in both sections indicated they would continue to fish the river if either proposed regulation change were implemented.

Estimated angler effort per unit of river length was higher than previous estimates. Anglers expended 1499 h/km of effort between Pinehaven and Riverside Campground, and 891 h/km of effort between Riverside Campground and Hatchery Ford.

Estimated total catch was 1.29 and 1.21 fish/h for the upper and lower survey sections respectively. No previous survey has demonstrated a total catch higher than 0.94 fish/h for either section.

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INTRODUCTION

The Henry's Fork Fisheries Study was initiated in the spring of 1986 as a cooperative research effort between Idaho State University (ISU), the Idaho Department of Fish and Game (IFG), and The Henry's Fork Foundation (HFF). The purpose of the study was to assess the status of the resource and provide data relevant to the management of the game fishery from Island Park Dam to Hatchery Ford. The study was continued through 1987.

Research efforts were directed toward providing information on salmonid abundance, rainbow trout growth and movements, summer habitat utilization by trout, creel information, and angler opinions regarding the condition of the existing fishery. Specific objectives were to:

1. Inventory the gamefish populations of the river between Island Park Dam and Hatchery Ford.

1. Assess growth and movements of rainbow trout (Salmo gairdneri) in the river.

3. Assess habitat quality by examining water temperature, dissolved oxygen, and species composition of aquatic macrophytes.

4. Examine microhabitat use by rainbow trout in Box Canyon and at the Harriman State Park.

5. Examine possible trout stranding due to gate closure at Island Park Dam.

6. Monitor abundance and summer habitat utilization of age-0 rainbow trout with emphasis on cover utilization.

7. Evaluate winter habitat utilization of juvenile rainbow trout.

8. Assess angler opinions regarding the condition of the fishery and a proposed regulation change.

9. Determine fishing effort and harvest levels in the river.

Objectives 1-3 were evaluated during both study years, while objectives 4 and 5 were evaluated in 1986 and objectives 6-9 in 1987.

STUDY SITE

The project reach extends from Island Park Dam to Hatchery Ford, a distance of approximately 26 river km. The reach is divided into seven study sections ranging in length from 1.8 to 5.4 km (Figure 1 and Table 1).

The Box Canyon section begins at Island Park Dam and ends at Box Canyon Village. The Last Chance section begins at the Box Canyon boat take-out. The Harriman North section begins at the irrigation diversion and ends at the HSP stock bridge. The Railroad Ranch section begins at the HSP stock bridge and ends at the Osborne highway bridge. The Harriman East section begins at the Osborne stock bridge and ends at the Pinehaven boat take-out. The section of the river referred to as the Lower Canyon in 1986 (Angradi and Contor 1987) was divided into two sections, the Pinehaven section and the Cardiac Canyon section, in 1987. The Pinehaven section extends from the boat take-out at Pinehaven to the boat take-out at Riverside Campground. The Cardiac Canyon section extends from the boat take-out at Riverside Campground to the boat take-out at Hatchery Ford.

The section electrofished on the Railroad Ranch in 1987 extends from the middle stock bridge to the upper end of the Millionaires Pool in front of the ranch buildings. Box Canyon was electrofished from the confluence of the Buffalo River to the Cabin Pool at the north end of Box Canyon Village.

Study reaches chosen represent higher gradient (Box Canyon and Lower Canyon), low gradient (Harriman North, Railroad Ranch, and Harriman East), and intermediate gradient (Last Chance) sections of the river of a length suitable for electrofishing (Table 1). All reaches could be sampled in a single day or night. Fish Creek, a tributary of the river which enters the Harriman East reach from the east, was also studied (Figure 1).

METHODS

1986 Population Estimates

Rainbow trout were captured from 26 June to 2 October 1986 using an aluminum drift boat equipped with electrofishing gear. Gear used included a 5000 watt generator, Coffelt variable voltage pulsator, and a single fixed boom anode or throwable anode.' The hull of the boat served as the cathode for pulsed DC operation. Flood lamps fixed to the bow provided illumination for night sampling. Most electrofishing was done with a crew of three using the throwable electrode. A total of 160 man-hours of effort was expended electrofishing.

High gradient reaches were sampled in daylight, all other reaches were sampled at night. Captured fish were held in a livewell until processed. Total length was recorded for all fish. Weights were recorded and scales taken from a subsample of fish captured. Hook scars were noted.

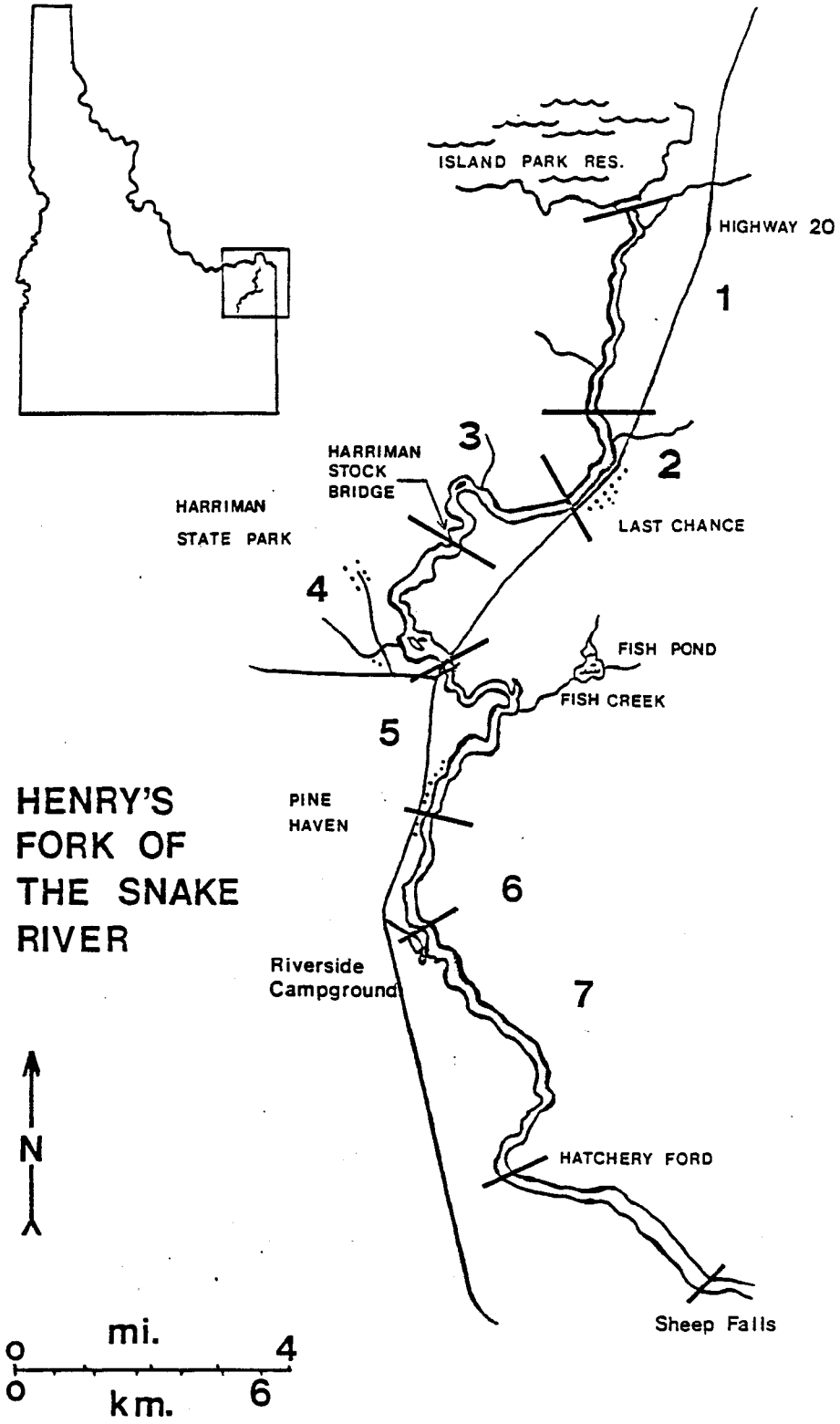

Figure 1. Location of study sections on the Henry's Fork River.

Table 1. Dimensions of study sections on the Henry's Fork of the Snake River.

Section	Length (km)	Mean width (m)	Area (hectare)	Gradient (%)
Box Canyon	5.2	60	24.3	0.40
Last Chance	1.8	100	18.0	0.30
Harriman North	5.2	130	67.6	0.10
Railroad Ranch	1.4	65	9.2	0.17 (1987)
	3.3	120	39.6	0.17 (1986)
Harriman East	4.6	95	43.7	0.07
Pinehaven	2.9	65	19.2	0.30
Lower Canyon	5.4	60	32.4	0.60 (1986)
Cardiac Canyon	7.5	65	48.8	0.60 (1987)

On 1 November 1986, a snorkel population estimate was conducted in the Lower Canyon at Hatchery Ford and Wood Road 700. Using a technique developed by Schill and Griffith (1984), five divers counted fish on 12 transects (six transects at each site) that ranged from 20 to 90 m in length. A total of 8500 m^2 of river was surveyed. SCUBA gear was used to count fish in a large pool at Hatchery Ford.

On 1 and 2 October 1986 during a low water episode a mark-recapture census of trout and mountain whitefish (Prosopium williamsoni) was conducted in the pool immediately downstream from Harriman Bridge. Using the gear described above, four passes were made and captured whitefish were marked by clipping or punching the adipose fin. The following day an equal recapture effort was made.

Fish Creek was sampled on 3 August 1986 using a backpack electrofishing unit. Two removal passes were made in each of three 150 m sections. The lower section was located near the mouth of the stream. The middle section was located approximately 0.7 km from the mouth, and the upper section was located at the discharge pipe from Fish Pond.

1987 Population Estimates

During the 1987 field season, mark-recapture population estimates were conducted by electrofishing in Box Canyon, the Railroad Ranch, Pinehaven and Cardiac Canyon. Most electrofishing was conducted with two aluminum drift boats equipped with pulsed D.C. electrofishing gear (3-5 amps, 400-550 volts). Boats were provided by IFG with a crew of two, and ISU with a crew of 2 or 3. The Railroad Ranch was electrofished at night; other sections were electrofished in daylight.

All rainbow and brook trout (Salvelinus fontinalis), and mountain whitefish captured on a marking run were given a temporary mark, usually a caudal punch or clip. Marked fish could then be identified as recaptures in subsequent electrofishing runs. Captured fish were held in a livewell until processing. In processing, fish were anesthetized with MS222, measured to the nearest millimeter, marked, examined for hook scars and released. A subsample of rainbow trout over 300 mm in length were tagged with monel metal jaw tags. Scales were collected from a subsample of trout.

For the Box Canyon and Railroad Ranch population estimates, the Adjusted Petersen Method (Chapman 1951) was used to estimate the number of trout and mountain whitefish. The following formula was used:

$$N - (m+1)\,(c+1) / r+1 \qquad (1)$$

Where: m = number of fish marked
c = number of fish examined for marks
r = number of marked fish in sample c
N = size of population at the time of marking

Confidence limits were obtained by considering R as a Poisson variable (Ricker 1975).

For the Pinehaven and Cardiac Canyon population estimates, where we were able to make multiple marking runs, the Schnabel Multiple Census Method (Ricker 1975) was used to estimate the number of trout and mountain whitefish. The following formula was used:

$$N = C_t M_t / R_t \quad (2)$$

Where: C = total sample on day t
M^t = total number marked prior to day t
R^t = total number of recaps in sample C_t
N^t = size of population

Confidence limits were obtained by considering R as a Poisson variable (Ricker 1975).

The percentage of the population in selected size classes was calculated by multiplying the percentage of the fish in a given size class in the electrofishing catch by the total population estimate. In addition, separate Petersen estimates were calculated for selected size classes in Box Canyon.

Rainbow Trout Age and Growth

Scales were collected from rainbow trout in 1986 and 1987 for aging and calculation of mortality rates. Scales were removed posterior to the dorsal fin, dorsal to the lateral line, and anterior to the adipose fin. Approximately 10 scales were removed per fish. Scales were dry mounted between microscope slides and read by microprojection at 84x. Ages were determined using number of annuli in the anterior circuli field. Distance from each annulus to the focus was determined by measuring along the longitudinal anterior scale axis.

Least-squares regression was used to derive a body-scale constant (intercept). Other techniques, including geometric mean regression, log Y tranformation, and polynomial regression may result in a better fit, but the use of the least-squares technique is consistent with previous studies and thus allows a more appropriate comparison. Lengths-at-age were back calculated using mean anterior scale radius values for each age class using the following formula:

$$L_a - (S_a/S\ (L - Y_a)) + Y_a \quad (3)$$

Where: S distance from focus to anterior scale margin
S_a = distance from focus to annulus
L = observed total length of fish at capture
Y_a = body-scale constant
L_a = calculated total length at age

Catch curves were developed using interval estimates of length-at-age derived from back calculation data applied to size class distributions from electrofishing. Total mortality rate (A) was estimated using the following

formulae:

$$A = 1 - S \quad (4)$$

$$S = e^{Zt} \quad (5)$$

Where: A – total annual mortality rate
S = survival rate
Z = slope of the catch curve (instantaneous total mortality)
t – time interval (1 year)

Angling mortality (E) and natural mortality (D) were estimated for the Pinehaven and Cardiac Canyon sections using the following formulas (Everhart and Youngs 1981):

$$E = H + M_r / N \quad (6)$$

$$D = A - E \quad (7)$$

Where: E – total angling mortality
H – total harvest
M_r = estimated mortality of caught and released fish
N = population estimate
D = natural mortality

Mortality of caught and released fish was estimated at 5% (after Mongillo 1984). Due to the amount of bait angling observed in the Lower Canyon, we consider 5% a conservative estimate of M_r.

Movements of Rainbow Trout

To evaluate movements, rainbow trout larger than 300 mm were tagged with monel aluminum jaw tags. Fish too large to be tagged were opercle Box Canyon, adipose fin; Last chance and Harriman North, pectoral fin; Railroad Ranch, pelvic fin; Harriman East, anal fin; Lower Canyon, dorsal fin. Tags were recovered by anglers and by project personnel.

Habitat Quality

On 10 and 11 October 1986, the aquatic vegetation at Last Chance, Harriman State Park, and Harriman East was quantitatively sampled. Six samples were collected at each of ten sampling transects. The sampling method is a modification of one used by Hampton (1981). At each transect, samples were taken at 5 m intervals along a line extending perpendicular to the channel. Samples w2re collected using a Hess invertebrate sampler with a basal area of 0.083 m^2 . Individual plant samples were later sorted to species and weighed. For half of the samples, invertebrates were separated from the vegetation and preserved.

To investigate possible effects of dissolved oxygen (DO) concentrations on the distribution of trout, water samples were collected from all study reaches in 1986 for determination of dissolved oxygen. On the

afternoon of 12 August 1986, a sample was collected at each of eight stations between Island Park Reservoir and Pinehaven. On the morning of 13 August 1986, six of the stations were resampled. Samples were analyzed using the Micro-Winkler technique. Values are expressed as mg/l dissolved oxygen and percent saturation.

Water temperature was monitored through each summer with two Ryan-Peabody recording thermographs. In 1986 one thermograph was installed at the Harriman Stock Bridge, and the second was installed at the gaging cable in Box Canyon. In 1987 one thermograph was located at the Harriman Stock Bridge and the second was placed at the Pinehaven boat access site. The thermographs were periodically checked against hand-held thermometers.

Microhabitat Utilization by Rainbow Trout

Methodologies for examining microhabitat use by rainbow trout were different for higher and lower gradient reaches. In the lower gradient reaches, initial efforts were focused on underwater observations using snorkeling gear. Poor water clarity and evasive behavior of trout proved problematical and resulted in the abandonment of underwater methods. Subsequent to this, observations were made from the bank. From the bank, a feeding adult or group of juveniles could be located and pinpointed. At the approximate position of the fishes snout (approximate focal point), microhabitat measurements were made. Measurements included depth, velocity, source of cover, distance to cover, distance to the bank, surface roughness, and substrate size. Size of fish was estimated. Microhabitat data were collected from all low gradient reaches.

In the high gradient study reaches (sections 1 and 6) we selected study sites to represent the available habitat. To determine the array of avaliable habitat we mapped sections 1 and 6 according to meso-habitat types (pools, runs, rapids, pocket water and others). After the meso-habitat was mapped, permanent sites were randomly selected.

Snorkeling upstream proved to be the best method for observing trout. Nonetheless, only 5 to 15% of the observed trout could we consider undisturbed. Only undisturbed trout were used for measurements.

After an undisturbed fish was located, a white stone was placed directly under the focal point. The length of the fish (estimated to the nearest centimeter by eye and a meter stick used in conjunction with noted points on the substrate) the time of day, focal depth, and the activity of the fish (feeding, resting, or hiding) was written on the stone with a carpenters crayon. Within 30 minutes we returned, measured, and recorded the following microhabitat parameters: date, time, water temperature, location, fish length, total depth, focal depth, surface velocity, focal velocity, cover type, distance to cover, an ocular estimate of water surface roughness, substrate, distance to shore, and fish activity.

Fish Stranding Survey

A survey was conducted to evaluate trout stranding due to gate closure at Island Park Dam on 30 September 1986. Stranded fish were located by walking four shoreline transects. A total of 6500 m of shoreline was examined. Transect 1 was located near RM 88.5 at Last Chance and extended

1000 m downstream. Transect 2 was located near RM 88 at Last Chance and extended 600 m upstream. Transect 3 was located near RM 85 at Harriman Bridge and extended 850 m upstream. Transect 4 was located near RM 87.5 at Last Chance and extended 800 m downstream. Transects 1, 2, and 3 were walked between 1700 and 1930 hours (2 h following complete gate closure) on 30 September. Transect 4 was walked at 0930 (18 h following complete gate closure) of 1 October. Both banks were examined for stranded fish. Stranded fish were collected and measured. Qualitative examination was also made of the large cobble bar 200 m downstream from Island Park Dam.

Abundance and Habitat Utilization by Age-0 Rainbow Trout

In July of 1987, fry counts were conducted by electrofishing in Box Canyon on the east side of the river at Box Canyon Campground, on the east side of the river at Last Chance opposite Last Chance Texaco, at Harriman East 1 km below the Osborne Stock Bridge on the east side of the river, and on the west side of the river at the Riverside Campground boat take-out. A Coffelt gas-powered backpack electrofishing unit was used. Counts were made at night at Last Chance and Harriman East, and in daylight elsewhere.

Three removal passes were made through six 20 x 2 m transects (replicates) parallel to shore at each site except Box Canyon. Four transects were electrofished in Box Canyon. A preliminary trial of the sampling method indicated that the use of block nets did not increase the efficiency of electrofishing. A subsample of trout from each site was measured to the nearest mm. A removal-depletion maximum likelihood model (Platts et al. 1983) was used to estimate numbers of trout. A Mann-Whitney U test was used to test for differences in mean numbers of fry per meter of shoreline among sites.

Four artificial instream cover treatments were installed at Harriman East. Treatments included boulders, pine tree tops, overhead cover structures, and controls. Each treatment was replicated five times, once in each of five study sections. Study section A was located 300 m downstream of the Osborne Stock Bridge on the west side of the river. Study sections B,C,D, and E were located 200 m downstream of the Osborne Stock Bridge on the east side of the river. Treatment sections were 10 m long and separated from adjacent sections by at least 5 m. Study sections were chosen to minimize variation in depth and water velocity. Assignment of treatments to treatment sections within study sections was random.

Boulder treatments consisted of approximately 10 boulders in two offset rows of five parallel to the shore. The outside row was not more than 3 m from the wetted perimeter. At the time of placement (21 June 1987) average water depth of placement wag 0.3 m. The boulders had an average horizontal (basal) area of 0.18 m , and were placed approximately 0.5 m apart.

Tree top treatments consisted of one 6 m tip section of a lodgepole pine anchored at an angle (tip downstream) into the current. Mean distance from the tip of tree to the edge of the wetted perimeter was 2.5 m. Mean water depth at 2-m intervals along the outside edge of the tree top from tip to butt were 0.53, 0.49, and 0.27 m respectively.

Overhead cover structures were 3.2-m long and 0.9-m wide and constructed of a wood frame covered with a sheet of translucent green fiberglass sheathing material. One structure was anchored parallel to the shore in each overhead cover treatment section. When the structures were installed the sheathing material was 0.1 to 0.15 m above the water surface.

Study sections were sampled by backpack electrofishing on 1 July 1987 and 2 August 1987. Study section A was not sampled on 1 July 1987. Three removal passes were made in each treatment section, and the number of trout in each treatment section was estimated using a removal-depletion maximum likelihood model (Platts et al. 1983). Block net were not used. Analysis of variance was used to test for main effects of treatments, study reaches, and sample date. Underwater observations were made by snorkeling the sections at night periodically through the summer.

Winter Habitat Utilization

One hundred and five study sites, 2 m wide by 20 m to 200 m long, were located among the Box Canyon, Last Chance, Harriman Ranch, Osborne Bridge, and Pinehaven reaches.

Bank habitat was ranked by visually estimating amounts of potential concealment cover. To determine the relative amounts of concealment cover, we found it necessary to snorkel some areas. Most of the sites could be consistently ranked by wading. Only rarely could we estimate concealment cover from the stream side or at distances greater than 3 m. After close inspection, what appeared to contain abundant potential concealment cover at a distance was often void of concealment cover. A high rank denoted a high amount of potential concealment cover. Medium and low rankings denoted medium and low amounts of potential concealment cover. Boulder clusters, undercut banks and submerged willow clumps were ranked high, embedded boulder clusters and shallow undercut banks (water depth under the bank less than 10 cm) were ranked medium, and banks with no observable concealment cover areas were ranked low. We deviated slightly from the standard definition of embeddedness for boulder clusters. If the interstitial spaces between boulders were occluded, it was considered embedded regardless of the percent of the boulder protruding through the fines.

We made 216 day and night snorkeling surveys from November 1986 to April 1987. We snorkeled in an upstream direction on all shore line sections and downstream on all mid-stream sections where velocities > 0.8 m/sec and depths > 1.0 m precluded upstream movement. We used diving lights during night observations. Displacement of juvenile rainbow trout by dive lights was minimal. Fish moved around the snorkeler and returned to their approximate previous station as the snorkeler moved past. Unless we snorkeled through the same station more than once every 10 minutes, fish appeared to remain in the same areas during subsequent passes. We minimized displacement by not shining the light directly on fish and by directing the light beam to the underside of the water surface. This procedure prevented the light beam from preceding our range of vision.

Single pass and three pass exectrofishing methodology was used to evaluate snorkel counts and to locate hiding fish during the day. A gas-powered backpack electrofishing unit (Coffelt BP-6) was used repeatedly on 21 of the Last Chance stations during January and February 1987. In most cases block nets were impractical because of the size of the river.

Winter daytime microhabitat utilization was determined by snorkeling and extracting juveniles from concealment cover with the backpack electrofisher. Winter nighttime microhabitat data was obtained by snorkeling at least two hours after sunset near abundant concealment cover. To ensure fish were not displaced by our dive lights we snorkeled upstream with the dive lights off. Approximately every three to four meters we turned on the light and immediately marked the fishes focal point. The focal point being the front and center point of the fishes snout For each fish, we measured the distance to shore, focal depth, total depth, water velocity at focal point and noted potential cover and substrate type. We measured the distance to shore to the nearest 10 cm, depth to the nearest 0.5 cm and velocity to the nearest 10 cm/s with a Marsh-McBirney electromagnetic velocity meter. Potential cover was considered to be any structure within 100 cm of the focal point that was large enough to completely conceal the observed fish. We used a substrate classification scheme similar to that described by Platts, Megahan and Minshall (1983) where diameters of boulders are > 305 mm, cobble 76 to 304 mm, gravel 4.8 to 76 mm, sand 0.83 to 4.75 mm and silt < 0.83 mm. Data were collected by a diver and recorded by personnel on the bank..

To evaluate the relationship between light intensity and the density of observable juvenile rainbow trout, we set up multiple snorkeling passes at 20 to 45 minute intervals through selected study sites from daylight to starlight. Concurrent to snorkel counts, we measured light intensity with a LiCor data recorder using a radiometric sensor (a pyrometer reading in Watts $/m^2$). The Li-Cor data recorder was set up on a 20 sec averaging to add consistency at the lower light levels. Light intensity, time of day, and water temperature were recorded before and after each snorkel pass. The light meter was placed at water level. Temperature was recorded with hand-held thermometers and on Ryan-Peabody thermographs. To facilitate future comparisons of trout behavior in other systems, we calculated true sunset time from our recorded Standard Mountain Time by adjusting for latitude and longitude for our specific location. As a manipulative experiment,

artificial light was supplied by a large commercial sign near the river. We turned this sign on three hours after sunset to increase light intensity and enable observation of the behavior of juvenile rainbow trout. This sign increased light intensity at our site equal to that of bright moon.

Angler Opinion Survey

From May through September 1987 an angler opinion survey was conducted between Island Park Dam and Mesa Falls. Two versions of the angler opinion survey questionnaire were used. Eighty-three of the original version were completed by anglers. Twenty-four (29%) were mailed in and 59 (71%) were conducted by interview. Two hundred and fifty-nine of the second, expanded version were completed by anglers. Sixty-eight (26%) were mailed in and 191 (74%) were conducted by interview. Interviews were conducted by ISU and IFG personel from May 1987 through September 1987.

Both versions included questions regarding angler residence, number of years and days per year spent fishing on the Henry's Fork, gear preference, angler satisfaction, angler opinion of the condition of the fishery, and angler opinion of a proposed regulation change. The second version included more explicit questions regarding perceived trends in angling quality on the river, and on specific proposed regulation changes. Both versions of the questionnaire are included in the appendices.

Version 1 of the questionnare was used only between Riverside Campground and Mesa Falls. Version 2 was used in all sections. Questions 1, 2, 4, 6, and 7 on version 1 correspond to version 2 questions 1, 2, 4, 7 and 9. Responses to these common question were combined into the analysis of the version 2 questionnaire. Questions unique to version 1 of the questionnaire (3, 5, and 8) were analyzed separately.

Creel Survey and Angler Counts

A stratified random two-stage probability sampling design (Malvestuto 1983) was used to sample the creel and angler effort at Pinehaven, Riverside Campground, Wood Road 700, and Hatchery Ford (Figure 2). Strata included three daily time periods (morning, midday, and evening), and three day classifications (weekday, weekend, and holiday weekend). Probability values (weights) were assigned to each strata and location based on the estimated probability of angler use. Location and time of each angler count was randomly selected. Midday and high use areas were more heavily weighted, and thus were more frequently sampled than other strata. Calculations were made independently within strata to eliminate bias.

During the survey five additional angler access points were identified. Angler counts at Wood Roads 314, 764 and spurs, and an unmarked road off Idaho Highway 20 opposite Wood Road 319 (Figure 2), indicated that the combined angler use of these areas was slightly more than that estimated for Hatchery Ford. Consequently, these sections were weighted equally with Hatchery Ford. Counts made at times other than those stipulated by the sample design are included in the appropriate strata. Information collected included number of hours fished, and the number of fish caught, killed and released. Fish killed by anglers were measured when possible. Angler opinion surveys were conducted concurrently with creel surveys.

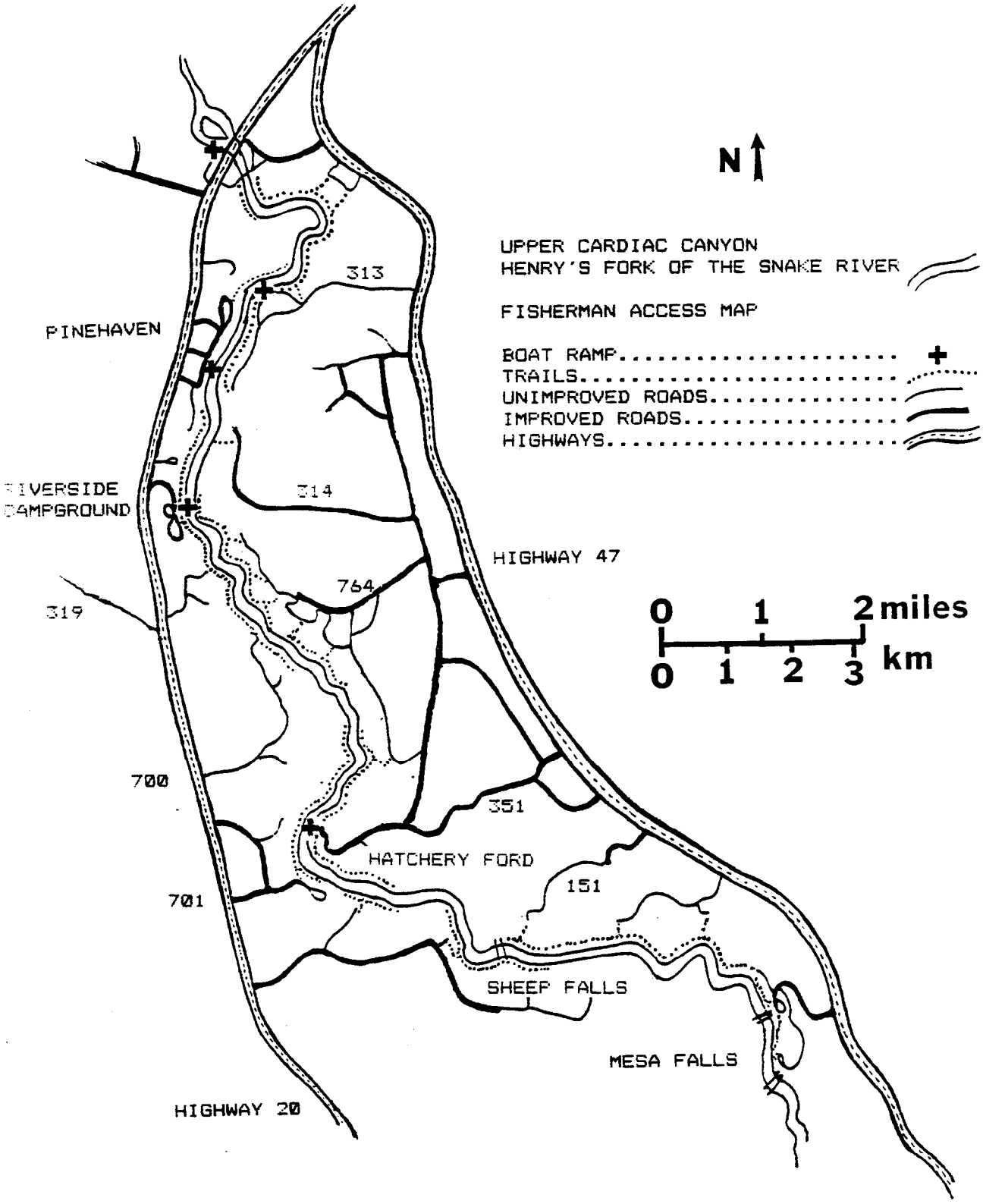

Figure 2. Access points and creel survey locations in the Lower Canyon of the Henry's Fork River. Numbers denote wood roads.

Catch per unit effort (CPUE) and total harvest were calculated from creel survey and angler count data. CPUE was estimated by dividing total measured catch by total measured effort. Total angler hours for each location, time and day strata were estimated by multiplying the mean number of angler hours per day by the number of days in the strata. Total angler hours for each location were estimated by summing the estimates for individual time and day strata. Total harvest was estimated by multiplying the CPUE by the total effort for each section.

RESULTS AND DISCUSSION

1986 Population Estimates

Catch per unit effort (CPUE), an index of abundance and catchability, was highest in Box Canyon (51 trout/h) and at Last Chance (29 trout/h), and lowest at the Railroad Ranch (13 trout/h) and Harriman East (10 trout/h) (Table 2). Differences in CPUE among study reaches indicate general trends in trout abundance, as well as differences in the effectiveness of electrofishing gear among reaches. For this reason, comparisons of CPUE between high and low gradient reaches may not be appropriate. Clearly, however, meaningful differences in CPUE exist between reaches with similar catchability, such as Box Canyon (51 trout/h) and the Lower Canyon (15 trout/h), or Harriman North (13 trout/h) and the Railroad Ranch (7 trout/h).

Other trout species captured were brook trout and cutthroat trout (Salmo clarki). Brook trout were common in Box Canyon, comprising 5 % of the Box Canyon catch, and were present in all reaches. Cutthroat trout comprised 1-2% of the catch in Box Canyon; a single cutthroat trout was captured on 2 October 1986 at the Harriman Stock Bridge. Angler reports of cutthroat trout caught at Pinehaven were not confirmed by electrofishing. Coho salmon (Oncorhynchus kisutch) and kokanee (Oncorhynchus nerka) were infrequent in the catch except during the salvage of fish from directly below Island Park Dam on 30 September - 1 October 1986. On these dates coho salmon and kokanee were captured in large numbers.

Efforts to complete a population estimate in Box Canyon did not produce satisfactory results. Successive passes through the reach produced few recaptures (Table 3). In early summer we calculated an estimate of 7,052 rainbow trout (95% CI = 3,663-14,846) using the Petersen model with two marking runs (1 and 3 July) and a single recapture run (13 August). Using the same marking runs and considering 13 and 16 August as recapture runs yields an estimate of 8,439 (95% CI — 4,785-16,285), and adding 6 September recaptures gives an estimate of 9,055 (95% CI = 5,441-16,047).

In early summer, 30% of the electrofishing catch was hook scarred, a higher percentage than was observed in later samples (Table 3).

A total of eleven trout and whitefish were counted during the snorkel population estimate in the Loer Canyon. Average density for all sites snorkeled was 0.13 fish/100 m . Underwater visibility was adequate for sampling, and the techniques used proved workable. Fish were either in the substrate and missed by the divers, or were not present at the time of sampling.

Table 2. Electrofishing results from 26 June 1986 to 2 October 1986.

Reach	CPUE (trout/h)	Mean Length(mm)	n	Mean Weight(g)	n	% Hook Scarred
Box Canyon	51	238	1381	279	165	14
Last Chance	29	213	276	121	79	17
Railroad Ranch	7	355	90	649	81	20
Harriman North	13	242	77	1099	14	30
Harriman East	10	239	34	190	25	9
Lower Canyon	15	225	59	189	17	3

Table 3. Electrofishing results for rainbow trout in Box Canyon below the mouth of the Buffalo River from 1 July 1986 to 1 October 1986.

Date	Number caught	Cumulative catch	Number recaptures	% Hook scarred
1 July	73	73	0	29
3 July	90	163	0	30
13 August	343	506	7	6
16 August	222	728	3	3
6 Sept	207	935	3	12

A mark-recapture census of mountain whitefish in the pool downstream from the Harriman Stock Bridge produced an estimate of 1462 whitefish in the pool, the equivalent of 3888 whitefish per hectare. Because the river was partially dewatered at the time of the census (1-2 October 1986), extrapolation of the population estimate riverwide may not be appropriate, as whitefish may have been concentrated from adjacent areas into the pool sampled. Forty-seven trout were marked during the census to obtain a population estimate, but an insufficient number of trout were recaptured for a population estimate to be calculated. This may be further evidence that trout were avoiding our electrofishing gear. During the two-day effort, 534 different whitefish were captured in the pool.

Population estimates were calculated for three electrofished sections of Fish Creek. The upper section had 97 trout/100 m; the middle section had 28 trout/100 m, and the lower section had 8 trout/100 m. In the upper section 84 trout (43 brook trout and 41 rainbow trout) were captured. In the middle section, 38 trout (22 brook trout and 16 rainbow trout) were captured. In the lower section 8 trout (4 brook trout and 4 rainbow trout) were captured. Mean total length of brook trout captured was 160 mm. Mean length of rainbow trout captured was 183 mm. Two large rainbow trout (460 and 590 mm) were captured in the upper section.

1987 Population Estimates

Population estimates for rainbow trout were completed for all sections sampled (Tables 4 and 5). Adult mountain whitefish estimates were completed for the Railroad Ranch and Pinehaven sections. Whitefish and brook trout estimates could not be made in Box Canyon because of inadequate recaptures.

A total of 66 brook trout was collected in the Box Canyon in May. Their length ranged from 123-282 mm (mean 194 mm). In addition, 12 cutthroat trout (range 383-462 mm) and 23 coho salmon were collected in Box Canyon, and one cutthroat trout was captured on the Railroad Ranch.

An estimate of numbers of rainbow trout larger than 175 mm was calculated for Box Canyon (Table 4). An estimate of 16,610 was produced by calculating numbers in each size group separately and then summing those estimates. An alternate method of combining numbers of fish marked and recaptured into a single estimate gave an estimate of 13,434 trout. By extrapolation from 1978 data presented by Coon (1978), we calculated an estimate of 18,796 rainbow trout larger than 250 mm for 1978. Rohrer (1983) reported an estimate of 15,155 wild rainbow trout larger than 179 mm in Box Canyon.

Box Canyon had an estimated density of 5.5 to 6.8 trout larger than 175 mm/100 m , depending upon method of population estimation used. The Cardiac Canyon had a densiy of 5.5 trout/100 m , followed by he Railroad Ranch with 3.9 trout/100 m , and Pinehaven with 3.6 trout/100m . The latter three estimates are for fish of all sizes collected, including fish smaller than 175 mm (Table 6). Mountain whitefish densities were similar in the Pinehaven and Railroad Ranch sections, with estimated 6.2 and 6.0 adult whitefish/100 m .

Table 4. Population estimates by selected size classes for Box Canyon rainbow trout. Marking runs were conducted on 12 and 13 May 1987. Recapture runs were conducted 20 May 1987.

Size Class (mm)	Number Marked	Number Captured	Number Recaptured	N	95% Confidence Interval
<175	260	357	1	--[1]	--
175-250	220	371	7	10,276	5,338-21,634
251-400	165	221	7	4,607	2,393-9,698
>400	168	183	17	1,727	1,102-2,853
all >175	553	775	31	13,434	9,553-19,541

[1] Insufficient recaptures to calculate an estimate.

Table 5. Population estimates for adult mountain whitefish and for rainbow trout of all sizes captured in 1987 for all sections except Box Canyon.

Study section and species	Number marked	Number captured	Number recaptured	N	95% Confidence interval
Railroad Ranch					
rainbow	277	177	13	3,534	2,124-6,264
whitefish	442	258	20	5,464	3,608-8,692
Pinehaven					
rainbow	730	164310[1]	23	6,846	4,626-10,069
whitefish	499	59170[1]	4	11,834	5,235-23,320
Cardiac Canyon					
rainbow	1,758	1237586	45	26,904	20,218-35,741

[1] total CtMt for Schnabel estimate

With the exception of Box Canyon, size-class distributions for the four sections were similar (Table 6, Figures 3-6). In all sections, most fish captured were in the 150-250 mm size class. In Box Canyon, 21% of all fish caught were larger than 350 mm. The next highest value for this group was 7% on the Railroad Ranch; Pinehaven and the Cardiac Canyon each had 3% larger than 350 mm. We feel that the number of large (>350 mm) fish on the Railroad Ranch is underestimated in our sample. The section sampled is the only one we felt we could possibly electrofish effectively, but it may not be representative of the entire Railroad Ranch. For example, in the 1986 electrofishing sample, 23% of the fish caught between the upper Harriman State Park boundary and the middle stock bridge were larger than 350 mm.

The size-class distribution for the 1987 Box Canyon electrofishing catch is similar to the 1986 distribution with two exceptions (Figures 3 and 7). Trout under 150 mm were fewer in the 1987 catch, probably because of the early (mid May) sampling dates (Box Canyon was sampled in July-September in 1986). Trout larger than 350 mm were better represented in the 1987 catch, due primarily, we feel, to improved electrofishing methods. Neither the 1986 or 1987 distribution resembles the distribution reported by Coon (1978) (Figure 8). Coon reported that trout smaller than 150 mm were "few" and were not included in the catch. Also, Coon captured very few (< 0.5%) trout larger than 450 mm. In our 1987 sample, 8% of the trout captured were larger 450 mm. We are uncertain if the difference between Coon's data and our own for Box Canyon reflects real differences in the population size-class structure or is an artifact of sampling differences.

The size-class distributions for Pinehaven and Riverside to Hatchery Ford were very similar (Figures 5 and 6), indicating that a single population is represented. No previous data are available for comparison with our results for the Cardiac Canyon.

Our 1987 electrofishing data for rainbow trout are summarized in Appendix A. Comparisons with previous IFG data are difficult because small fish have not been treated equally in all electrofishing efforts. When all available electrofishing data are adjusted to disregard fish smaller than 225 mm (Appendix C), our data indicate an increase in the proportion of fish larger than 400 mm in Box Canyon, in the spring, since the initiation of the slot limit.

Table 6. Percentages of total 1987 electrofishing catch of all rainbow trout captured in selected size intervals, Henry's Fork of the Snake River. Comparable values from 1986 electrofishing catch are in parentheses.

Study Section	Total Catch	Total Length(mm) <150	150-250	251-350	351-450	>450
Box Canyon	194 (1381)	1 (18)	45 (44)	17 (26)	13 (9)	8 (3)
Railroad Ranch[1]	449 (90)	4 (7)	63 (16)	26 (29)	5 (22)	2 (26)
Pinehaven	754	5	59	33	2	1
Cardiac Canyon	180 (59)	5 (5)	74 (54)	18 (37)	2	1 (0)

[1]Different sections sampled in 1986 and 1987. See text for details.

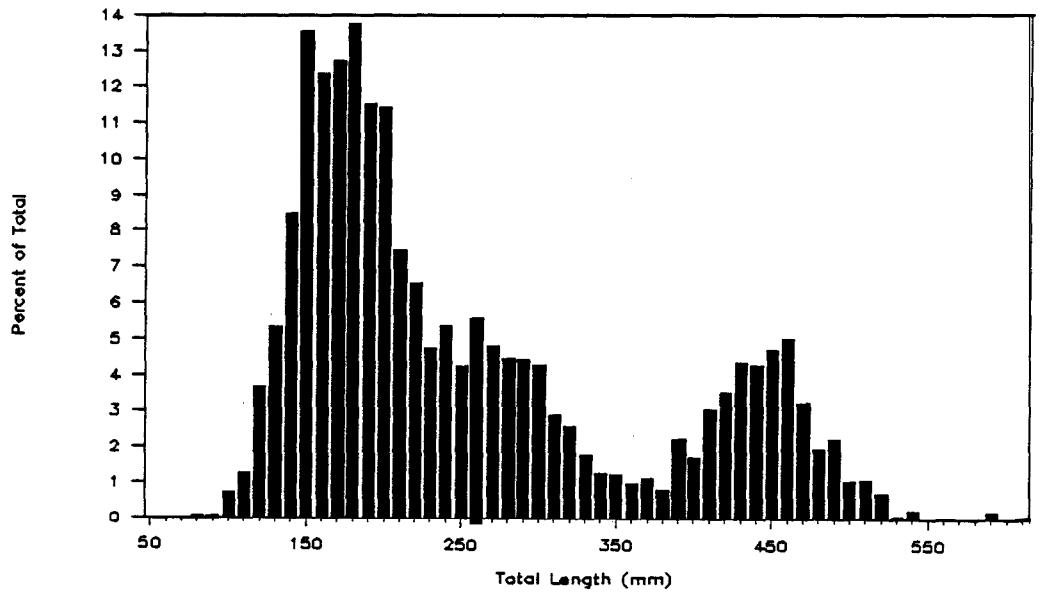

Figure 3. Length frequency by percent of rainbow trout captured in 1987 by electrofishing in Box Canyon (n = 1943, avg. length 250 mm).

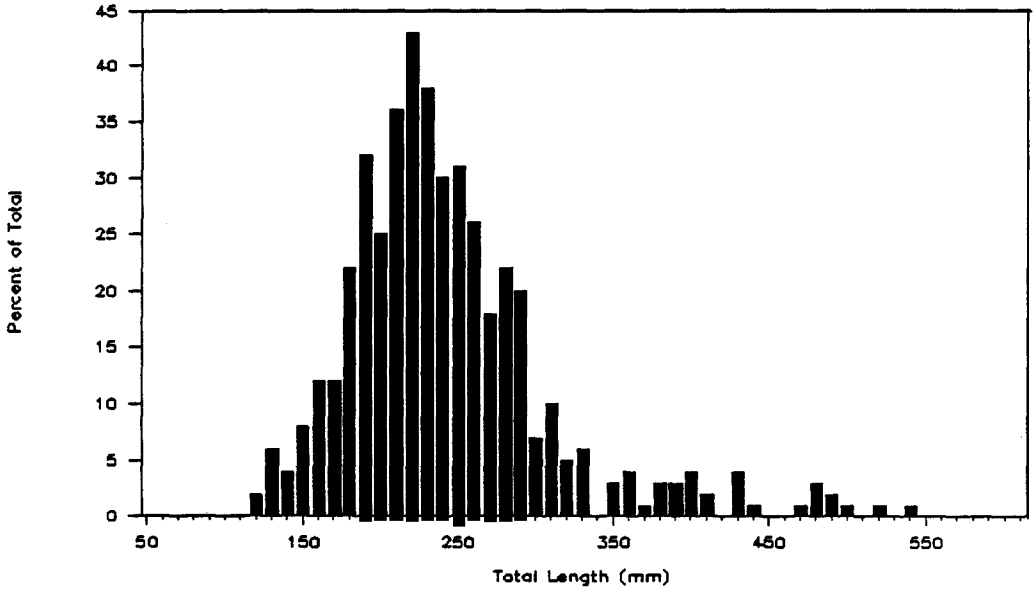

Figure 4. Length frequency by percent of rainbow trout captured in 1987 by electrofishing on the Railroad Ranch between the middle stock bridge and the ranch buildings (n = 449, avg. length 239 mm).

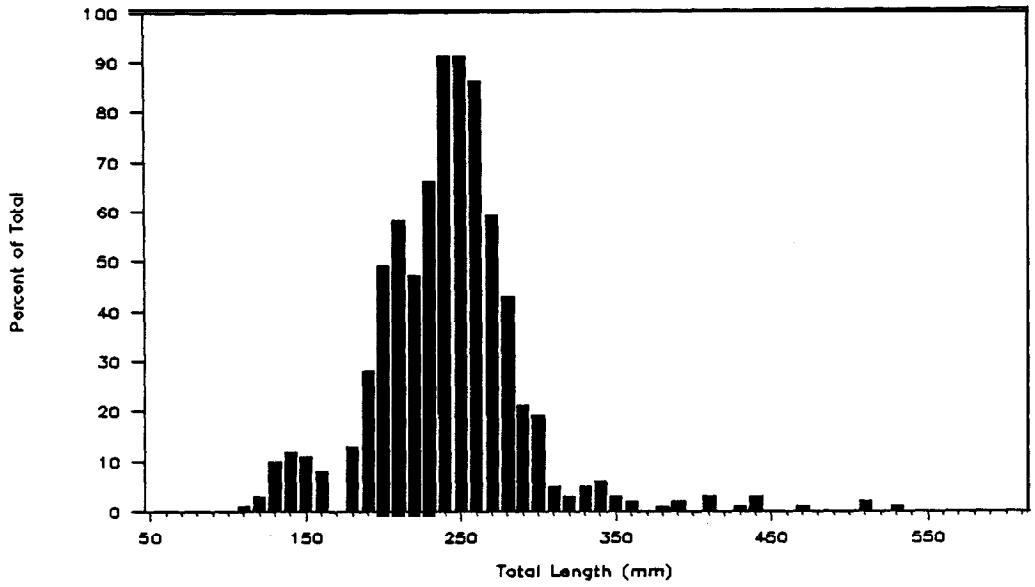

Figure 5. Length frequency by percent of rainbow trout captured in 1987 by electrofishing between Pinehaven and Riverside Campground (n = 754, avg. length 239 mm).

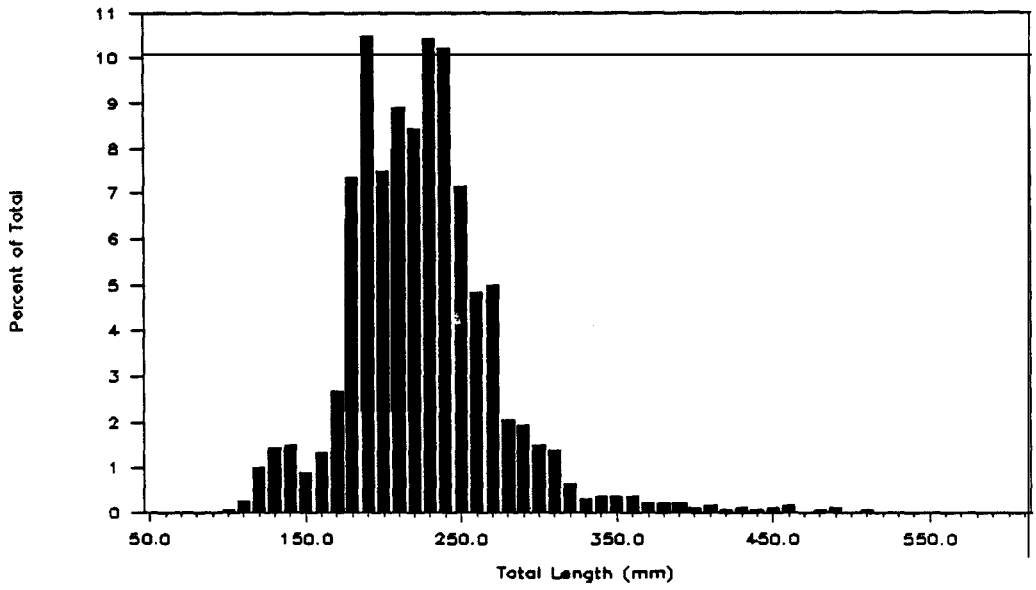

Figure 6. Length frequency by percent of rainbow trout captured in 1987 by electrofishing between Riverside Campground and Hatchery Ford (n = 1806, avg. length 223 mm).

1986 Rainbow Trout Age and Growth

Mean length of rainbow trout captured by electrofishing was greatest at the Railroad Ranch (355 mm) and smallest at Last Chance (213 mm; Table 2). Mean length of trout captured for all reaches was 239 mm. We could obtain previous electrofishing data for Box Canyon only. Mean length of 1381 rainbow trout we captured in Box Canyon was 238 mm. Coon (1978) reported a mean length of 280 mm for 691 rainbow trout captured in Box Canyon in May 1978, but he did not include trout smaller than 150 mm in his sample. Rohrer (1983) reported a mean length of 295 mm for 193 Box Canyon trout.

The length-frequency distribution for all trout captured indicates strong representation of age-0 (50-170 mm) and age-l+ (170-290 mm) year classes (Figure 7). The age-2+ (290-370 mm) year class was poorly represented. The age-3+ (>370 mm) and age-4+ and older year classes were well represented. Ages at length are based on growth data reported by Rohrer (1983), and our own scale analysis. The length-frequency distribution for trout captured in Box Canyon (Figure 8) is not distinguishable from the distribution for trout in all sites combined.

The length-frequency distribution for Coon's (1978) Box Canyon electrofishing data (Figure 9) differs from this distribution in several respects. Coon captured only three (0.43%) trout 450 mm or larger, our catch included 41 (3%) trout 450 mm or larger. For the age-1 year class, Coon's sample had a peak frequency between 250 and 270 mm. In our sample, the age-1 year class peak frequency was between 230 and 250 mm (Figures 7 and 8). Coon (1978) reported wild rainbow trout under 150 mm in total length were "few", and were not counted in the sample. In our sample, trout this size were numerous, accounting for 18% of the total catch (Table 7). Differences in relative abundance of small trout may in part be due to seasonal differences between samples. Coon (1978) completed his sampling in the third week in May. We electrofished in Box Canyon from 1 July through the first week in October.

At Last Chance, the age-0 year class accounted for 40% of trout captured (Figure 10, Table 7), indicating this area may provide important juvenile rearing habitat. On the Harriman North reach, age-0, age-1+, and age-4+ and larger year classes were present. Age-2+ and age-3+ trout were poorly represented, together accounting for only about 9% of the catch (Figure 11, Table 7). Based on length-frequency distributions, the trout population sampled at Harriman North appears more similar to the trout population at Last Chance than to the trout population on the Railroad Ranch (Figure 12). On the Ranch, all age classes are present, but larger (>300 mm) trout dominated the catch.

Data are sparse for Harriman East due to our inability to effectively sample the deep glides that characterize the reach. The length-frequency distribution for Harriman East (Figure 13) is similar to the distribution for the Railroad Ranch, with the exception of large trout which are missing or were not sampled at Harriman East.

In the Lower Canyon, the age-1 and age-2 year classes account for 90% of trout captured (Figure 14, Table 7). The few large trout captured in this

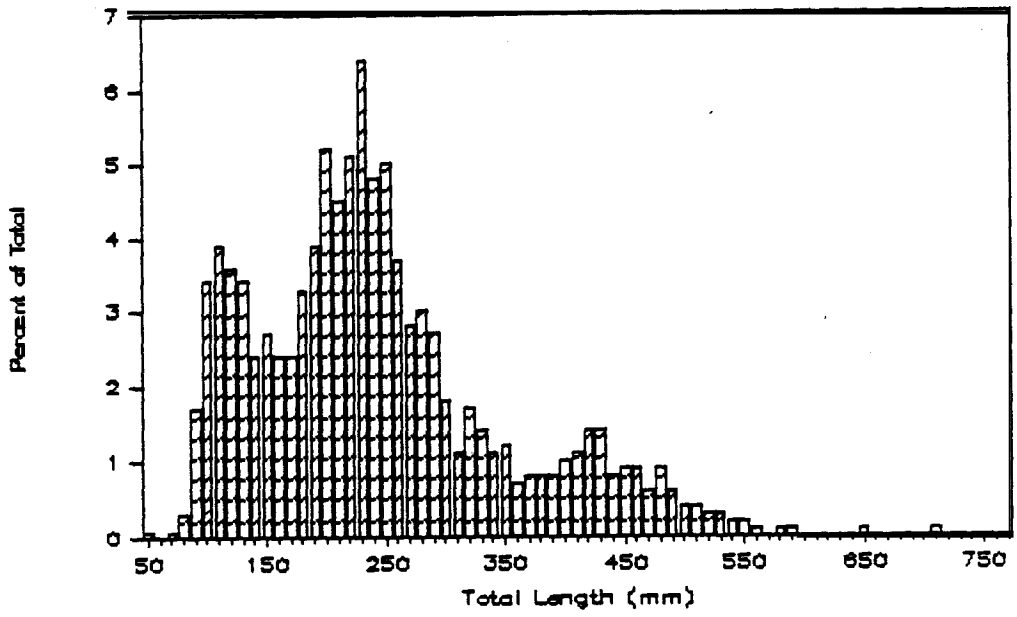

Figure 7. Length frequency by percent of rainbow trout captured in 1986 by electrofishing in all reaches (n = 1917, avg. length 239 mm).

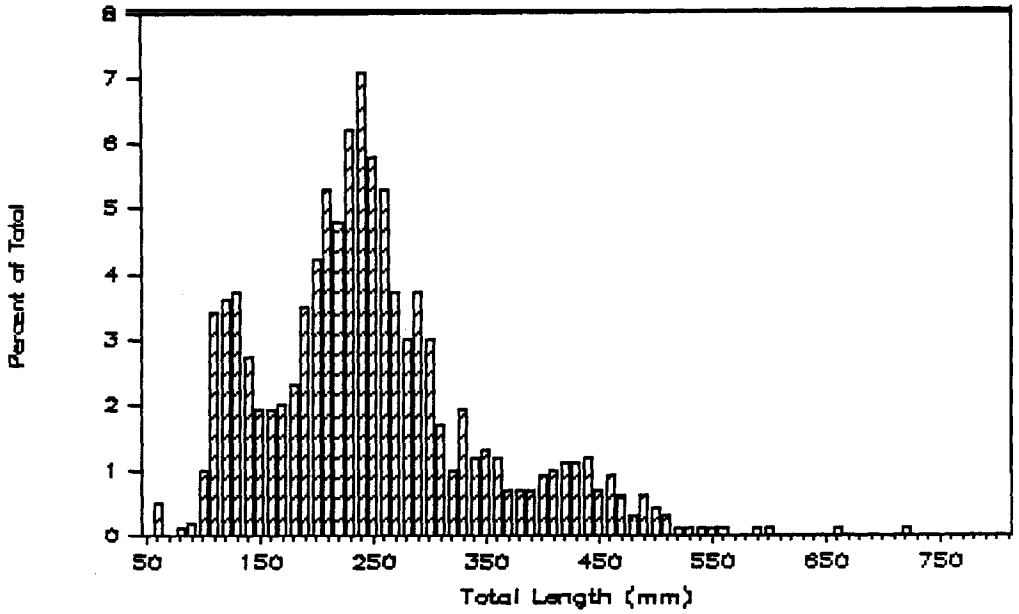

Figure 8. Length frequency by percent of rainbow trout captured in 1986 by electrofishing in Box Canyon (n = 1381, avg. length 238 mm).

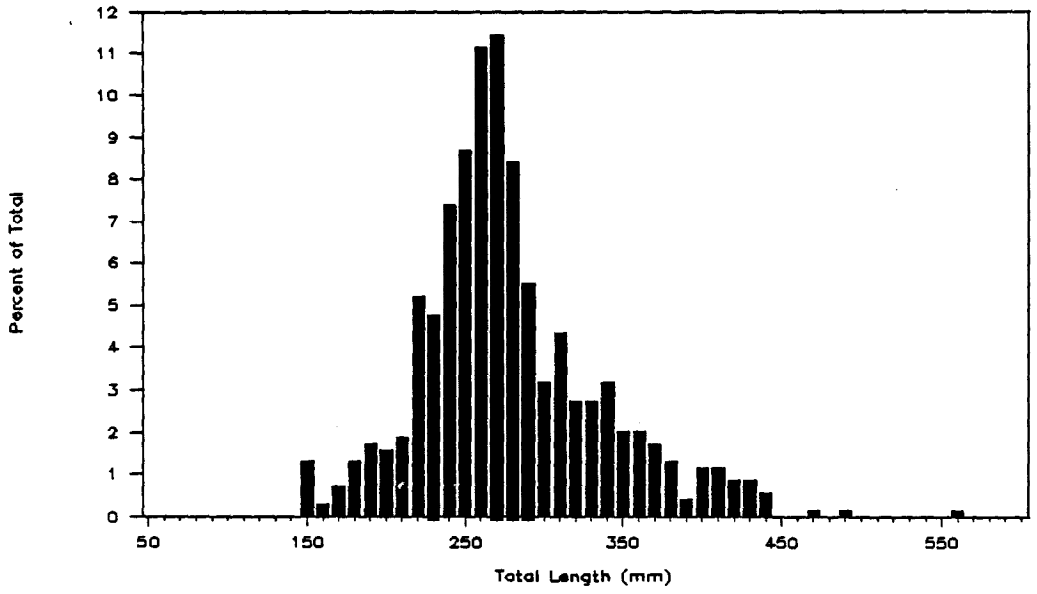

Figure 9. Length frequency by percent of rainbow trout captured in 1978 by electrofishing in Box Canyon (data from Coon 1978; n = 692, avg. length 280 mm).

Table 7- Percentages of rainbow trout by size interval, 1986.

Reach	N	Total Length (mm)				
		<150	150-250	250-350	350-450	>450
Box Canyon	1381	18	44	26	9	3
Last Chance	276	40	35	9	10	6
Harriman North	77	28	30	19	4	19
Railroad Ranch	90	7	16	29	22	26
Harriman East	34	13	37	43	7	0
Lower Canyon	59	5	54	37	4	0

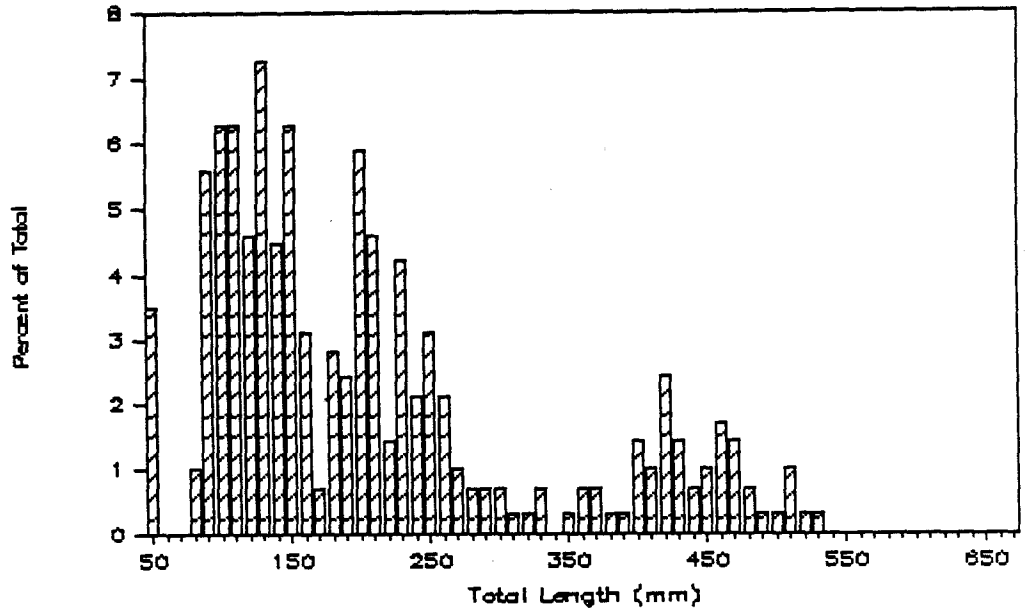

Figure 10. Length frequencies of rainbow trout captured by electrofishing in 1986 at Last Chance (n = 276, avg. length 211 mm).

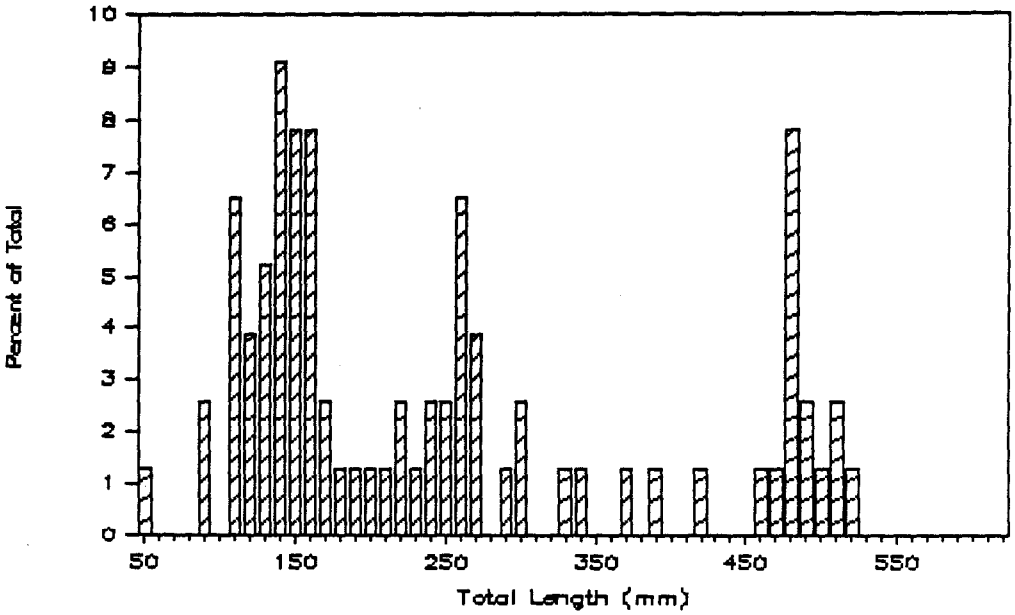

Figure 11. Length frequencies of rainbow trout captured by electrofishing in 1986 at Harriman North (n = 76, avg. length 244 mm).

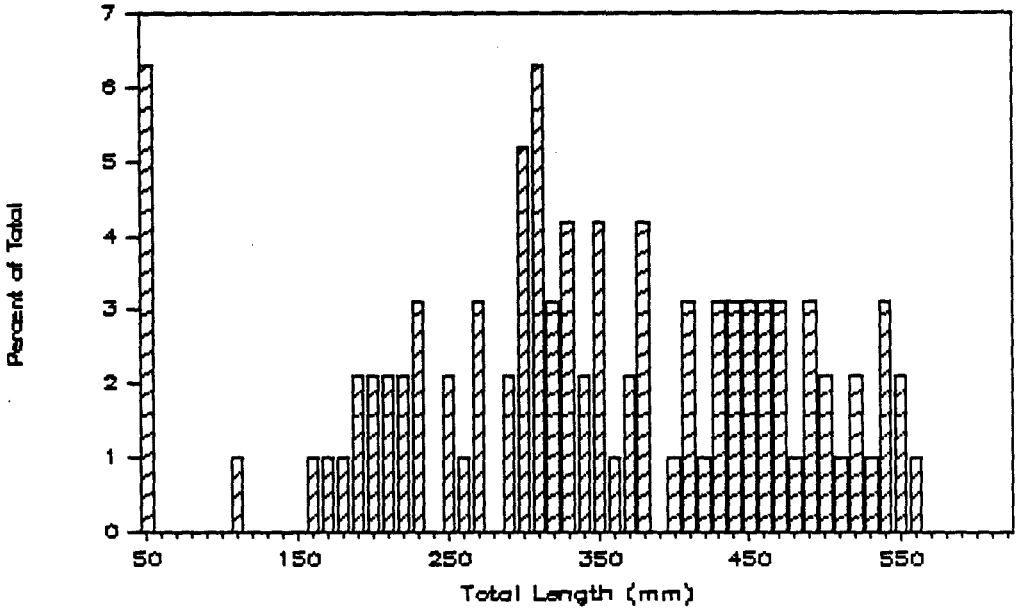

Figure 12. Length frequencies of rainbow trout captured by electrofishing in 1986 at the Railroad Ranch (n = 90, avg. length 355 mm).

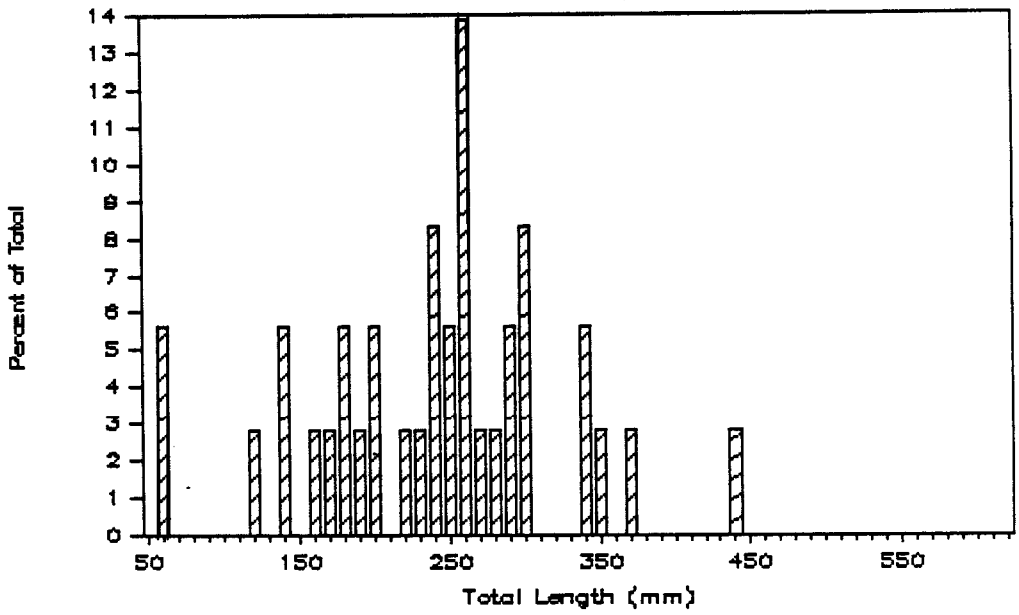

Figure 13. Length frequencies of rainbow trout captured by electrofishing in 1986 at Harriman East (n = 34, avg. length 238 mm).

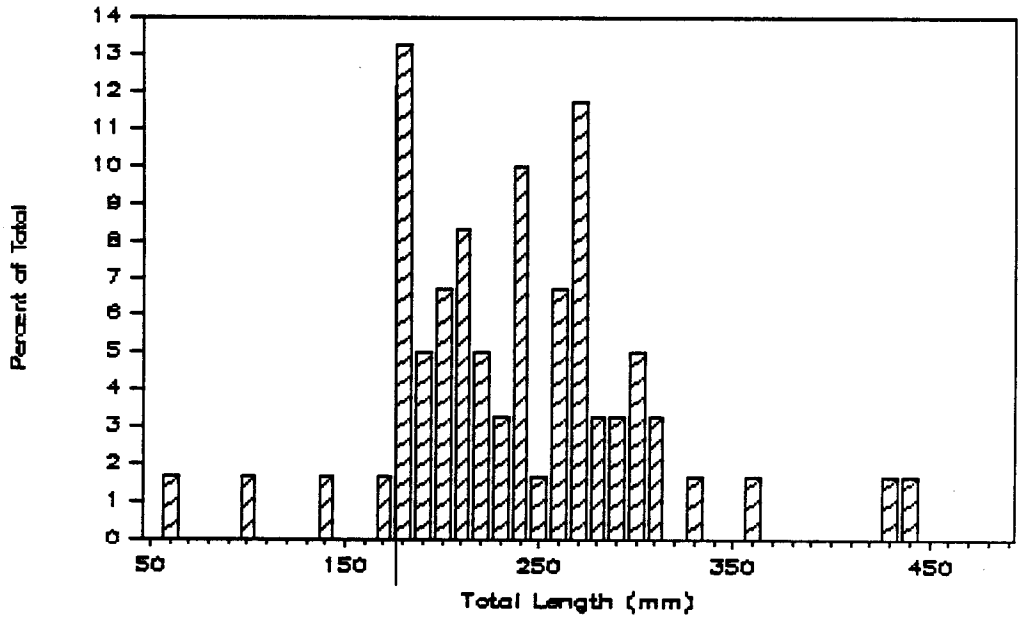

Figure 14. Length frequencies of rainbow trout captured in 1986 by electrofishing in the Lower Canyon (n = 59, avg. length 226 mm).

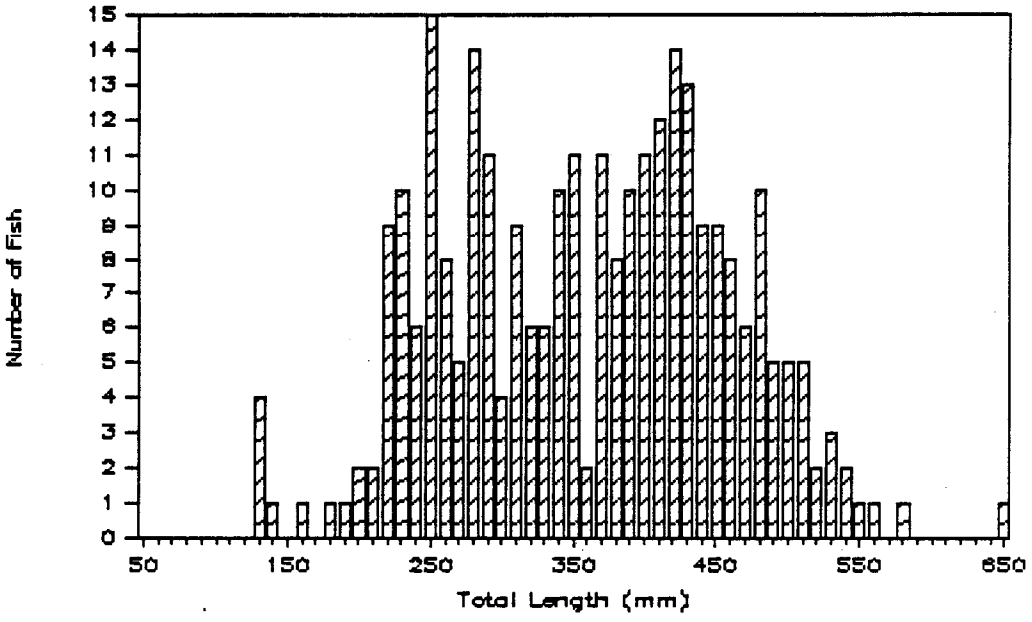

Figure 15. Length frequencies of hook scarred rainbow trout captured in 1986 by electrofishing in all reaches (n = 285, avg. length 357 mm).

reach came from the upper part of the reach in the vicinity of Riverside campground.

Fifteen percent of all rainbow trout captured had hook scars. A larger percentage of fish were scarred in the more heavily fished reaches upstream from Osborne Bridge than at Harriman East or in the Lower Canyon. The percentage of fish with hook scars was highest (30%) at Harriman North. The unexpected low percentage of scarred fish in Box Canyon is due to the high number of small (<200 mm) unscarred fish in the examined catch. Because of the gear typically used by Box Canyon anglers, these small fish are a minor component of the fishery. The length-frequency distribution for all scarred trout captured (Figure 15) is shifted to the right compared to the length-frequency distribution for all fish captured, indicating larger fish are disproportionately more likely to be scarred.

1987 Rainbow Trout Age and Growth

Estimated annual growth increments and total length-at-age were similar to those reported by Rohrer (1981). Young age-classes (1+ and 2+) had larger growth increments in Box Canyon than in downstream sections (Tables 8-11). We hypothesize that this increased relative rate of growth in Box Canyon results from the difference in the water temperature regimes between Box Canyon and downstream sections. In Box Canyon, winter temperatures are warmer than downstream areas, and summer temperatures remain in a range (15-17 C) near the optimum for trout growth (unless discharge is halted). In downstream sections, water temperature often exceeds 20 C in summer.

Mean estimated growth increments for older age classes do not follow this pattern. Growth is probably more variable in older fish, and the problem is compounded by our small sample sizes. Fish in Box Canyon tend to exhibit rapid early growth, and fish in downstream sections exhibit more uniform growth through life (Tables 9-11).

Estimated total annual mortality for rainbow trout was 53% in Box Canyon, 68% on the Railroad Ranch, and 82% for the Pinehaven and Cardiac Canyon sections combined (Table 12). Mortality estimates were calculated using the least squares regression catch-curve method (Figures 16-18). Other methods, such as those of Jackson, Heincke, and Chapman and Robson (Everhart and Youngs 1981), produced similar results. Annual mortality of rainbow trout in Box Canyon was similar to that of the 50% value reported for a catch-and-release section of the Madison River (Vincent 1980).

Angling mortality was preliminarily estimated at 18 and 9% for Pinehaven and Cardiac Canyon, respectively. No data are available on trout outmigration in the Lower Canyon, but we speculate that anchor ice formation may account for much of the overwinter natural mortality component.

1986 Trout Movements

No tagged and recaptured fish moved out of the vicinity of original capture. One fin-clipped fish from Box Canyon was recaptured at HSP. We recaptured 9 (2.7%) tagged fish (including angler tag returns) and 16 (1%)

Table 8. Calculated mean total lengths and annual increments of growth of wild rainbow trout captured by electrofishing between Island Park Dam and Riverside Campground in 1986 and 1987.

Age	n	Mean TL at Capture (mm)	Calculated mean total length (mm) at annulus					
			1	2	3	4	5	6
1	77	224	143					
2	30	274	129	227				
3	41	401	152	274	356			
4	37	458	155	276	364	429		
5	11	525	158	305	387	451	496	
6	1	540	142	256	329	427	460	532
Grand Mean (mm)			146	265	363	434	493	532
Growth Increment (mm)			146	119	98	71	59	39
Number of Fish			197	120	90	49	12	1

Table 9. Calculated mean total lengths and annual increments of growth of wild rainbow trout captured by electrofishing in Box Canyon in 1986 and 1987.

Age	n	Mean TL at Capture (mm)	Calculated mean total length (mm) at annulus					
			1	2	3	4	5	6
1	17	172	152					
2	11	277	137	242				
3	32	405	156	280	361			
4	31	454	160	275	359	423		
5	11	525	163	308	389	453	496	
6	1	540	148	261	331	429	461	532
Grand Mean (mm)			155	277	364	431	493	532
Growth Increment (mm)			155	122	87	67	62	39
Number of Fish			103	86	75	43	12	1

Table 10. Calculated mean total lengths and annual increments of growth of wild rainbow trout captured by electrofishing on the Railroad Ranch in 1986 and 1987.

Age	n	Mean TL at Capture (mm)	Calculated mean total length (mm) at annulus			
			1	2	3	4
1	5	208	132			
2	12	271	105	206		
3	6	371	129	240	332	
4	4	458	137	292	388	434
Grand Mean (mm)			120	231	355	435
Growth Increment (mm)			120	111	124	80
Number of Fish			27	22	10	4

Table 11. Calculated mean total lengths and annual increments of growth of wild rainbow trout captured by electrofishing from Pinehaven to Riverside Campground in 1986 and 1987.

Age	n	Mean TL at Capture (mm)	Calculated mean total length (mm) at annulus			
			1	2	3	4
1	55	241	112			
2	7	273	99	217		
3	3	414	133	259	348	
4	2	517	115	259	396	482
Grand Mean (mm)			112	235	367	482
Growth Increment (mm)			112	123	132	115
Number of Fish			67	12	3	2

Table 12. Estimated annual total mortality rates (A), survival rates (S), and instantaneous mortality (Z) for rainbow trout on the Henry's Fork of the Snake River between Island Park Dam and Hatchery Ford. Data are from 1986 and 1987. Lower Canyon Section includes data from Pinehaven and Cardiac Canyon sections.

Section	Z	S	A	Age Classes
Box Canyon	0.76	0.47	0.53	2-5
Railroad Ranch	1.13	0.32	0.68	2-5
Lower Canyon	1.72	0.18	0.82	2-4

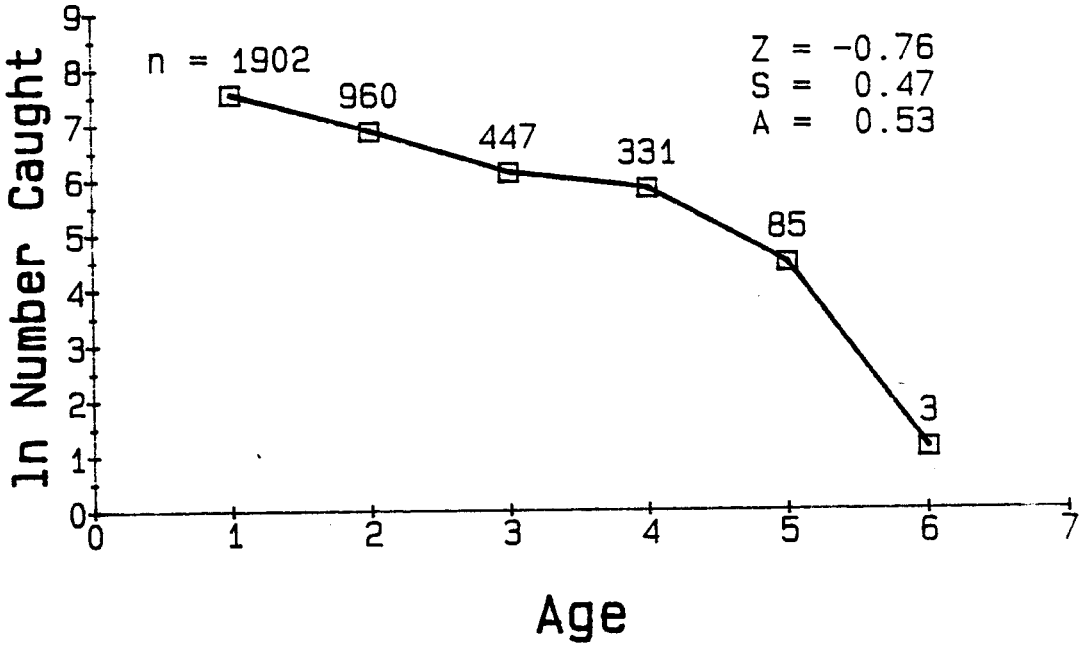

Figure 16. Rainbow trout catch curve for Box Canyon developed from 1986 and 1987 electrofishing data. Estimate of Z based on ages 2-5.

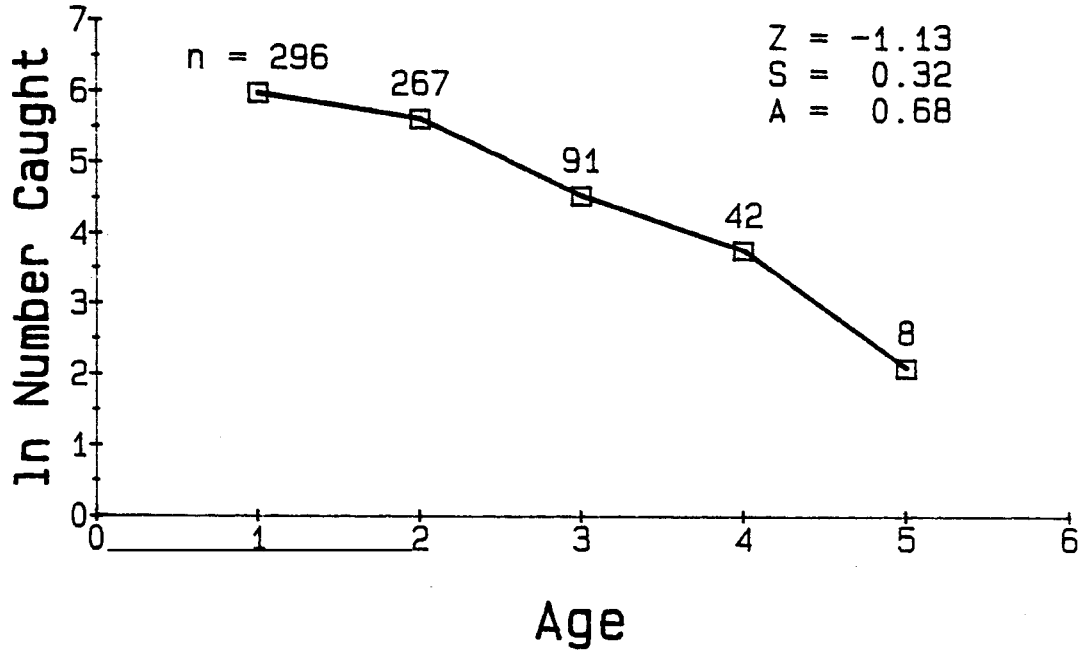

Figure 17. Rainbow trout catch curve for the Railroad Ranch developed from 1986 and 1987 electrofishing data. Estimate of Z based on ages 2-5.

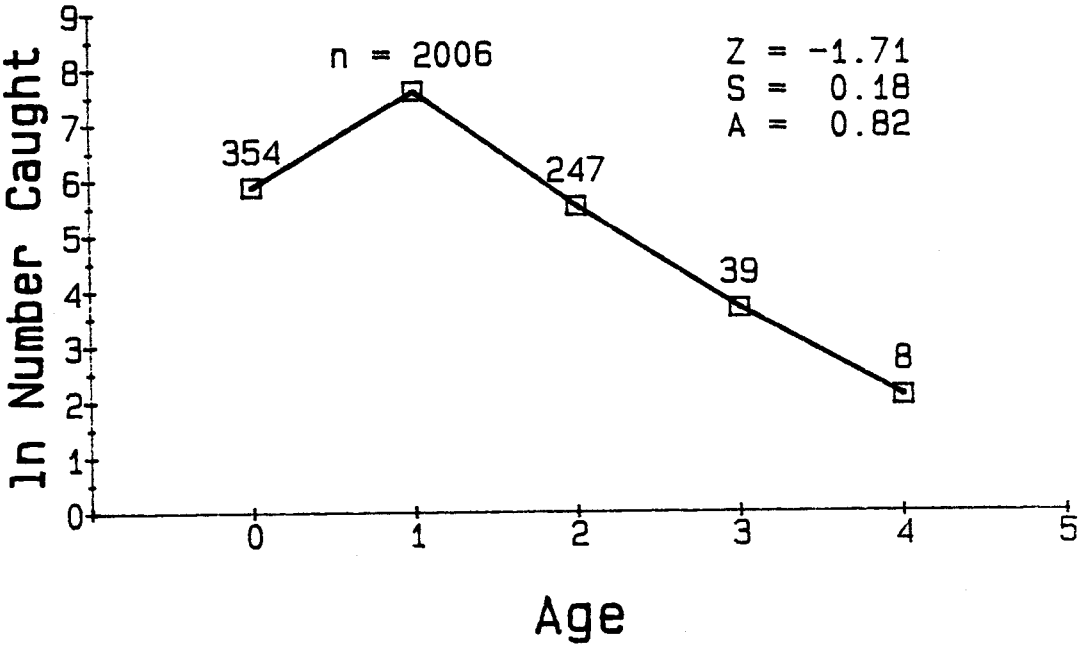

Figure 18. Rainbow trout catch curve for the Lower Canyon developed from 1986 and 1987 electrofishing data for the Pinehaven and Cardiac Canyon sections.

Table 13. Numbers of trout marked, tagged, and recaptured by electrofishing and angling on the Henry's Fork from 26 June 1986 to 18 August 1986.

Reach	Marked	Marked Recaps	Tagged	Tagged Recaps
Box Canyon	1173	13	196	1
Last Chance	216	3	52	5
Harriman North	50	0	24	3
Railroad Ranch	37	0	53	0
Harriman East	25	0	9	0
Lower Canyon	57	0	2	0
Total	1558	16	336	9

marked fish (Table 13). Rohrer (1984) reported little movement of resident salmonids during the summer for the same reach of river.

1987 Trout Movements

Twenty-nine jaw-tagged rainbow trout were recaptured in 1987 (Appendix B). Sixteen fish were recovered in Box Canyon, eight on the Railroad Ranch and five at Last Chance. One fish, tag #133, was tagged 1 October 1986 at the middle stock bridge on the Railroad Ranch, and was caught by an angler in Box Canyon on 20 June 1987. All other tag returns were from the vicinity of tagging. Rohrer (1984) concluded that late-fall or early-spring upstream movement was for spawning purposes. He found little summertime movement.

Twenty-eight rainbow trout captured in Cardiac Canyon had old 1987 fin clips from Box Canyon and the Railroad Ranch. These fish represent about 2% of the total catch in Cardiac Canyon, which suggests downstream movement of trout from the Ranch and Box Canyon may be an important source of recruitment to the fishery in the lower sections.

Two tagged fish were caught and reported by anglers more than once. A 420 mm trout was tagged (# C10422) on 21 June 1986 in the Big Bend area of the Railroad Ranch by an angler cooperating in the tagging effort. The fish was caught by anglers twice in August of 1986 and again on 17 July 1987 in the vicinity of tagging. A 450 mm trout was tagged (#117) on 20 May 1987 in Box Canyon by the IFG electrofishing crew. This fish was caught by anglers on 15 and 22 June 1987 in the vicinity of capture.

1986 Habitat Quality

Macrophyte community composition differed considerably from that described by Hampton (1981). Sampling at the same locations, at the same time of year, and using similar methods, two species not found by Hampton in 1979 and 1980 are apparently important components of the present community. These two species, Ranunculus aquatilis and Zannichellia palustris, accounted for 36 and 10 % of the total wet weight of the samples (Table 14). Hampton (1981) reported Elodea canadensis and two species of Potamogeton as together accounting for 74% of the total wet weight in both 1979 and 1980. In our samples, these species accounted for 11% of the total weight. In the community we sampled, Myriophyllum spp. and Ranunculus aquatilis were most important, accounting for 79% of the total weight. A survey of macrophytes by Shea (1979) was non-quantitative (Shea, pers. commun.), but she described a community similar to the one reported by Hampton (1981). In a survey by Hansen (1959), Potamogeton pectinatus was most important, accounting for 40% of the wet weight of the sample. Ranunculus aquatilis, a species not found by Hampton (1981) in 1979 or 1980, accounted for 13% of Hansen's sample.

Aquatic macrophytes were abundant at all stations except Big Bend. Ranunculus aquatilis occurred at all stations. Myriophyllum spp. were present at all stations except Fish Creek and Pinehaven, where only Ranunculus was collected.

Average wet weight (kg/m^2) of aquatic vegetation per sample station was highest at the Pinehaven, Cookhouse and Harriman Bridge South stations

Table 14. Percent species composition by wet weight of aquatic vegetation in low gradient reaches of the Henry's Fork.

Species	1986[a]	1980[b]	1979[c]	1977[d]	1959[e]
Elodea canadensis	1	13	24	35	4
Potamogeton bectinatus	9	34	33	32	40
Myriophyllum spp.	43	25	25	23	7
Potamogeton Qerfoliatus	1	27	17	3	3
Ranunculus aquatilis	36	n.f.[f]	n.f.	1	13
Zannichellia palustris	10	n.f.	n.f.	n.f.	n.f.
Callitriche verna	n.f.	1	1	1	1
Sagittaria spp.	n.f.	n.f.	n.f.	n.f.	9
Naias spp.	n.f.	n.f.	n.f.	n.f.	16

[a] This study.
[b] Hampton (1981).
[c] Hampton (1981).
[d] Shea (1979).
[e] Hansen (1959).
[f] n.f. — not found.

Table 15. Average wet weight (kg/m^2) of aquatic vegetation per sample station.

Station	1986[a]	1980[b]	1979[c]
Last Chance	2.3	6.3	7.8
Big Bend	0.6	3.6	2.3
Harriman Bridge N.	2.0	2.7	2.1
Harriman Bridge S.	2.8	3.2	7.5
Cookhouse	2.7	3.6	2.1
Silver Cr. Outlet	0.9	1.6	2.1
Osborne Bridge	1.7	3.1	2.4
Harriman East	1.0	n.s. [d]	3.9
Fish Creek	1.0	n.s.	2.9
Pinehaven	3.0	n.s.	7.6
x	1.8	3.4	4.1
s	0.9	1.4	2.5

[a] This study.
[b] Hampton (1981).
[c] Hampton (1981).
[d] n.f. - not sampled.

(Table 15). Data collected in 1979 by Hampton (1981) indicate a similar trend. Average wet weight for all stations was 1.8 kg/m^2 , compared with 4.1 kg/m^2 reported by Hampton (1981). Variation among stations in average wet weight of aquatic vegetation per sample was less than in previous surveys (Table 15).

Dissolved oxygen did not fall below about 7 mg/l on the two days sampled (Table 16). Dissolved oxygen dropped from an average **of** 19.4 mg/l for all sites on the afternoon of 12 August 1986 to an average of 12.3 mg/l at the resampled sites on the following morning. Dissolved oxygen did not change appreciably overnight at the Island Park Dam outlet or at Last Chance.

Water temperatures displayed large daily fluctuations at HSP and were constant at the Island Park Dam outlet (Figures 19 and 20). Mean daily water temperature fluctuation at HSP was 4.8 C for the period of record (16 June to 12 August 1986). Mean daily water temperature fluctuation at Island Park Dam outlet was 0.56 C for the period of record (27 June - 12 August 1986). Maximum daytime temperature at HSP was 23.5 C and occurred on 26 June 1986. Maximum nighttime water temperature at HSP was 17 C and occurred on 3 July 1986. Maximum daytime water temperature at the dam outlet was 21 C on 1, 2 July 1986. Maximum nighttime water temperature at the dam outlet was 20 C from 28 June to 1 July 1986.

1987 Habitat Quality

Maximum and minimum daily temperatures and daily fluctuations were similar at the Harriman Park stock bridge and the Pinehaven boat take-out, and were similar to 1986 temperatures at the Harriman bridge for the same period of record. Daily fluctuations were large compared with the relatively constant temperatures measured in Box Canyon at the dam outlet Daily fluctuations were slightly greater at the Harriman Stock Bridge than at Pinehaven (Figures 21-24). Maximum recorded daytime temperature was approximately 23 C on 14 June 1987 at both sites.

Microhabitat Utilization

Size of fish could not be accurately estimated from shore, and observed fish were catagorized as age-0 or adults. Substrate at all sampling points was gravel. Cover utilized was primarily the bank (40%), and aquatic macrophytes (40%). Adults and parr utilized similar microhabits with respect to depth and velocity (Table 17). Adult trout were observed further from cover and closer to the bank than parr. The data suffer from the limitation that only surface feeding adult fish could be located.

Data analysis for habitat utilization in high gradient reaches is incomplete. Preliminary findings suggest microhabit preference of rainbow trout in Box Canyon is similar to that reported by Bovee (1978). Rainbow trout selected a mean total depth of 70 cm (SD = 20.04, n = 264) with a range of 22 cm to 140 cm. Focal depth averaged 48 cm (SD = 23.12, n = 264) with a range of 6 to 120 cm. Focal velocity ranged from 0.01 m/s to 0.59 m/s. Fish over 200 mm selected an average focal velocity of 0.22 m/s with a mode of 0.4 m/s. Feeding fish selected higher velocities (0.45 m/s) than did resting or inactive fish (0.1 m/s). Seventy-nine percent of fish observed were within one meter of structural cover, and 73% were

Table 16. Dissolved oxygen in the Henry's Fork River on two dates as determined by a Micro-Winkler technique.

Station	Time	Temp (C)	DO (mg/1)	%Sat
		12 Aug 1986		
I.P. Res.	13:30	21	19.06	216
I.P. Dam Outlet	13:30	17	15.74	165
Last Chance	14:20	18	16.50	175
Big Bend, H.S.P.	14:50	20	16.55	180
H.S.P. Picnic Area	15:30	22	20.21	250
Above Harriman Spring	15:50	17	20.95	170
Below Harriman Spring	15:50	9	20.16	220
Pinehaven	16:52	17	20.00	220
		13 Aug 1986		
I.P. Dam Outlet	4:56	15	17.40	165
Last Chance	5:12	13	17.00	160
Big Bend, H.S.P.	5:32	13	6.99	66
H.S.P. Picnic Area	5:46	16	7.78	77
Above Harriman Spring	6:00	13	8.46	82
Pinehaven	6:20	14	7.57	73

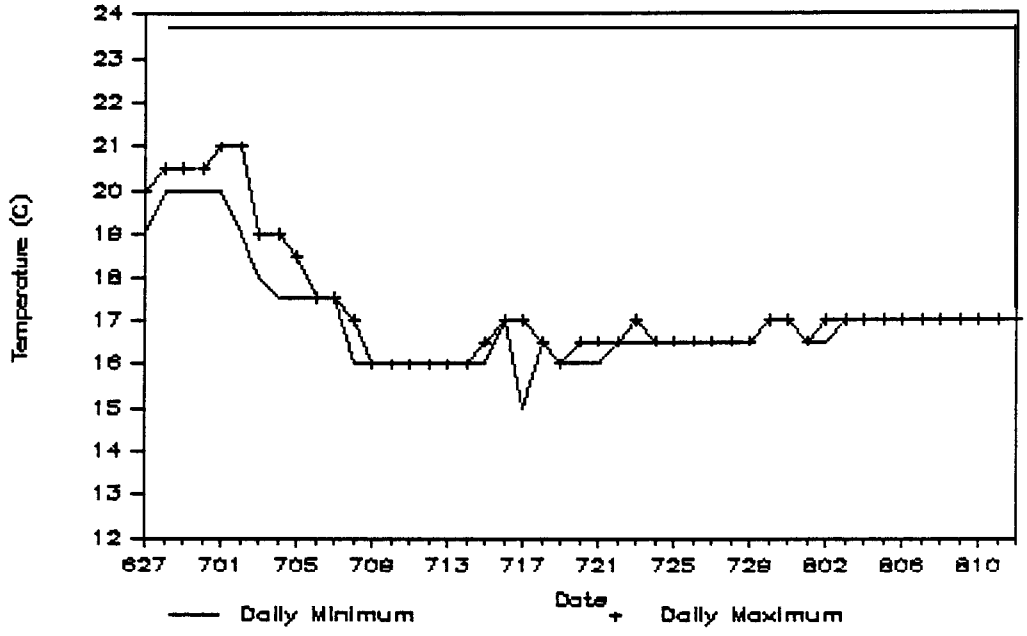

Figure 19. Minimum and maximum water temperatures recorded in Box Canyon from 27 June 1986 through 12 August 1986.

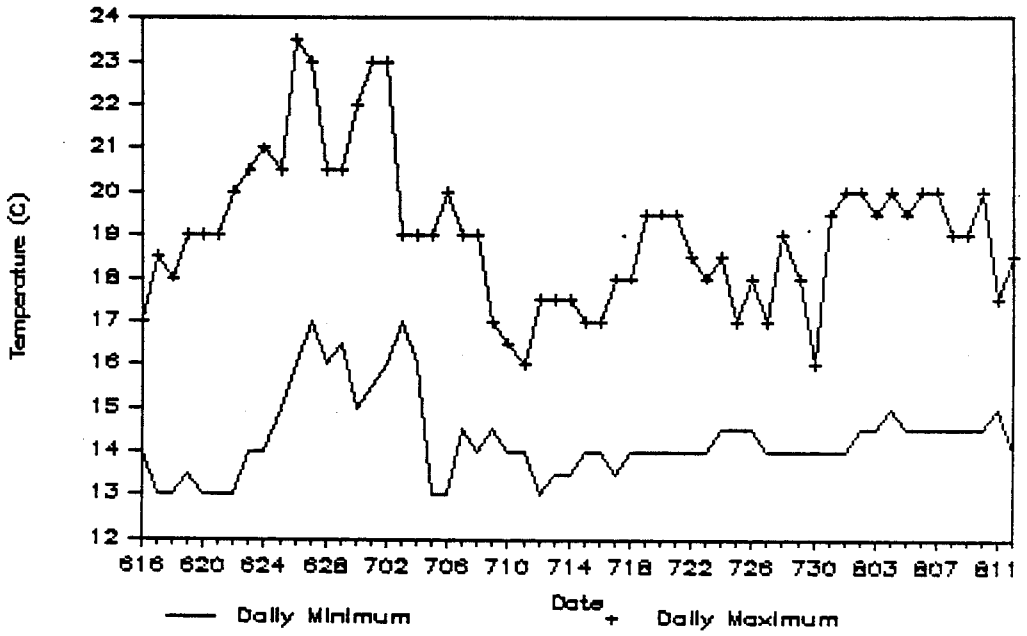

Figure 20. Minimum and maximum water temperatures recorded at Harriman State Park from 16 June 1986 through 12 August 1986.

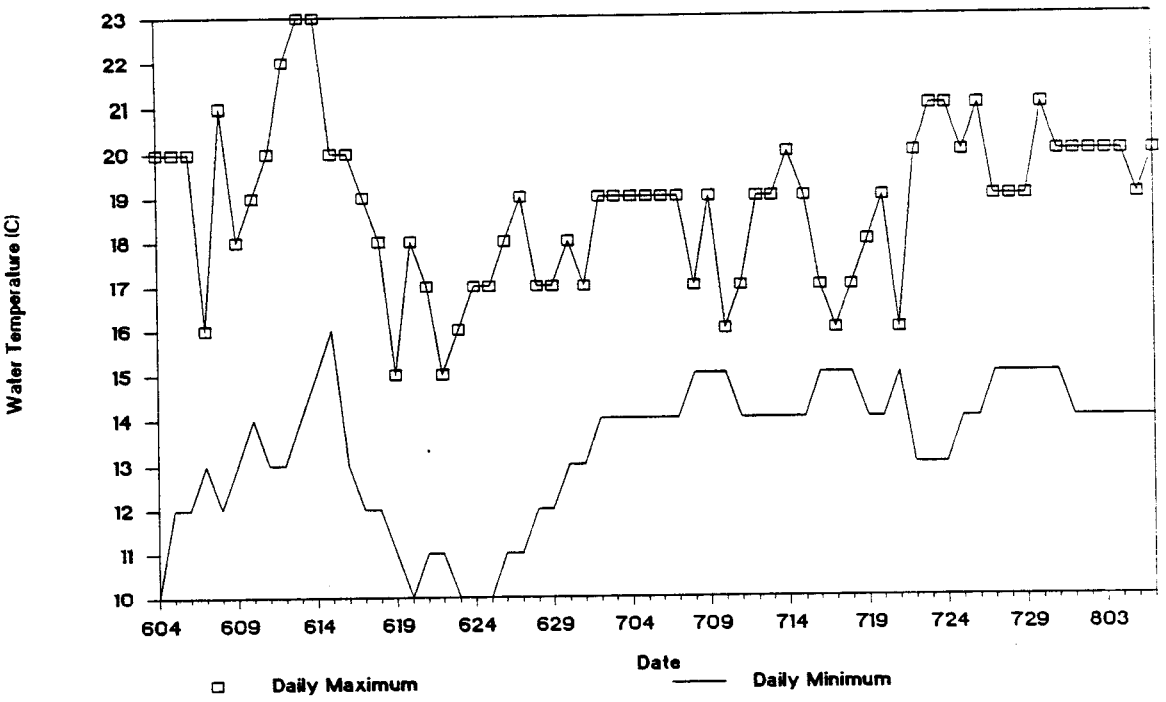

Figure 21. Maximum and minimum temperatures recorded at the Harriman Stock Bridge between 4 June 1987 and 6 August 1987. Maximum recorded temperature was 23 C. Minimum recorded temperature was 10 C. Mean daily fluctuation was 5.5 C.

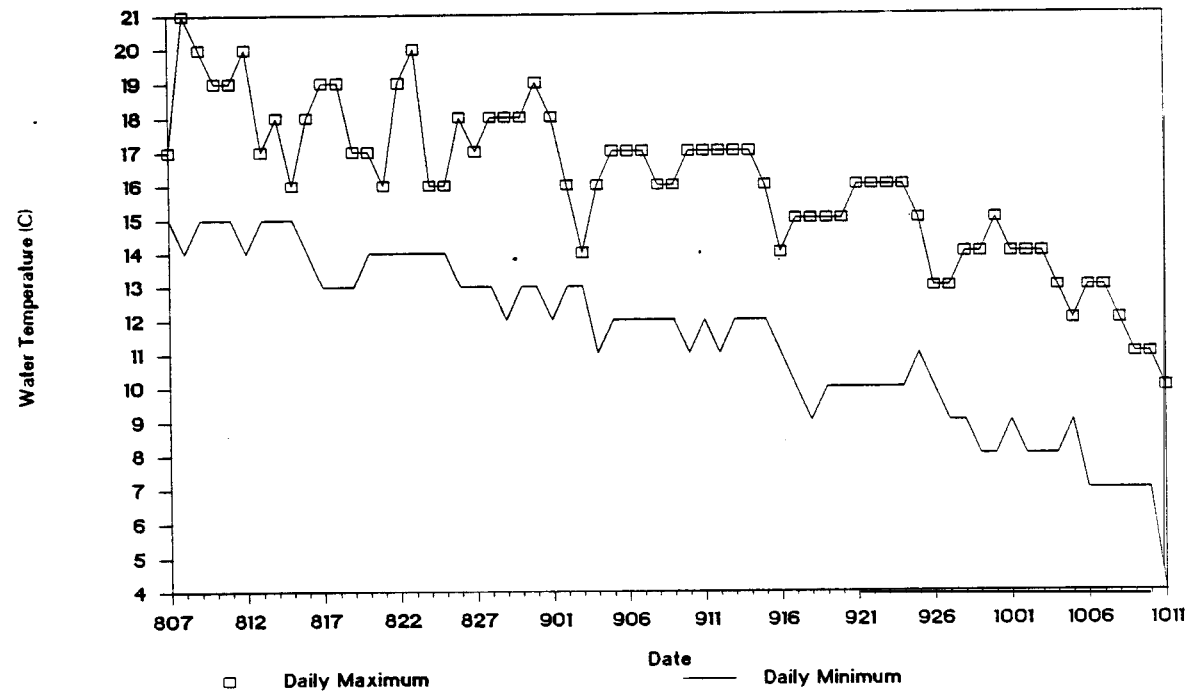

Figure 22. Maximum and minimum temperatures recorded at the Harriman Stock Bridge between 7 August 1987 and 11 October 1987. Maximum recorded temperature was 21 C. Minimum recorded temperature was 4 C. Mean daily fluctuation was 4.7 C.

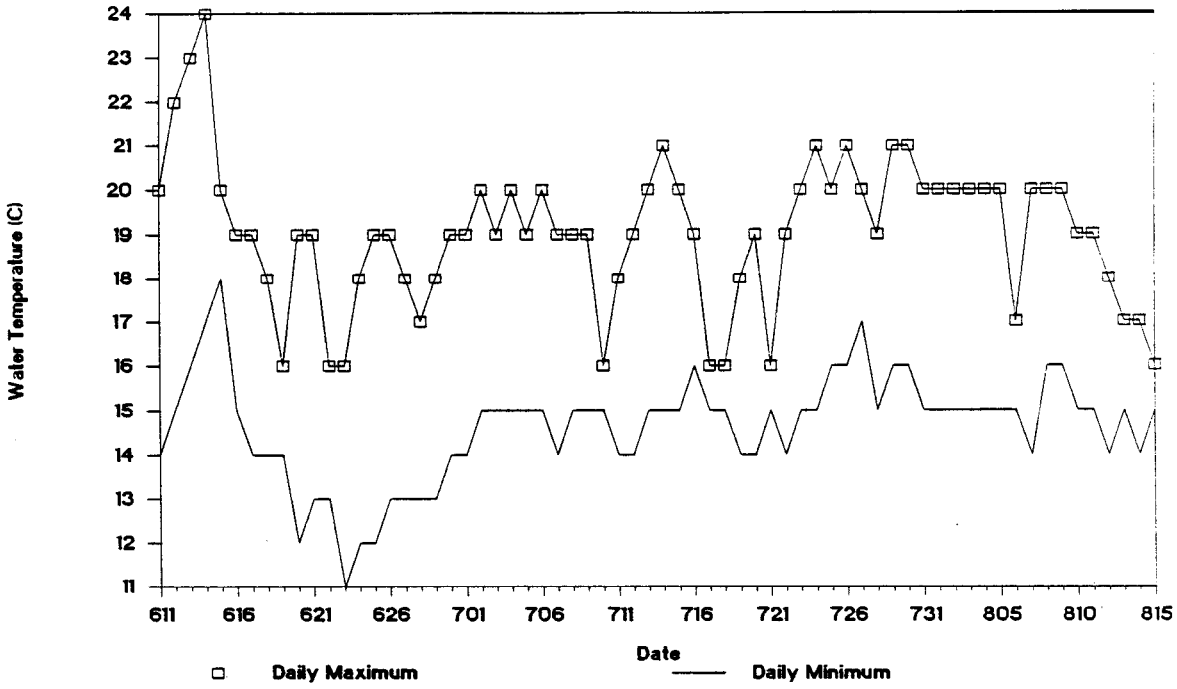

Figure 23. Maximum and minimum temperatures recorded at the Pinehaven take-out between 11 June 1987 and 15 August 1987. Maximum recorded temperature was 24 C. Minimum recorded temperature was 11 C. Mean daily fluctuation was 4.4 C.

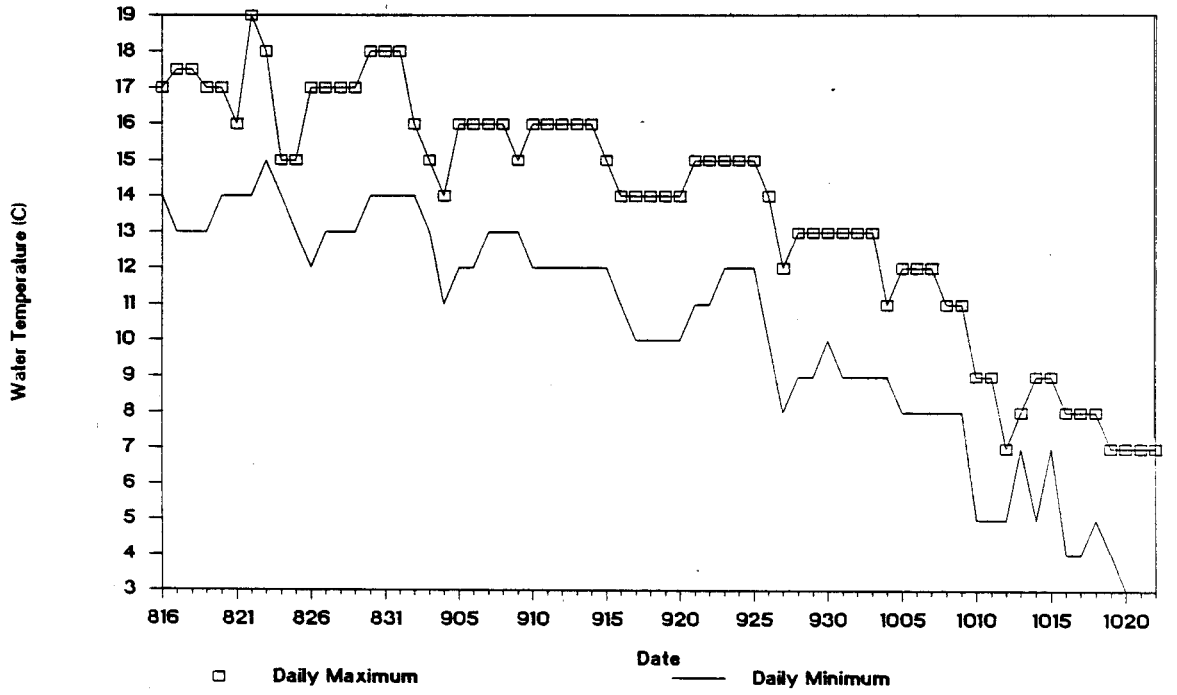

Figure 24. Maximum and minimum temperatures recorded at the Pinehaven take-out between 16 August 1987 and 22 October 1987. Maximum recorded temperature was 19 C. Minimum recorded temperature was 3 C. Mean daily fluctuation was 3.5 C.

Table 17. Means of selected microhabitat variables for low gradient reaches of the Henry's Fork River from 30 June 1986 to 18 August 1986.

Variable	Adult	Age-0
Total Depth (m)	0.51	0.53
Surface Velocity (m/s)	0.48	0.60
Distance to Cover (m)	0.56	0.19
Distance to Bank (m)	1.80	3.22
N	31	22

within 0.5 in. Ninety-nine percent of the observed fish were associated with cover (including depth and surface roughness as cover).

Fish Stranding Survey

A total of 12 stranded fish, all age-0 rainbow trout, were collected in 1986. Five trout (63 to 86 mm) were collected along transect 1. Mean length was 69 mm. Five trout (82 to 103 mm) were collected on transect 3. Mean length was 93 mm. One 65 mm trout was collected on transect 4. Mean length of trout collected from transect 3 (Harriman Bridge) was significantly ($P<0.015$) larger than trout collected from transect 1 (Last Chance). All stranded trout were associated with deposited drifts of vegetation, primarily Potamogeton. The dewatered perimeter rarely exceeded 2 m on any transect, and pools remaining above the receded water line were rare. Many sculpins (Cottus spp.) were stranded on the cobble bar downstream from the discharge tube.

The low number of trout stranded (one trout per km of shoreline) indicates minor stranding impact of dewatering. Anecdotal reports of high stranding mortality during sudden reductions in discharge in previous years suggests that by ramping discharge down, stranding of trout was avoided. The stranded trout collected were smaller than the average age 0 rainbow trout (100-130 mm) for the same time of the year as determined by electrofishing. This suggests that the slower developing or later emerging fry are most vulnerable to stranding.

Abundance and Habitat Utilization by Age-0 Rainbow Trout

In 1987, age-0 rainbow trout were found at all sites except Riverside Campground (Table 18) in mid to late July. The highest mean density, 9.4 trout/m, was at Last Chance. Harriman East and Box Canyon had densities of 0.6 and 0.9 trout/m respectively. Mean density at Last Chance was significantly different ($P <0.05$) from mean density at Harriman East and Box Canyon. Harriman East and *Box* Canyon were not significantly different ($P >-0.05$). Since not all sections were sampled at the same time, comparisons between sites are less useful than comparisons of trends over time. Follow-up surveys are needed to determine if these trends remain consistent.

The unexpected low number of age-0 trout found in Box Canyon may have resulted from electrofishing in daylight, or perhaps the smaller mean length of trout captured there (Table 18) may indicate that larger fry used a more mid-channel daytime habitat and were not effectively sampled. Another possibility is that fry emerging in Box Canyon drop downstream to lower gradient stream reaches. Transects were sampled in order. At Last Chance, transect 1 was sampled at 2300, and transect 6 was sampled at 0200. The apparent increase in fry density with transect sampled at this site may have resulted from sampling through a microhabitat shift. Harriman East was sampled at 2400, and no trend of increased density over time was noted.

The main effects of study section and treatment were not significant ($P > 0.05$), indicating that neither the treatments themselves nor their location had an effect on the number of age-0 trout present in the

Table 18. Number of age-0 rainbow trout per meter of shoreline calculated from 1987 fry counts. Number of trout determined by successive electrofishing removal passes. Riverside Campground and Box Canyon were electrofished in daylight; Last Chance amd 'iarriman East were electrofished at night.

Site	Date	Transect 1	2	3	4	5	6	x	Mean Length (mm)
Last Chance	7-15	2.8	5.4	8.7	14.6	11.8	13.2	9.4	69.4
Harriman East	7-16	0.8	0.3	0.6	1.2	0.6	0.2	0.6	67.4
Riverside C.G.	7-29	0	0	0	0	0	0	0.0	na[1]
Box Canyon	7-31	0.5	1.2	1.4	0.6	na	na	0.9	61.4

[1] Not applicable.

treatment sections at the time of sampling (Table 19, Figures 25 and 26). The main effect of sampling date was significant ($P < 0.05$, Table 19), indicating that fewer age-0 trout were present in all sections, regardless of treatment, on the 2 August 1987 sampling date. On both occasions a small number of adult brook trout were associated with tree top treatments.

On the 1 July 1987 sampling date, the tree top treatment held a larger, number of trout than the other treatments, although the difference was not statistically significant. Our observations indicate that this treatment provided the largest area of zero or near zero water velocity. These results suggest that cover designs that provide shallow areas of zero velocity are used disproportionately by age-0 trout early in the summer when the fish are less than 60 mm in length. Horner and Bjornn (1976) reported that fry prefer velocities less than 0.08 m/sec. Griffith (1972) stated that young trout are closely associated with cover, rarely found more than 1 m from suitable escape cover. The shorelines at Harriman East are lacking in this type of cover. At Last Chance, where shoreline transects showed age-0 trout to be relatively abundant (Table 18), boulders and overhanging banks provide extensive areas of low velocity habitat.

Age-0 trout observed at night by snorkeling were above the substrate and active in summer. Use of cover for hiding was not observed.

Winter Habitat Utilization

In the daytime, we observed no juvenile rainbow trout while snorkeling transects in both bank and non-bank areas. Furthermore, we observed no juvenile rainbow trout during the day on preliminary and follow-up dives in areas not measured. This daytime hiding behavior was observed at stream temperatures ranging between 0.0 to 7.5 C. We did not snorkel at temperatures warmer than 7.5 C.

At night, no juveniles were observed in or near large macrophyte beds in non-bank areas. Low densities were found in several non-bank locations in Box Canyon where fish were observed in protected areas among large (>1 m diameter) in slow velocity water. No fish were observed at night in non-bank areas in the Last Chance, Harriman State Park, Osborne Bridge, and Pinehaven reaches.

A total of 96% of the 1,531 fish observed during the night were near boulder clusters along the bank. However, this habitat represented only 35% of the bank habitat surveyed$_2$ We observed juvenile rainbow trout densities of 5 to 100 fish/100 m in the high-ranked bank habitat which consisted of boulder clusters and developed undercut banks. Medium- and 12w-ranked banks had densities of 0 to 5 fish/100 m and 0 to 1 fish/ 100 m , respectively. Without exception, where we observed potential concealment cover along the bank, we found abundant juvenile rainbow trout at night.

Table 19. Number of trout in each treatment section in 1987 summer cover utilization experiment as determined by successive electrofishing removal passes on 1 July and 2 August 1987. Study section A was not sampled on 1 July 1987. Mean number of trout sampled was significantly different ($P < 0.05$) between sampling dates.

Treatment	Study Section	Treatment Section	1 July	2 August
Boulders	A	4	--	1
	B	4	20	14
	C	4	22	3
	D	2	45	8
	E	4	18	3
Overhead Cover	A	3	--	1
	B	1	55	10
	C	3	6	2
	D	4	6	2
	E	2	31	7
Tree Top	A	2	--	5
	B	3	46	7
	C	2	68	2
	D	1	63	5
	E	3	42	5
Control	A	1	--	4
	B	2	35	4
	C	1	40	3
	D	3	9	3
	E	1	60	9
Total			566	86[1]

[1] Total does not include study section A.

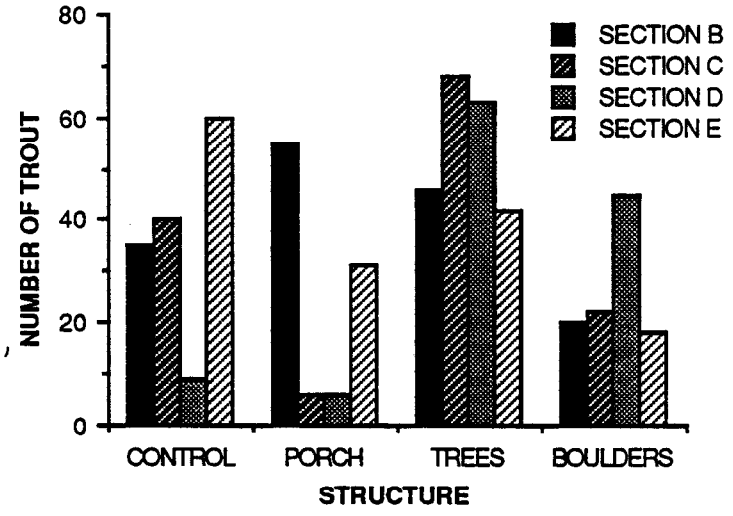

Figure 25. Number of trout found on 1 July 1987 in each treatment section of the cover utilization experiment. Note that section A was not sampled.

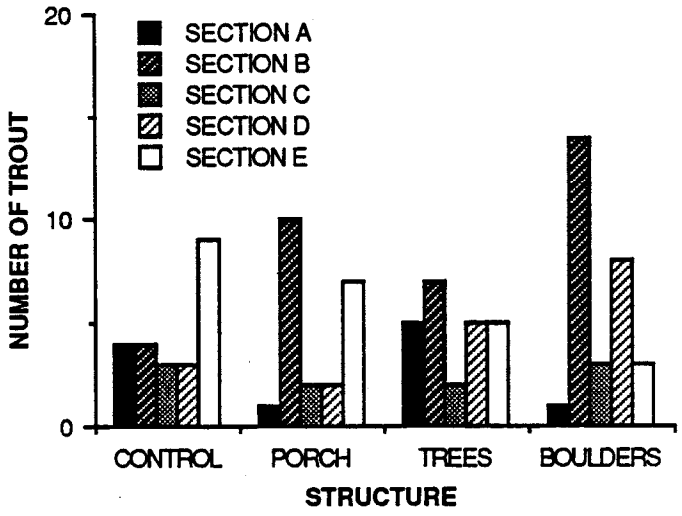

Figure 26. Number of trout found on 2 August 1987 in each treatment section of the cover utilization experiment.

Winter daytime microhabitat utilized by juvenile rainbow trout in the Henry's Fork consisted of the interstitial spaces between and under boulders along the bank. Undercut banks with dense root wads or dense woody debris were also utilized. Single logs with few branches were not utilized as daytime concealment cover. Many of the undercut banks that provided winter habitat earlier in the winter were dewatered when flows were reduced below Island Park Dam in February. Only deep and well developed undercut banks continued to provide concealment cover at lower flows. These banks were only found in areas absent of cattle grazing such as on islands and within fenced areas.

Winter nighttime microhabitat utilized by juvenile rainbow trout in the Henry's Fork consisted of the slow velocity areas near the bank that were closely associated with daytime concealment cover. Microhabitat measurements of 66 juvenile rainbow trout indicated that they were found within 4 m of the bank with the mode around 1 m (Figure 27). Focal velocity was 0.15 m/s or less with a mode of 0.03 m/s and a mean of 0.07 m/s. Focal depths ranged from 20 to 40 cm with a mean of 29 cm. Fish were consistently either on the substrate or within 5 cm, so total depth was exactly or nearly the same as the focal depth. Cover associated with the focal point was primarily (65%) boulders (Table 20). All other cover types were less than 10% each. A total of 87% of all winter nighttime focal points were within 100 cm of concealment cover.

Dusk emergence of juvenile rainbow trout began 25-35 minutes after real sunset time with light intensities near 0.40 X 10 watts/m (Figure 28). Densities increased until they stabilized about 180 miutes after real sunset time with light intensities of about 0.50 X^{-5} 10 watts/m (Figure 29). Moonlight or the addition of constant artificial light decreased nighttime densities (Figure 30). Densities dropped from 11.11 fish/100 m^2 at a light intensity of 0.36 X 10^{-5} watts/m^2 before the moon rise to a density of 3.17 at a light intensity of 0.36 X 10^{-3} watts/m^2 after the moonrise. Before the addition of artificial light in the form of of a neon sign, density was 18.25 fish/100 m^2 at a light intensity of 0.13 X 10^{-5} watts/m^2 . Twenty minutes after the addition of artificial light, we observed a density of 12.69 trout at a light intensity of 0.12 X 10^{-4} watts/m^2 and we watched fish enter the interstitial spaces between and under boulders in the interim.

Figure 27. Distance to shore of juvenile rainbow trout observed at night in winter on the Henry's Fork.

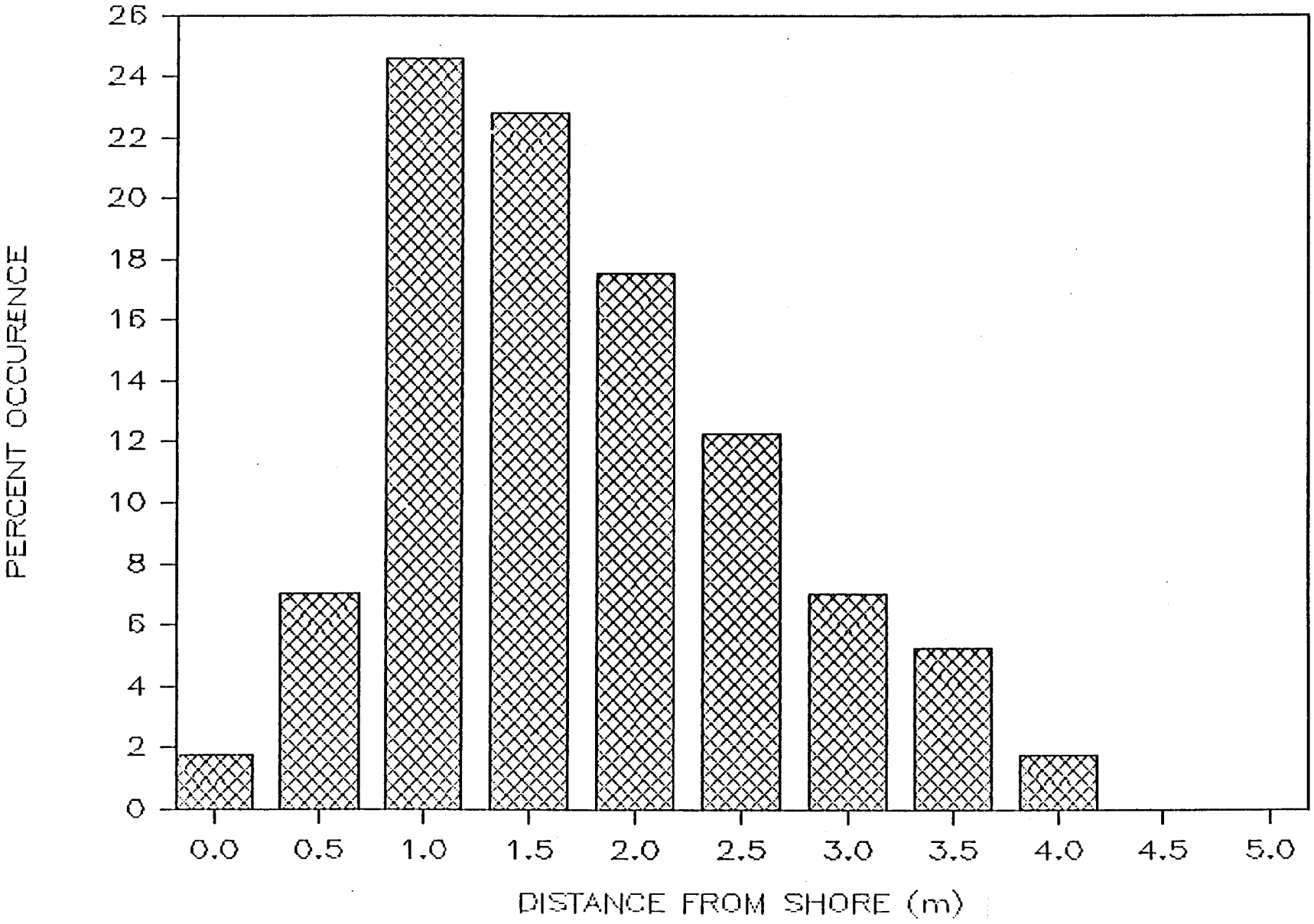

Table 20. Habitat association of juvenile rainbow trout in winter at night.

Habitat	Number of fish
boulder	980
depression	122
aquatic plants	101
cobble	68
woody debris	S7
no cover	203

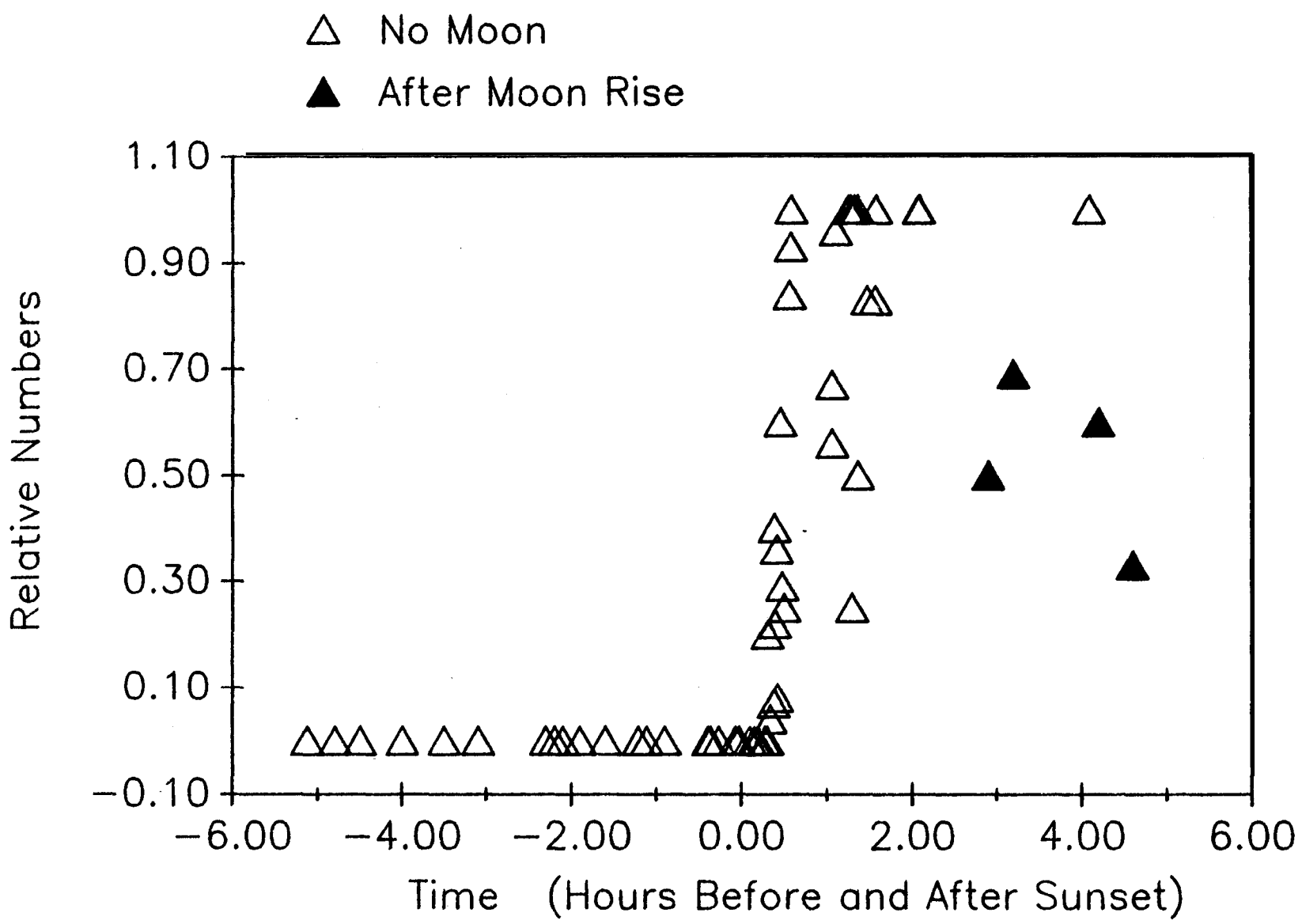

Figure 28. Relationship between light levels and number of juvenile rainbow trout observed at night in winter.

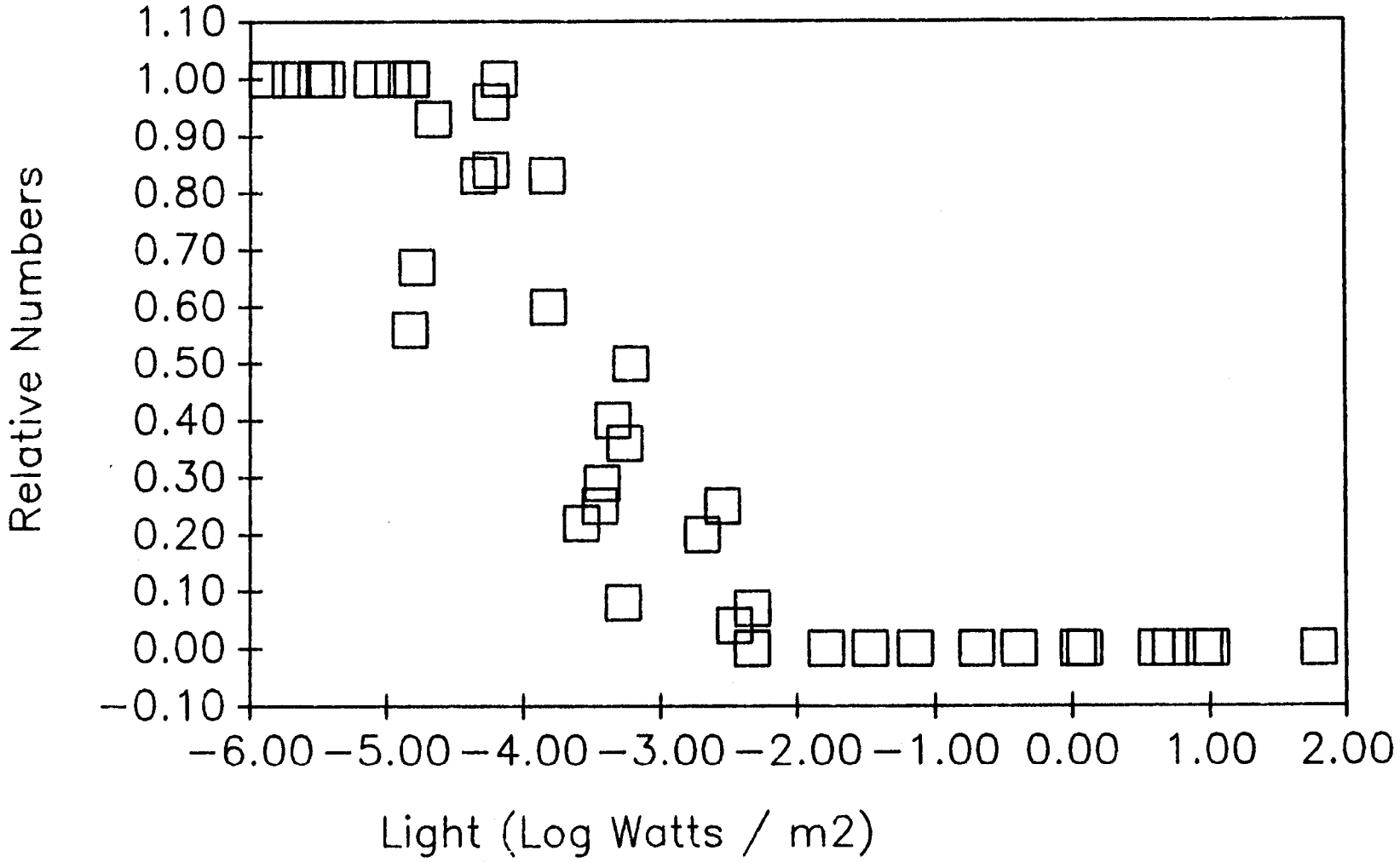

Figure 29. Numbers of juvenile rainbow trout observed before and after sunset in winter

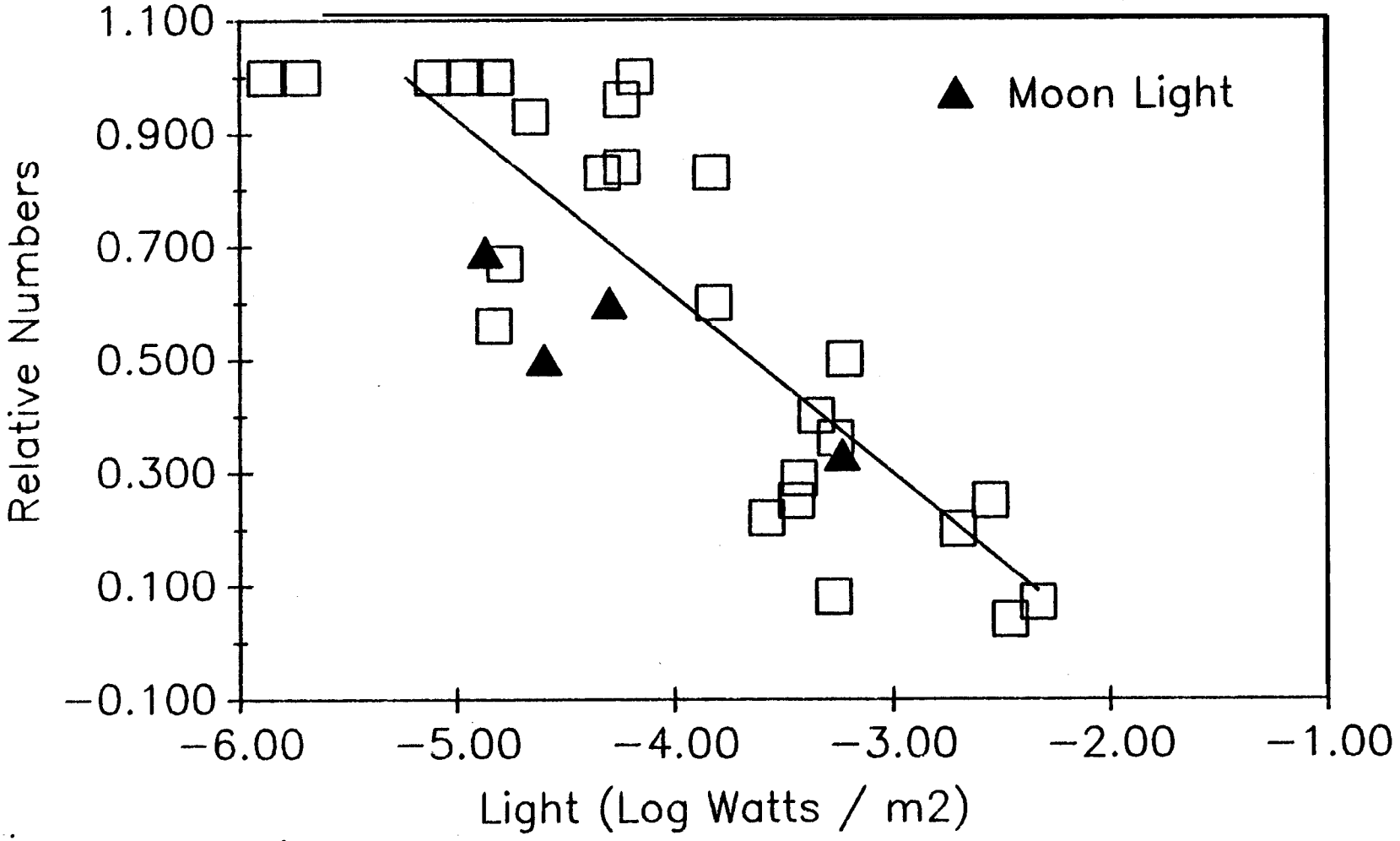

Figure 30. Effect of moonlight on numbers of juvenile rainbow trout observed at night in winter.

Angler Opinion Survey

Eighty-three (83) version 1 questionnaires were completed by anglers fishing between Pinehaven and Mesa Falls. Two hundred and fifty-nine (259) version 2 questionnaires were completed by anglers; 173 version 2 questionnaires were completed by anglers fishing between Island Park Dam and Riverside Campground (upper survey reach), and 86 version 2 questionnaires were completed by anglers fishing between Riverside Campground and Mesa Falls (lower survey reach).

Of the questionnaires completed, 153 (45%) were by Idaho anglers and 187 (55%) were by nonresident anglers. Of the Idaho anglers surveyed, 48 (31%) were fishing between Island Park Dam and Riverside Campground, and 105 (67%) were fishing between Riverside Campground and Mesa Falls (Table 21). In total number of resident anglers, Bonneville, Fremont, and Bannock Counties were ranked first, second and third. Together they accounted for 67 percent of the resident anglers. Bonneville County was ranked first in the lower reach (53%), and was ranked second in the upper reach (27%), following Fremont County with 29 percent of the anglers. Fifteen counties were represented in the sample. Of the Idaho anglers surveyed, 139 (91%) were from counties in southeastern Idaho.

One hundred and twenty-three (66%) of the nonresident anglers were surveyed in the upper reach; 64 (34%) were surveyed in the lower reach (Table 22). In total number of nonresident anglers, California, Utah, and Colorado were ranked first, second, and third. Together they accounted for 62 percent of the nonresident anglers (Table 22). Twenty-four states (11 western, 7 eastern, 6 midwestern) were represented in the sample. California was ranked first, and Utah and Colorado were ranked second or third in both the upper and lower survey reaches. One angler reported South American residence.

The Harriman Ranch was ranked first most frequently by anglers fishing between Island Park Dam and Riverside Campground as the section they preferred to fish. Last Chance was ranked second most frequently, and Box Canyon was ranked third most frequently (Table 23). Anglers fishing between Riverside Campground and and Mesa Falls ranked Box Canyon first most frequently (Table 24). Last Chance and the Harriman Ranch were ranked first the second most frequently. These results suggest that anglers surveyed while fishing the Lower Canyon probably fish upper sections of the river at least as often.

The number of years of fishing experience on the Henry's Fork was similar for both survey reaches (Table 25). Most of the anglers have been fishing the river five years or less. The weighted mean number of years fished was 12 for both reaches.

Table 21. Residency by county for Idaho anglers that responded to question 1 of versions 1 and 2 of the 1987 ISU/IFG angler opinion questionnaire, Henry's Fork of the Snake River, Idaho. Note that all version 1 responses are included with version 2 responses and all are from anglers fishing between Pinehaven and Mesa Falls.

County	n	Rank	I. P. Dam to Riverside		Riverside to Mesa F	
			n	%	n	%
Bonneville	69	1	13	27	56	53
Fremont	21	2	14	29	7	7
Bannock	15	3	8	16	7	16
Bingham	12	4	0	0	12	11
Jefferson	13	4	1	2	12	11
Ada	8	5	4	8	4	4
Teton	5	6	1	2	4	4
Kootenai	2	7	2	4	0	0
Madison	2	7	2	4	0	0
Blaine	1	8	1	2	0	0
Boise	1	8	0	0	1	3
Canyon	1	8	0	0	1	1
Caribou	1	8	1	2	0	0
Clark	1	8	1	2	0	0
Twin Falls	1	8	0	0	1	3
Total	153		48	100	105	100

Table 22. Residency by state for nonresident anglers that responded to question 1 of versions 1 and 2 of the 1987 ISU/IFG angler opinion questionnaire, Henry's Fork of the Snake River, Idaho. Note that all version 1 responses are included with version 2 responses and all are from anglers fishing between Pinehaven and Mesa Falls.

State	n	Rank	I. P. Dam to Riverside		Riverside to Mesa F.	
			n	%	n	%
California	62	1	43	35	19	30
Utah	39	2	20	16	19	30
Colorado	15	3	9	7	6	9
Oregon	7	4	4	3	3	7
Washington	7	4	6	5	1	2
Wyoming	7	4	3	2	0	6
Florida	5	5	1	1	4	6
Montana	5	5	5	4	0	0
New York	5	5	4	3	1	2
Arizona	4	6	2	2	2	3
Michigan	4	6	4	3	0	0
Nevada	4	6	1	1	3	3
Texas	4	6	3	2	0	2
Pennsylvania	3	7	3	2	0	0
Alaska	2	8	2	2	0	0
Connecticut	2	8	2	2	0	0
Louisiana	2	8	2	2	0	0
Ohio	2	8	2	2	0	0
Wisconsin	2	8	2	2	0	0
Illinois	1	9	1	1	0	0
Iowa	1	9	0	0	1	2
Maryland	1	9	1	1	0	0
N. Carolina	1	9	1	1	0	0
Oklahoma	1	9	1	1	0	0
Total	187		123	100	64	100

Table 23. Frequency of ranks of sections of the Henry's Fork River most often fished by anglers fishing between Island Park Dam and Riverside Campground that responded to question 5 of version 2 of the 1987 ISU/IFG angler opinion questionnaire.

Section	Rank					
		2	3	4	5	6
Box Canyon	33	25	44	6	2	2
Last Chance	48	58	17	10	0	
Harriman Ranch	97	20	18	1	1	0
Pinehaven-Riverside	11	12	4	24	6	0
Riverside-Mesa Falls	5	5	6	4	10	4
Other[1].	7	4	10	2	1	4

[1]. Responses include Warm River to Ashton (2), Henry's Lake Outlet, Chester (2).

Table 24. Frequency of ranks of sections of the Henry's Fork River most often fished by anglers fishing between Riverside campground and Mesa Falls that responded to question 5 of version 2 of the 1987 ISU/IFG angler opinion questionnaire.

Section	Rank					
		2	3	4	5	6
Box Canyon	46	15	1	2	2	0
Last Chance	18	1	10	2	3	0
Harriman Ranch	18	5	10	3	1	0
Pinehaven-Riverside	7	7	7	2	4	0
Riverside-Mesa Falls	12	9	2	1	1	0
Other[1]	3	4	0	0	0	0

[1]Responses include Ashton to Chester, Mack's Inn (3), the Buffalo River, Big Springs to Macks Inn (2), Coffee Pot, Chester, Warm River to Ashton (2)

Table 25. Angler responses to questions 2 and 4 of version 1, and questions 2, 3 and 4 of version 2 of the 1987 ISU/IFG angler opinion questionnaire, Henry's Fork River, Idaho. Note that all version 1 responses are included with version 2 responses and all are from anglers fishing between Pinehaven and Mesa Falls.

Question 2. How many years have you fished the Henry's Fork?

	I. P. Dam to Riverside		Riverside to Mesa F.	
	n	%	n	%
1-5	61	35	92	56
6-10	40	23	26	16
11-15	26	15	11	7
16-20	17	10	10	6
21+	29	17	26	16

Question 3. How many days per year do you fish the Henry's Fork?

1-5	50	30	40	51
6-10	31	19	14	18
11-15	16	10	13	16
16-20	13	8	1	1
21-50	39	23	10	13
51+	17	10	1	1

Question 4. What type of terminal gear do you prefer to use?

Bait	3	2	32	19
Lures	2	1	15	9
Flies	159	92	79	47
Combination	8	5	43	25

Anglers surveyed in the lower reach fished the river fewer days per year (Table 25). In the lower reach, 69% of the anglers fished 10 or fewer days, compared with 49% for the upper reach. In the upper reach, 33% of the anglers fished the river more than 20 days, and 10% fished the river more than 50 day per year. In the lower reach, 14% of the anglers fished more than 20 days. The mean number of hours fished per day (version 1, question 3) was four.

Flies were the preferred terminal gear in both survey reaches (Table 25). In the upper reach 92% of the anglers surveyed preferred flies; 47% in the lower reach preferred flies. In the lower reach 19% of the anglers preferred bait, and 25% preferred a combination of gear. Coon (1977) reported that 49% of the anglers interviewed between Riverside and Mesa Falls were using bait, 9% were using lures, and 42% were using flies. The percentage (9%) of anglers using lures has remained the same.

Anglers cited multiple reasons why they preferred to fish the section they fished most often. In the upper reach 65% fished there for the type of water, and 59% for the size of fish present (Table 26). Thirty percent of the anglers surveyed in the upper reach cited type of regulations as a reason they fished where they did. Only 10% (the fewest of any cited reason) of the anglers surveyed in the lower reach cited type of regulations as a reason they fish there. Apparently, anglers that fish special regulation areas feel more strongly about the regulations than are anglers who fish areas with general regulations. Because special regulations attract certain anglers and exclude others, additional special regulations are therefore likely to have a marked effect on the distribution of effort through the surveyed sections of the Henry's Fork. Thirty-seven percent (the most of any cited reason) of the anglers surveyed in the lower reach cited reasons other than those included on the questionnaire; most anglers cited scenic values or were camping in the area.

More anglers were satisfied with the quality of their fishing experience in the upper survey reach than in the lower survey reach (Table 26). In the upper reach, 63% of the' anglers surveyed responded that the section they were fishing met their expectations for quality trout fishing. In the lower survey reach, 50% of the anglers stated that the section met their expectations.

Of the upper reach anglers surveyed that had an opinion on the quality of the fishing in the upper survey reach over the last five years, most (65%) felt that the fishing had declined (Table 26). As expected, most (65%) lower reach anglers had no opinion on the upper reach fishery. Of the lower reach anglers surveyed that had an opinion on the quality of the fishing in the lower survey reach, 54% felt the fishing had declined, and 37%'felt that there had been no change in the fishing. Again, most (72%) upper reach anglers had no opinion on the lower reach fishery.

Table 26. Angler responses to questions 6 and 7 of version 1, and questions 6, 7, 8, 9, 10, 11, and 12 of version 2 of the 1987 ISU/IFG angler opinion questionnaire, Henry's Fork River, Idaho. Version 1 questions 6 and 7 are the same as version 2 questions 7 and 9. Note that all version 1 responses included with version 2 responses are from anglers fishing between Riverside Campground and Mesa Falls.

Question 6. Why do you fish this section [the one you fish most often]?

	I. P. Dam to Riverside		Riverside to Mesa F.	
	n	%	n	%
Regulations	52	30	8	10
Type of Water	102	59	19	23
Reputation	58	33	29	35
Fish Size	112	65	30	36
Number of Fish Caught	43	25	20	24
Ease of Access	38	22	19[1]	23
Other	17	10	31[1]	37

Question 7. Does this section meet your expectations for quality trout fishing?

Yes	109	63	75	44
No	58	34	84	50
No Response	6	3	10	6

Question 8. In the last five years do you think fishing from Island Park Dam to Riverside Campground has:

Improved	16	9	4	5
Declined	80	46	21	24
No Change	28	16	5	6
No Opinion	43	25	56	65
No Response	6	4.	0	0

Question 9. In the last five years do you think fishing from Riverside Campground to Mesa Falls has:

Improved	1	1	9	5
Declined	33	19	49	29
No Change	7	4	33	20
No Opinion	125	72	68	40
No Response	7	4	10	6

Table 26. Continued.

Question 10. Which of the following regulations do you most support:

	I. P. Dam to Riverside		Riverside to Mesa F.	
	n	%	n	%
Maintain current regulations on Henry's Fork with no changes?	29	17	44	51
Catch-and-release from Island Park Dam to Mesa Falls, artificial lures and flies, single barbless hooks?	117	67	27	31
Extend slot limit from current boundary at Riverside Campground downstream to Mesa Falls, artificial lures and flies, single barbless hooks?	24	14	10	12
No Response	3	2	5	6
Question 11. Would you fish the Henrys Fork from Island Park Dam to Mesa Falls if catch-and-release were implemented?				
Yes	161	93	63	7
No	8	5	23	27
No Response	4	2	0	0
Question 12. Would you fish the Henry's Fork from Riverside Campground Mesa Falls if the slot limit was implemented in this section?				
Yes	131	76	78	91
No	24	14	8	9
No Response	18	10	0	0

Table 27. Estimated angler effort on the Henry's Fork River between Pinehaven and Mesa Falls. Data are from the present study: 23 May 1987 to 7 September 1987, Rohrer (1984): 1982 data, Coon (1977): 1976 data, and Jeppson (1973): 1973 data.

Section	Date	Miles	Total Effort (h)	Effort (h/km)
Pinehaven to Riverside C.G.	1987	1.7	4,105	1,499
	1982	3.4	2,505	458
	1976	3.4	6,579	1,202
	1973	3.4	7,044	1,287
Riverside C.G. to Hatchery Ford	1987	5.3	7,607	891
Riverside C.G. to Lower Mesa F.	1976	12	4,377	227
	197	12	1,983	102

Of the proposed regulation change options on the questionnaire (maintain current regulations, catch-and-release from I.P. Dam to Mesa Falls, and extend slot limit from Riverside to Mesa Falls), catch and release was most popular in the upper reach (67% support,Table 26). In the lower reach, no change was the most popular option, with 51% support.

Most anglers surveyed indicated they would fish the river from Island Park Dam to Mesa Falls if catch-and-release was implemented. Ninety-three percent of the anglers surveyed in the upper reach, and 73% of the anglers surveyed in the lower reach indicated they would fish the survey reach under catch and release regulations (Table 26). Ninety-one percent of the lower reach anglers and 76 % of the upper reach anglers indicated they would fish in the lower survey reach under a slot limit.

Among the anglers surveyed with version 1 of the questionnaire, 46% indicated they would be in favor of more restrictive regulations, and 44% were opposed (question 8).

Based on the responses of anglers surveyed (particularly questions 10, 11, and 12) we conclude that catch and release was considered acceptable, if not necessarily preferred, by most anglers for the entire survey reach from Island Park Dam to Mesa Falls. However, among anglers that fish below Riverside Campground, the slot limit option was somewhat more palatable.

Creel Survey and Angler Counts

Our estimate of angler effort per stream km between Pinehaven and Mesa Falls was higher than that reported by Rohrer (1984), Coon (1977), or Jeppson (1973, Table 27). Differences in length of section surveyed preclude direct comparison of total effort. Anglers expended an estimated 11,712 hours fishing between Pinehaven and Hatchery Ford (1,039 h/km) between 23 May 1987 and 7 September 1987. Estimates of total angler hours at each survey location are 3,748 h at Riverside Campground, 1,021 h at Wood Road 700, and 1,419 h each at Hatchery Ford and all other roads combined.

Our effort estimate of 891 h/km for Riverside to Hatchery Ford is four-fold what Coon (1977) estimated for Riverside to Mesa Falls in 1976 (227 h/km, Table 27). Our casual observations of angler effort made below Hatchery Ford suggest that effort between Hatchery Ford and Mesa Falls has probably increased at the same relative rate as effort above Hatchery Ford. Boating effort was not measured in our survey, but based on casual observations of average number of float trips observed on weekdays and weekends, we estimate 225-250 float trips were made through this section in 1987. The improved access at Hatchery Ford should increase the level of boat effort in the future.

Our effort estimate of 1,499 h/km from Pinehaven to Riverside is comparable to the 1976 and 1973 estimates (Table 27). Rohrer (1984) suggested that his low (458 h/km) estimate for 1982 resulted from a poor angling year. We feel our estimate is conservative because it does not include the lower boundary of Harriman State Park (Wood Road 16), a high use area included in previous surveys.

The estimated total catch has increased over previous estimates from Pinehaven to Riverside and from Riverside to Hatchery Ford (Table 28). From Pinehaven to Riverside the total catch has increased nearly three-fold since 1973 and 1976. As noted above, 1982 was apparently a poor angling year. Number of trout killed in 1987 was half that of 1973 and 1976 due to the increase in the number of caught and released trout (Table 28).

The estimated total catch from Riverside to Hatchery Ford has increased from under 100 trout/km in 1973 and 1976 (Table 28) to 1,153 trout/km in 1987. This increase is only partially explained by increased effort. Again, we caution against direct comparisons among non-identical survey sections.

Estimated catch per unit effort (CPUE) has increased dramatically in both sections over previous surveys (Table 29). No previous survey has estimated total CPUE greater than 1 fish/h (we are unsure if the 1976 and 1973 estimates include released fish). Anglers fishing with flies had the highest total CPUE (Table 30). Flyfishermen caught 1.52 trout/h compared with 0.85 and 1.04 trout/h caught by lure and bait fisherman. Bait fisherman caught and killed the most trout/h, 0.61 trout/h, compared with 0.10 and 0.37 trout/h killed by fly and lure fishermen. Apparently bait anglers are catching fewer and harvesting more fish than are fly or lure fishermen.

The size-distribution of angler-caught trout (Table 31) indicates that most fish caught were small. Less than 5% of the fish caught by anglers were larger than 305 mm, which is very similar to our electrofishing catch for the same section: 7% of our sample was larger than 305 mm (Figs. 5 and 6). Jeppson (1973) reported that 16% of the 1373 angler catch was larger than 305, and Coon (1977) reported that 23% of the 1976 catch was larger than 305 mm.

Table 28. Estimated angler catch of rainbow trout on the Henry's Fork River between Pinehaven and Mesa Falls. Data are from the present study: 23 May 1987 to 7 September 1987, Rohrer (1984): 1982 data, Coon (1977): 1976 data, and Jeppson (1973): 1973 data.

Section	Date	Total Catch		Killed		Released	
		no.	no./k	no.	no./km	no.	no./km
Pinehaven to Riverside C.G.	1987	5,295	1,935	1,026	375	4,269	1,560
	1982	1,698	310	195	35	1,503	275
	1976	3,779	690	3,779	690	na[1]	na
	1973	4,794	876	4,794	876	na	na
Riverside C.G. to Hatchery Ford	1987	9,813	1,153	1,902	223	7,911	927
Riverside C.G. to Lower Mesa F.	1976	1,328	69	1,328	69	na	na
	1973	1,783	93	1,783	93	na	na

[1] Not applicable.

Table 29. Estimated catch per unit effort (CPUE) in trout per hour for the Henry's Fork River between Pinehaven and Mesa Falls. Data are from the present study: 23 May 1987 to 7 September 1987, Rohrer (1984): 1982 data, Coon (1977): 1976 data, and Jeppson (1973): 1973 data.

Section	Date	Total CPUE	Killed CPUE	Released CPUE
Pinehaven to Riverside C.G.	1987	1.29	0.25	1.04
	1982	0.70	0.10	0.60
	1976	0.91	0.57	0.34
	1973	0.69	na[1]	na
Riverside C.G. to Hatchery Ford	1987	1.21	0.25	0.96
Riverside C.G. to Lower Mesa F.	1976	0.50	0.30	0.20
	1973	0.94	na	na

[1] Data not available.

Table 30. Estimated catch per unit effort (CPUE) in number of trout per hour by gear type for anglers fishing from Riverside to Mesa Falls. Anglers that used flies or flies plus other gear were considered flyfisherman. Anglers that used lures or lures plus other gear were considered lure fisherman. Anglers that used bait only were considered bait fisherman.

Gear Type	Caught & Released	Caught & Killed	Total
Flies	1.41	0.10	1.52
Lures	0.48	0.37	0.85
Bait	0.44	0.61	1.04
All Gear	1.04	0.25	1.29

Table 31. Size-class distribution of fish caught by anglers using all gear types from Riverside to Mesa Falls from opening day to 9 September 1987.

Size Class (mm)	Number Caught	Percent
<305	516	95
305-355	11	2
356-406	12	2
407-457	3	< 1
458-508	3	< 1
509-559	1	< 1
Total	546	100

MANAGEMENT IMPLICATIONS

Winter flow management is critical in a regulated system like the Henry's Fork. Rapid flow reductions in the winter during the day threaten the juvenile salmonids within substrate interstitial spaces in dewatered areas. As we observed on the Henry's Fork, the probability of being stranded is high when these boulder areas are suddenly dewatered. Where flow reductions are obligatory, all winter reductions should be done incrementally and at night. Minimum flow models should consider nighttime and daytime microhabitat requirements for winter conditions in addition to summer requirements. Minimum flows should not be based on wetted perimeter methodology only. On the Henry's Fork most of the usable winter habitat is limited to bank areas. During low flows many kilometers of shallow undercut banks and boulder clusters are dewatered. During these low flows total wetted areas is reduced by only a small percent while most of the winter habitat is dewatered. Our findings show that juvenile trout do not just move over to deeper water, but that they either leave the system or die. Other areas in the system with abundant concealment cover in the non-bank areas would theoretically have different results. For regulated streams where the natural hydrograph has been altered, flushing flows should be considered to clean cobble and boulders by removing fines from the interstitial spaces. Furthermore, our winter field data showing reduced numbers of trout wintering in heavily sedimented areas adds support to the literature describing the impacts of sedimentation to salmonid populations.

Our data have implications for the design, installation, and evaluation of habitat improvements. Winter habitat requirements should be incorporated into future projects. Improvement structures and placements should provide concealment cover such as boulder cluster in low velocity areas. Depending on the nature of the stream, groups of boulders set close together instead of a single boulder may provide more winter habitat than a single boulder.

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Appendix A. Length frequency distributions for rainbow trout longer than 131 mm for all sections electrofished in 1987. Size class column indicates upper limit of class.

Size class(mm) Date sampled:	Box Canyon 5/12 to 5/20	R.R. Ranch 6/2 to 6/9	Pinehaven 9/18 to 9/27	Cardiac Canyon 9/16 to 9/26
140	197	12	26	77
150	131	8	11	16
160	122	12	8	24
170	123	12	0	48
180	130	22	13	133
190	110	32	28	189
200	111	25	49	135
210	75	36	58	160
220	64	43	47	152
230	48	38	66	188
240	53	30	91	185
250	42	31	91	129
260	55	26	86	87
270	46	18	59	90
280	44	22	43	37
290	43	20	21	35
300	42	7	19	27
310	28	10	5	25
320	25	5	3	12
330	17	6	5	6
340	13	0	6	7
350	12	3	3	7
360	10	4	2	7
370	11	1	0	4
380	8	3	1	4
390	23	3	2	4
400	17	4	0	2
410	30	2	3	3
420	36	0	0	1
430	41	4	1	2
440	40	1	3	1
450	44	0	0	2
460	48	0	0	3
470	32	1	1	0
480	18	3	0	1

Appendix A. Continued

Size Class	Box Canyon	R.R. Ranch	Pinehaven	Cardiac Canyon
490	21	2	0	2
500	10	1	0	0
510	11	0	2	1
520	6	1	0	0
530	1	0	1	0
540	2	1	0	0
550	0	0	0	0
560	0	0	0	0
570	0	0	0	0
580	0	0	0	0
590	2	0	0	0
600	2	0	0	0
Total	1944	449	754	1806

APPENDIX B. Angling and electrofishing tag recoveries.

TAG NO.	TAGGED	LENGTH	LOCATION	RECOVERED	LENGTH	LOCATION
C12385	91286	474	UPPER RANCH	92586	448	RANCH
C10483	71786	465	LAST CHANCE	72386	414	LAST CHANCE
C12618	70186	466	BOX CANYON	80086	414	LOWER BOX CANYON
C10420	62186	520	MIDDLE RANCH	70586		MIDDLE RANCH
C12630	70286	375	BOX CANYON	72086		LOWER BOX CANYON
C10481	71686	470	LAST CHANCE	72586	403	LAST CHANCE
C5776	71686	495	LAST CHANCE	81386	510	LAST CHANCE
C12668	71786	450	LAST CHANCE	81386	450	LAST CHANCE
C10422	62186	420	MIDDLE RANCH	80086	426	MIDDLE RANCH
C10422	62186	420	MIDDLE RANCH	82486	448	MIDDLE RANCH
C10422	62186	420	MIDDLE RANCH	71787	426	MIDDLE RANCH
t196	10186	390	BOX CANYON	53087	313	BOX CANYON
B814	51287	449	BOX CANYON	53087	426	UPPER BOX CANYON
C9076	51387	383	UPPER BOX CANYON	71387	460	UPPER BOX CANYON
t120	10186	507	MIDDLE RANCH	72487	470	MIDDLE RANCH
t1396	90686	345	BOX CANYON	61387	358	MID BOX CANYON
C12702	51287	434	BOX CANYON	52587	428	MID BOX CANYON
t143	10186	433	MIDDLE RANCH	61587		RANCH
t117	52087	450	BOX CANYON	62287	538	UPPER BOX CANYON
C2703	51287	492	BOX CANYON	61787	414	LOWER BOX CANYON
t117	52087	450	BOX CANYON	61587	538	UPPER BOX
t1307	90686	437	BOX CANYON	90987	370	MID BOX CANYON
t1388	90686	456	BOX CANYON	52087	460	BOX CANYON
t1399	90686	430	BOX CANYON	52087	440	BOX CANYON
t1396	90686	345	BOX CANYON	52087	384	BOX CANYON
t1327	93086	491	BOX CANYON	51287	491	BOX CANYON
C12651	62686	330	MIDDLE RANCH	60987	378	RANCH
t133	10186	485	LOWER RANCH	62087	426	BOX CANYON
C10483	71786	465	LAST CHANCE	72386	414	LAST CHANCE

Appendix C. Percent of all rainbow trout caught by electrofishing exceeding selected total lengths from the Henry's Fork between Island Park Dam and Hatchery Ford. Trout smaller than 225 mm were excluded from the calculations to eliminate bias from variation in probability of capture of smaller fish among electrofishing efforts. Sample sizes shown are totals of all fish captured. The 1978 data are from Coon (1978) and 1980-81 data are from Rohrer (1981).

Section	Total Length (mm)								% of Sample
	>250	>300	>350	>400	>450	>500	>550	n	> 225 mm
Box Canyon									
Spring 1978	83	33	14	14	6	1	0	690	89
Fall 1980	79	29	5	<1	0	0	0	380	91
Spring 1981	96	65	34	17	4	1	<1	733	95
Summer 1981	97	68	33	15	4	1	<1	270	92
Summer 1986	71	39	25	17	7	2	1	1383	51
Spring 1987	86	60	47	40	19	3	<1	1911	46
Railroad Ranch									
Summer 1986	96	81	55	45	31	14	3	90	87
Fall 1986	86	54	49	43	40	11	0	76	46
Spring 1987	60	22	13	6	1	0	0	449	55
Last Chance									
Summer 1986	78	57	52	44	22	5	0	276	34
Harriman East									
Summer 1986	62	24	10	5	0	0	0	34	62
Pinehaven to Riverside									
Fall 1987	60	9	3	2	1	1	0	754	66
Riverside to Hatchery Ford									
Fall 1986	71	17	7	7	0	0	0	59	47
Fall 1987	51	12	5	2	1	<1	0	1852	49

[1] Percent of total catch used in calculating percentages larger than selected sizes.

Appendix D

Version 1 of the ISU/IFG 1987 angler opinion questionnaire

1987 HENRY'S FORK FISHERIES STUDY ANGLER INTERVIEW

Angler Opinion Survey

1. What county (residents) or state (nonresidents) do you live in ?_____

2. How many years have you fished the Henry's Fork?_____

3. How long did you fish today? _____hours

4. What type of gear did you use today? Bait_____ Lures_____ Flies_____

5. What section(s) of the river did you fish today?

   Harriman Park lower boundary near Pinehaven to Riverside Campground _____
   Riverside Campground to Hatchery Ford _____
   Hatchery Ford to Mesa Falls _____

6. Are you satisfied with your angling experience today? Yes___ No___

7. In your opinion, has the quality of the angling in the river between Pinehaven and Mesa Falls in the last 5 years:

   Improved_____ Stayed the Same_____ Declined_____ No Opinion_____

8. Would you be in favor of managing the Henry's Fork from the Harriman State Park Lower Boundary to Mesa Falls under more restrictive regulations? Yes___ No___

Creel Survey

9. What was the number of each species that you caught and killed?

	Caught	Killed	Lengths							
Rainbow Trout	_____	_____	____	____	____	____	____	____	____	____
Brook Trout	_____	_____	____	____	____	____	____	____	____	____
Whitefish	_____	_____	____	____	____	____	____	____	____	____
Other_____	_____	_____	____	____	____	____	____	____	____	____

No._____

Appendix E

Version 2 of the ISU/IFG 1987 angler opinion questionnaire

Summer 1987

Dear Henrys Fork Angler:

The Henrys Fork from Mesa Falls to Island Park Dam is managed as a quality trout fishery for wild trout. In addition, trophy trout management applies to the portion of river from Riverside Campground to Island Park Dam. Current regulations on the Henrys Fork are:

1. General regulations from Mesa Falls to Riverside Campground: trout limit - 6 fish, only 2 larger than 16 inches.

2. Special regulations from Riverside Campground to Island Park Dam: trout limit - 3 under 12 inches and 1 over 20 inches, artificial flies and lures only, single barbless hooks required.

3. In addition to item 2, the river within Harriman State Park is fly-fishing only.

The fly-fishing-only regulation is an access agreement for public use at Harriman State Park.

The Department has received public requests to extend trophy trout management downstream to include the Mesa Falls to Riverside Campground section. The Department is evaluating angler opinions concerning quality trout management options on this section of the Henrys Fork. The following questionnaire is designed to provide the Department with your opinion regarding the Henrys Fork. Your cooperation will help us better manage the Henrys Fork as a quality wild trout fishery.

1. What county (residents) or state (nonresidents) do you live in? _____

2. How many years have you fished the Henrys Fork? _____

3. Approximately how many days per year do you fish the Henrys Fork? _____

4. What type of terminal gear do you prefer to use? Bait___ Lures___ Flies_____

5. Which section(s) of the Henrys Fork do you usually fish? Please rank if you fish more than one section (use #1 as the most frequent).
   Mesa Falls to Riverside Campground (C.G.)_____
   Riverside Campground to Pinehaven _____
   Harriman Ranch _____
   Last Chance _____ Box Canyon _____ Other _____

EQUAL OPPORTUNITY EMPLOYER

6. Why do you fish this section? Type of Regulation___ Type of Water___ Reputation___ Fish Size___ Number of Fish Caught___ Ease of Access___ Other___

7. Does this section meet your expectations for quality trout fishing? Yes___ No___. Why?_____

8. In the last five years do you think fishing from Island Park Dam to Riverside Campground has: Improved____ Declined____ No Change____ No Opinion____

9. In the last five years do you think fishing from Riverside Campground to Mesa Falls has: Improved____ Declined____ No Change____ No Opinion____

10. Which of the following regulations do you most support?
    _____ Maintain current regulations on Henrys Fork with no changes.
    _____ Catch-and-release from Island Park Dam to Mesa Falls, artificial flies and lures only, single barbless hooks.
    _____ Extend slot limit (3 trout under 12", 1 trout over 20") from current boundary at Riverside Campground downstream to Mesa Falls, artificial flies and lures only, single barbless hooks.

11. Would you fish the Henrys Fork from Island Park Dam to Mesa Falls if catch-and-release regulations were implemented? Yes____ No____

12. Would you fish the Henrys Fork from Riverside Campground to Mesa Falls if the slot limit was implemented in this section? Yes____ No____

13. Comments: _____
    _____

DEFINITIONS: (from 1986-1990 Idaho Fisheries Management Plan)

Quality - a fishery in designated wild fish waters which yields wild fish, either consumptively or nonconsumptively and in which angler densities are controlled either directly or indirectly by regulation, access, or other factors. (Quality fisheries are usually characterized by tackle and/or limit regulations, above-average catch rates, and exceptional aesthetic conditions.

Trophy - a fishery which yields fish predominantly larger than the norm for the general area in which the fishery occurs. (Trophy fisheries may be supported by either wild or hatchery fish and are generally characterized by limit and/or tackle regulations intended to allow fish to achieve large average size before harvest. Catch rates may be below average in trophy waters.)

Submitted by:

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Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

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