WILD STEELHEAD STUDIES
SALMON AND CLEARWATER RIVERS

ANNUAL PROGRESS REPORT
Period Covered January 1 - December 31, 1994

Prepared by:

Terry B. Holubetz, Fisheries Research Biologist
Brian D. Leth, Fisheries Technician

Fisheries Research Section
Idaho Department of Fish and Game

Prepared for:

U. S. Department of Energy
Bonneville Power Administration
Environment. Fish and Wildlife
P.O. Box 3621
Portland, OR 9720X-362 1

IDFG 97- 10
Project Number 9 1-073
Contract Number DE-B179-9 1 BP2 1182

MAY 1997

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES (Cont.)

LIST OF FIGURES

LIST OF FIGURES (Cont.)

LIST OF APPENDICES

ABSTRACT

To enumerate chinook salmon *Oncorhynchus tshawytscha* and steelhead *0. mykiss* adult escapements, weirs were operated in Marsh, Chamberlain, West Fork Chamberlain, and Running creeks. Beginning in late July 1994, a juvenile trap was installed in Running Creek to estimate juvenile outmigrants. Plans have been completed to install a weir in Rush Creek to enumerate steelhead adult escapement beginning in spring 1995. Design and agreements are being developed for Johnson Creek and Captain John Creek.

Data collected in 1993 and 1994 indicate that spring chinook salmon and group-B steelhead populations are truly nearing extinction levels. For example, no adult salmon or steelhead were passed above the West Fork Chamberlain Creek weir in 1994, and only 6 steelhead and 16 chinook salmon were passed into the important spawning area on upper Marsh Creek. Group-A steelhead are considerably below desirable production levels, but in much better status than group-B stocks. Production of both group-A and group-B steelhead is being limited by low spawning escapements. Studies have not been initiated on wild summer chinook salmon stocks.

Comparisons of escapement objectives at Bonneville and Lower Granite dams with resultant juvenile production objectives in key study streams show a large deficit for group-B steelhead. Group-A steelhead escapement and production objectives are more closely related, indicating that escapement objectives are adequate to achieve the desired production results.

Despite problems in its initial operation, the development of an electronic/video adult salmon and steelhead counting facility shows great promise as a very useful research tool to enumerate and classify spawning escapement with a minimum of labor and stress or harm to the fish. Developmental research on this counting facility should continue.

It is recommended that intensive production studies be conducted on representative key study streams to document with precision: status of stocks, relative response to recovery measures, and adult spawning escapement and resultant juvenile production relationships through a full range of escapement levels.

Authors:

Terry B. Holubetz
Fisheries Research Biologist

Brian D. Leth
Fisheries Technician

INTRODUCTION

Definitive production data for wild steelhead *Oncorhynchus mykiss* and salmon *0. sp.* populations in Idaho is generally lacking, and with the classification of wild spring and summer chinook salmon *0. tshawytscha* populations as threatened and the impending classification of wild steelhead stocks, the priority for obtaining more definitive adult escapement and juvenile production data on representative streams has been greatly elevated. Key streams have been selected and weirs are being designed and installed to enumerate spawning adults into these streams. Juvenile traps will be installed to sample emigrating juvenile salmon and steelhead. Wild steelhead trout parr and outmigrants will be PIT-tagged and released back to their location of capture in several streams to determine migration timing of steelhead smolts through the lower Snake River and Columbia River migration corridor and to estimate smolt production. Analysis of timing data will provide valuable information for future water management and fishery management decisions on the lower Snake and Columbia rivers. Snorkel counts and electrofishing will be used to estimate annual production of juveniles in key streams.

Much of the wild steelhead and chinook salmon refugium is located within the Frank Church River of No Return Wilderness Area and the Selway-Bitterroot Wilderness Area. These designations have preserved large areas of habitat in pristine condition. Some of the streams addressed in this report are located within the boundaries of theses wilderness areas. Research techniques have been modified to meet wilderness management constraints and values.

STUDY AREAS

Wild steelhead trout and chinook salmon populations are present in Idaho in many tributaries of the Salmon River and Clearwater River drainages. Due to the vastness of the area and the large number of fish producing tributaries throughout these drainages, Idaho Department of Fish and Game (IDFG) has set up intensive research studies in a few selected key drainages to evaluate long-term production and survival of these valuable stocks of wild fish.

The planned timing of implementing such studies in selected key study streams follows:

- Marsh Creek - 1994
- Chamberlain Creek - 1994
- Running Creek - 1995
- Rush Creek - 1995
- Rapid River - 1995
- Johnson Creek - 1996
- Captain John Creek - 1997

Chamberlain Creek Drainage

Chamberlain Creek is a tributary of the Salmon River located in the approximate center of Idaho and is approximately 28 miles long. The sampling stations in the drainage are located from the mouth of Chamberlain Creek to the headwaters of Chamberlain Creek at the Rim

Creek-South Fork Chamberlain Creek confluence. There are currently 53 snorkeling stations in the drainage - 22 stations on the mainstem Chamberlain Creek and 31 stations in 10 tributaries of Chamberlain Creek (Figure 1).

Intensive parr monitoring began in 1992 when 22 new sites were established in the Chamberlain Creek drainage adding seven tributaries that had not previously been snorkeled. In 1993, 21 new sites were established to achieve a more favorable balance between "B" and "C" channels, defined by Rosgen (1985). Four new sites were established in 1994 in two tributaries that had not previously been snorkeled.

In 1994, the mainstem Chamberlain Creek snorkel sites were divided into upper and lower strata. Six sites (three C-channel and three B-channel) are located in the upper strata and the densities measured in those sites were not used to estimate chinook salmon parr density for the drainage. After three years of observing these sections, it became apparent that there were no chinook salmon spawning escapements that high in the drainage. The 1992 and 1993 data have been adjusted by omitting the data from the six upper strata sections for the 1992-1994 chinook salmon density trends. In three years of snorkeling, the most upstream observation of either adult or juvenile chinook salmon was in the vicinity of the mouth of No Name Creek. There are no physical barriers preventing migration of adult chinook salmon into upper Chamberlain Creek.

Resident stocks of fish include: rainbow trout *0. mykiss,* westslope cutthroat trout *0. clarki,* bull trout *Salvelinus confluentus,* mountain whitefish *Prosopium williamsoni,* sculpin *Cottus sp.,* and dace *Rhinichthys sp.*

Running Creek Drainage

Running Creek is a tributary of the Selway River drainage and is located partially within the confines of the Selway-Bitterroot Wilderness Area. The upper 10 miles of Running Creek are outside the wilderness boundary. Running Creek is in pristine condition with cool, clear water and clean substrate. A single lane dirt road provides access to upper Running Creek, but no timber harvest has occurred in the drainage.

Snorkel site stations are located from the mouth of Running Creek to the South Fork of Running Creek. There are currently 18 snorkel stations in the Running Creek drainage; 10 on the mainstem and 8 located in four tributaries (Figure 2).

Selway Falls on the Selway River and the Lewiston Dam migration barriers for chinook salmon stopped all chinook salmon escapement above the falls. After passage facilities were installed at the falls in 1965 and improvements were made at the Lewiston dam fishways, IDFG brought in eggs from wild Salmon River chinook salmon stock and Carson Hatchery in Washington, and these were incubated in an incubation channel on Running Creek. This procedure was repeated for five years and then discontinued. Since then, no further supplementation has been implemented. It is important to note that populations of natural spring chinook salmon have been established and currently exist in the Running Creek drainage some 25 years after the introductions were made.

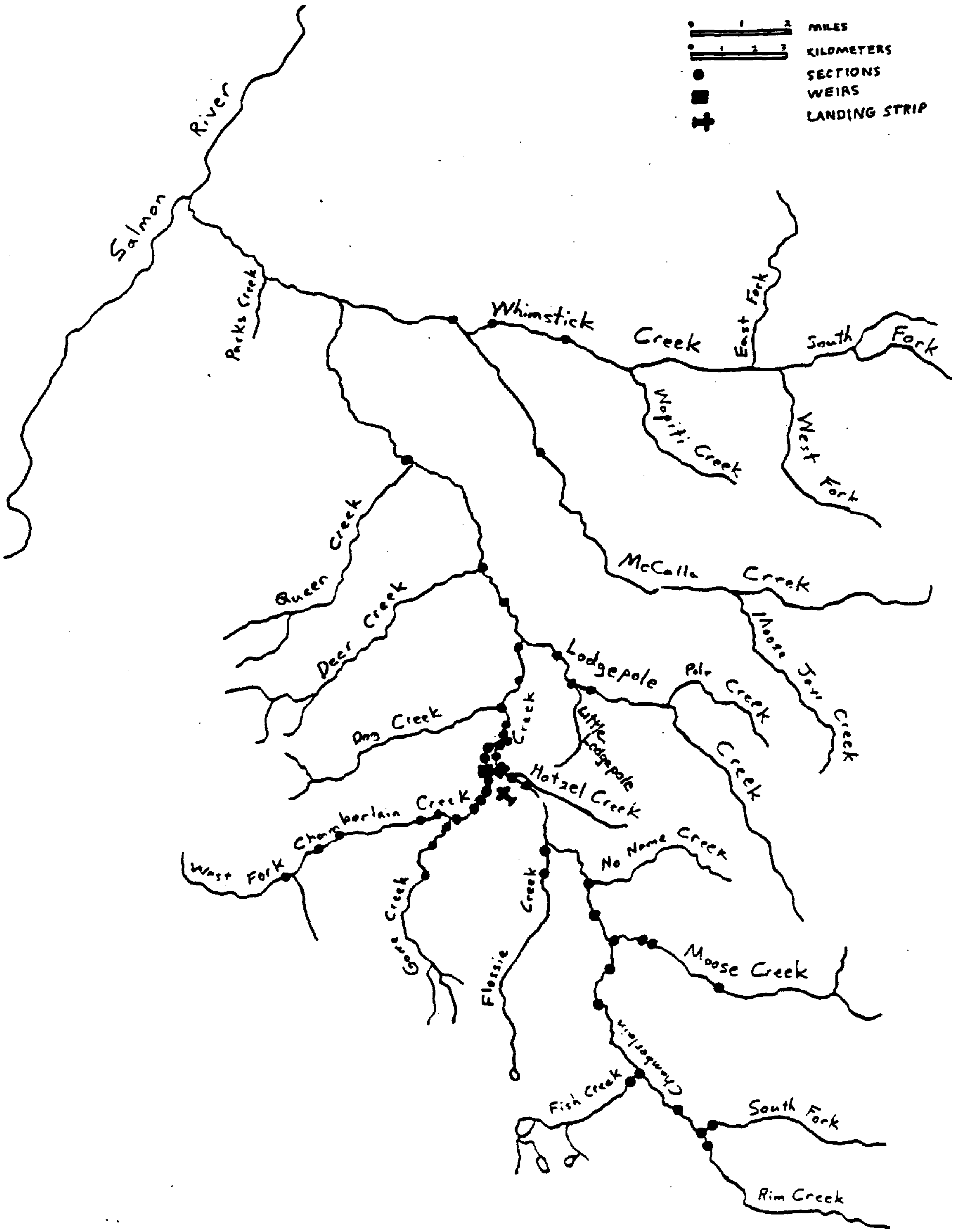


Figure 1. Location of existing weirs and snorkel sites sampled in the Chamberlain Creek drainage, 1994.

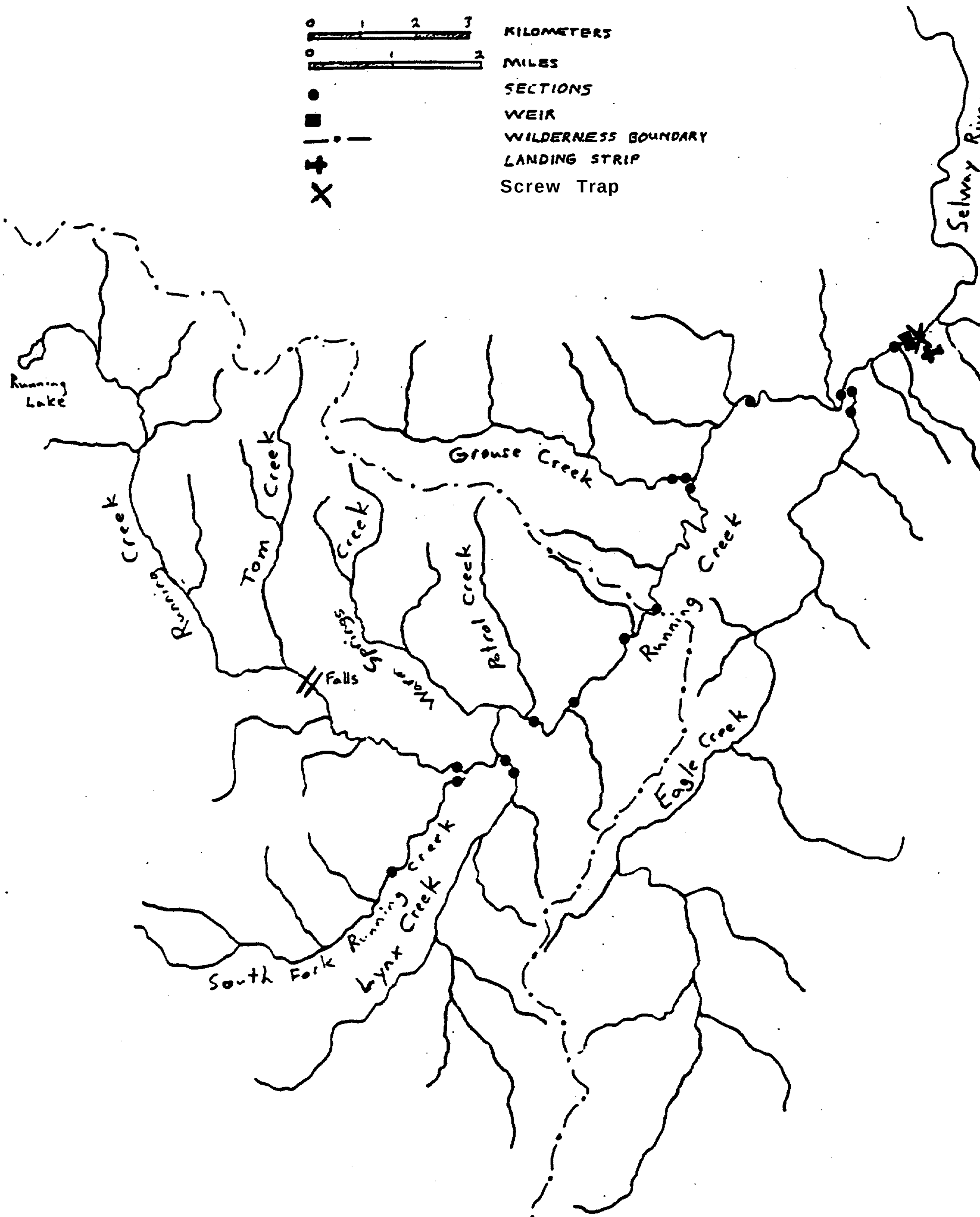


Figure 2. Location of weir, screw trap, and snorkel sites in the Running Creek drainage, 1994.

Group-B steelhead are native to the drainage and have persisted, despite the effects of poor fishways at Lewiston Dam and the natural Selway Falls. The future production of wild steelhead and natural chinook salmon in Running Creek is being threatened by excessive downstream migrant mortality in the lower Snake and Columbia rivers. Running Creek has been a productive steelhead stream in past years.

Resident stocks of fish include: rainbow trout, westslope cutthroat trout, bull trout, mountain whitefish, sculpin, and dace.

Rush Creek

Rush Creek is approximately 16 miles long and is a major tributary of Big Creek. Big Creek flows into the Middle Fork Salmon River. Rush Creek is located within the confines of the Frank Church Wilderness Area and is composed of almost entirely B-channel with cool, clear water and clean substrate. The steelhead in Rush Creek are a wild group-A native run and classified for wild fish management. No supplementation has occurred in the Middle Fork Salmon River drainage.

Project staff conduct snorkel surveys in Rush Creek annually. A total of 13 snorkel sites have been established on Rush Creek, ranging from the mouth of Rush Creek to Telephone Creek. To date, there have been no spawning surveys conducted in Rush creek due to its steep, narrow canyon. Plans have been developed to install a temporary weir near the mouth of Rush Creek to enumerate the steelhead spawning escapement.

Johnson Creek

Johnson Creek flows into the East Fork of the South Fork Salmon River. Johnson Creek is approximately 35 miles long and maintains excellent spawning and rearing habitat for both salmon and steelhead. Despite the declining adult escapements statewide, these stocks of salmon and steelhead seem to be somewhat stable, although still historically low.

Plans are being proposed to install a weir in Johnson Creek in the spring of 1996 to enumerate adult steelhead and salmon.

Marsh Creek

Marsh Creek is located at the headwaters of the Middle Fork Salmon River and is approximately 12 miles long. The upper three miles are almost entirely C-channel and contain good spawning habitat for salmon and steelhead. Juvenile steelhead, after emerging, generally move downstream to lower Marsh Creek, presumably to seek more suitable rearing habitat.

A picket style weir was installed near Capehorn Creek in the spring of 1994 to enumerate adult steelhead escapement into the upper section of Marsh Creek.

Project staff conduct snorkel surveys in Marsh Creek annually.

Rapid River

Rapid River is the main tributary of the Little Salmon River. The mainstem Rapid River is approximately 21 miles long; the upper 17 miles are roadless and are classified as wilderness. Rapid River in composed of almost entirely B-channel with clear, cool water and clean substrate. The steelhead run in Rapid River is a wild group-A, native run. Adults are counted at the upstream migration barrier near the mouth of Rapid River. All adults possessing an adipose fin are released above the barrier to spawn naturally. Any hatchery strays captured at the barrier are released to the Little Salmon River. No steelhead supplementation occurs in Rapid River and it is classified for wild fish management.

IDFG project staff conduct snorkel surveys annually in Rapid River and West Fork Rapid River. Two snorkel sites are classifies as general parr monitoring (GPM) sites and have consistently been snorkeled since 1985. Additional sites have been added to Rapid River. Currently there are 13 sites on the mainstem

Resident species of fish include rainbow trout, westslope cutthroat trout, bull trout, mountain whitefish, sculpin, and dace.

METHODS

Parr Abundance

To determine the relative abundance of juvenile salmon and steelhead in numerous anadromous productions streams in Idaho, snorkel counts in representative sites have been conducted since 1985. Since 1992, several key study streams have been snorkeled intensively to reduce variability and increase the reliability of parr production estimates.

Snorkel counts in representative sample sites were completed in the following study streams: Chamberlain Creek, Running Creek, Johnson Creek, Marsh Creek, and Rapid River. All fish observed were identified and their lengths were estimated to the nearest inch as described by Petrosky and Holubetz (1987). The stations encompass at least two habitat types (e.g., riffle, pool, run) and are usually between 50 m and 150 m in length. Physical habitat measurements were made with methodologies describes by Petrosky and Holubetz (1987).

Juvenile Emigration

Timing of downstream emigration is lacking for many wild steelhead and salmon stocks in Idaho. Accurate smolt outmigration timing data will provide valuable information for future water flow management decisions in the downstream migration corridor of the lower Snake and Columbia rivers. Fry, parr, and smolt emigrations for salmon and steelhead from the study streams will vary throughout the year and from year to year. Different techniques will be used in the various study streams to document smolt migration timing.

Running Creek

A wide variety of downstream migrant sampling gear was investigated and it was determined that the most appropriate method was a screw trap with a 5 ft diameter cone supported by overhead cable. A screw trap was installed near the mouth of Running Creek on July 8 of 1994, and remained operational until November 3, 1994. It was secured by 3/8 in cable on a pulley system that allowed the trap to be moved upstream and downstream as flow dictated. It was installed directly below a riffle where flows concentrated such that it fished nearly the entire thalweg. Daily records of steelhead and salmon emigrant numbers and sizes were kept by Tony Wright, manager of the Running Creek Ranch, through a contractual agreement with IDFG.

Rapid River

An IDFG research group has been operating a picket-style weir at the Rapid River Fish Hatchery to catch downstream migrating bull trout. The weir is constructed of a single wing angled downstream to a 17 cm diameter intake pipe that empties into a trap box. The pickets are 1.7 cm in diameter and spaced 1.3 cm apart. Although the weir is designed to catch larger fish (> 300 mm), a subsample of smaller fish were caught. In cooperation with this research group, all steelhead incidentally caught were counted and measured. All but the young-of-the-year steelhead were PIT-tagged and released upstream to measure trap efficiency.

Scale samples from all juvenile steelhead caught were taken and later analyzed to determine the age of the fish. This data was compared to length frequencies to verify the ability of determining age class of these juvenile steelhead using length criteria.

Chamberlain Creek and Rush Creek

Currently there are no plans to install a screw trap or any other downstream migrant trap in Chamberlain Creek or Rush Creek. In Chamberlain and Rush creeks, juvenile steelhead were captured with seine and electrofishing gear and marked with PIT tags. Interrogations at lower Snake and Columbia river dams will provide valuable stock specific information on migration timing.

PIT Tagging

In order to obtain accurate information on the timing of migrating smolts through the lower Snake and Columbia river migration corridor, several years of PIT tag interrogation records will be obtained to see if the data show patterns that can be used to implement real time decisions for water management.

Juvenile steelhead and salmon were PIT-tagged in selected streams of the Salmon River and Selway River drainage. Tagging was completed by members of the National Marine Fisheries Service (NMFS) and IDFG research groups.

During the 1993 field season, members from NMFS and IDFG PIT-tagged wild stocks of juvenile salmon and steelhead in several drainages in Idaho. Analysis of the 1994 spring outmigration timing at Lower Granite Dam and the proportion of tagged fish detected at Lower Granite, Little Goose, Lower Monumental, and McNary dams was made.

Adult Spawner Enumeration

It is important in production studies to be able to precisely relate the number of spawning adults to the resultant parr abundance. Installation and operation of temporary weirs will enable the complete enumeration of spawning adults above the weirs. Weir locations were selected below the traditional spawning grounds.

With wild stocks of Snake River salmon and steelhead being the focus of recent and proposed listing under the Endangered Species Act (ESA), the need to develop new technology that would provide total enumeration of spawning escapement without harming the environment or the migrating fish was greatly elevated. Such technology is required to be temporary and not harmful to the site as these facilities are being developed on private or state lands within large wilderness areas in central Idaho. All parties desired to design these facilities with the least amount of impact to wilderness values.

The challenge of developing suitable weir designs was approached keeping the following characteristics in mind:

1. Portability.
2. Ease of installation and removal.
3. Ability to quickly pass fish without harm.
4. Compatibility with wilderness.
5. Ability to withstand moderately high flows.

All materials would have to be transported to the weir sites by aircraft.

The Chamberlain Creek and West Fork Chamberlain Creek weirs were designed with a cable support system attached to large trees with 4 in wide nylon web straps. The weir pickets were laced on a high cable approximately 6 ft above the water and a low cable approximately at the water surface. The substrate weir/picket interface is stabilized by a large steel “I” beam installed on its side in the substrate (Appendix A1).

The Running Creek and Rush Creek weirs were designed to withstand larger flows and employed a large steel sill plate installed in the substrate to support aluminum tripods, weir panels, catwalk, and counting chamber (Appendix A2).

The counting chambers at each weir were designed to provide live trapping capability as well as continuous passive video counting. The experimental development of video counting technology is being conducted with a Fuhrman time-lapse video recording system. This recording system is interfaced with a 17.5 in x 14 in x 6 ft Smith-Root electronic counting tunnel, which detects changes in conductivity. As fish pass through the tunnel, an adjustable sensitivity control allows the user to determine the minimum size of fish that will activate the counter. An infrared light allows the video system to record fish images at night as well as day. The entire system is powered by three deep-cycle 12 V batteries and charged by a solar panel. The system is activated by a fish passing upstream through the counting tunnel which is located immediately downstream of the video counting apron (Appendix A3). The signal from the electronic counter triggers the video to go into an alarm mode and record images in the camera's field of view for 28 seconds at three to four frames per second. After the alarm shuts off, the video recorder goes into a time-lapse mode recording one frame every three seconds. An experienced observer will be able to determine the sex and estimate the length from the video record. The time lapse portion of the tape will provide a control in determining the reliability of the system to video tape all larger (> 12 in) fish passing through the tunnel. Testing of the electronic video system will occur in 1994 and 1995 with both steelhead and chinook salmon adult migrants. When the system is fully tested and performance is satisfactory, additional units will be purchased and installed at the remaining weirs.

Plans to install a newly designed temporary weir in Running Creek approximately 3/4 miles above the mouth of Running Creek were approved in the spring of 1994. Construction of the prototype began in the spring of 1994 and was completed in August of 1994. During the summer months, the sill beam, tripods, and weir panels were flown into Running Creek by helicopter.

Plans to install a weir of the same construction in Rush Creek, a tributary of Big Creek, were approved in the summer of 1994. The weir will be installed near the mouth of Rush Creek and attended to by researchers stationed at the Taylor Ranch, a satellite research facility of the University of Idaho.

Redd Counts

A combination of ground and helicopter redd counts were conducted in the trend spawning areas of each research study drainage for both steelhead and salmon. There is some controversy over the reliability of steelhead redd counts among biologists, so we have compared adult escapements at weirs in study streams to redd counts conducted in trend spawning areas. These comparisons will provide useful information on the reliability of redd counts in areas where adult enumeration is not possible.

Adult Escapement:Juvenile Production Relationships

Current steelhead management strategies rely on maintaining a minimum adult escapement at Lower Granite Dam. These minimum escapements are intended to provide the needed spawning escapement to sustain future generations and provide productive future fisheries. IDFG has adopted a goal to achieve a resultant parr abundance that is 70% of the estimated carrying capacity of juvenile steelhead and salmon. Comparisons between recent adult escapements at Lower Granite Dam and actual spawning escapements and redd counts at study streams are made. It will also be useful to compare adult escapements at Bonneville

Dam and Lower Granite Dam with the resultant parr production in specific study streams for both A and B groups of steelhead to analyze the effect of using the present adult escapement objectives at Bonneville and Lower Granite dams of 62,200 and 20,000 wild and natural group-A steelhead and 13,300 and 10,000 wild and natural group-B steelhead, respectively. In addition, redd counts for selected wild steelhead streams were compared to estimated wild escapements at Lower Granite Dam and Bonneville Dam (parameters used in the Columbia River Management Plan).

RESULTS AND DISCUSSION

Parr Abundance

Chamberlain Creek Drainage

Intensive snorkeling was conducted in the Chamberlain Creek drainage during July and August of 1994. Snorkel data for 1994 are summarized in Table 1 and Table 2. Densities for chinook salmon were measured using only the data collected in C-channel types, the preferred rearing habitat for chinook salmon. Steelhead densities are measured using only the data collected in B-channel types, the preferred rearing habitat of steelhead. Four of the sections snorkeled are "monitoring" sites and have been snorkeled consistently since 1985 to establish long-term juvenile salmon and steelhead trends. They are identified as CHA1 through CHA4. Estimations of parr abundance are also expressed as percent of carrying capacity utilized (PCC) based on stream channel type and habitat condition (Rich et al. 1992). Carrying capacity of chinook salmon in the mainstem is 77 parr/100 m^2 and 108/100 m^2 in West Fork Chamberlain Creek. Carrying capacity for steelhead trout in the mainstem is 20 parr/100 m^2 and 14 parr/100 m^2 in West Fork Chamberlain Creek. The current IDFG goal is to maintain a parr density that is 70% of the rated carrying capacity. Because carrying capacity changes between habitat types and condition, only densities from the preferred habitat of each species were used to calculate the PCC.

Chinook Salmon Parr - Age 0 chinook salmon parr density averaged 39.3 parr/100 m^2 (range: 35.6 to 42.7/100 m^2, N=2) in the mainstem and 10.5 parr/100 m^2 (range: 0 to 24.6/100 m^2, N =7) in West Fork Chamberlain Creek. Chamberlain Creek is at 50.8% of carrying capacity and West Fork Chamberlain is at 9.7% of its rated carrying capacity. Based on the IDFG goal of reaching 70% parr carrying capacity, the mainstem is at 72.4% of reaching the goal and West Fork Chamberlain is 13.8% of the current goal (Figure 3). While densities of chinook salmon parr are up from 1992 and 1993, abundance trends from the four monitoring sites since 1985 show a continual decline in juvenile salmon abundance (Figure 4).

Steelhead Trout Parr - Age 1 and age 2 steelhead parr density averaged 2.9 parr/100 m^2 (range: 0 to 7.6/100 m^2, N = 14) in the mainstem and 3.3 parr/100 m^2 (range: 2.1 to 4.6/1 00 m^2, N = 5) in West Fork Chamberlain Creek. Steelhead were distributed more evenly throughout the drainage in both B- and C-channel types than were chinook salmon. Mainstem Chamberlain Creek is currently at 14.5% of carrying capacity and West Fork Chamberlain Creek is at 23.3% of carrying capacity. Based on current IDFG goals, the mainstem is 20.7% of the goal and West Fork Chamberlain is at 33.3% of the current goal (Figure 5). Steelhead parr

Table 1. Physical characteristics and year of site establishment of snorkel site stations in Chamberlain Creek drainage during July and August 1994. Channel types are by Rosgen (1985). Sections are ordered going upstream.

Section	Channel Type	Length (m)	Mean Width (m)	Strata	Year Established
Mainstem					
Deer Creek	B	103	13.3	lower	1993
McCalla Cutoff	B	108	11.7	lower	1993
Cutbank	B	82	11.9	lower	1993
Lodgepole Camp	B	114	12.0	lower	1993
Dog Mouth	B	95	10.3	lower	1992
Below West Fork (CHA-1)	B	130	10.0	lower	1985
Below West Fork Con.	B	136	7.9	lower	1992
West Fork Mouth	B	92	9.2	lower	1992
Below L. Hotzel Fence	B	70	9.1	lower	1993
Hotzel	B	129	8.2	lower	1992
Upper Hotzel	C	115	9.5	lower	1993
Airstrip (CHA-4)	C	96	10.0	lower	1985
No Name Mouth	B	54	13.8	lower	1992
Aspen Grove	B	92	8.6	lower	1993
Smokehouse	B	94	8.7	lower	1992
Lower Redtop	C	116	*	upper	1992
Fish Mouth	C	143	*	upper	1992
Upper Redtop	C	164	*	upper	1992
Forks	B	71	6.6	upper	1992
TRIBUTARIES					
Rim Creek					
Mouth	B	52	5.3	upper	1992
South Fork Chamberlain Creek					
Mouth	B	52	2.3	upper	1992
Fish Creek					
Trail Crossing	8	39	2.4	upper	1992
Moose Creek					
Mouth	B	62	5.5	lower	1992
3-Blaze Trail Crossing	B	43	4.9	lower	1993
Mouth of Moose Jaw	C	115	5.2	lower	1993
Upper	B	53	5.8	lower	1992
Flossie Creek					
Trail Crossing	C	88	2.4	lower	1992
Old Beaver Dam	C	68	1.7	lower	1993

Table 1. Continued.

Section	Channel Type	Length (m)	Mean Width (m)	Strata	Year Established
West Fork Chamberlain Creek					
Mouth	B	94	4.4	lower	1992
Bottom of Beal Meadow	C	99	4.6	lower	1992
Beal Cabin Fence	C	78	5.5	lower	1993
Sagebrush Fence	C	129	5.0	lower	1992
Stonebraker Airstrip	C	102	4.6	lower	1993
CHA-2	C	132	5.0	lower	1985
CHA-3	B	76	5.3	lower	1985
Beaver Stump	C	68	3.1	lower	1993
1 st Crossing	C	70	4.4	lower	1992
Spring	B	53	4.2	lower	1992
Old Packbridge	B	60	4.6	lower	1993
Tumbledown Bridge	B	58	2.5	lower	1992
Game Creek					
Trail Crossing	8	55	4.2	lower	1992
Diversion Ditch	B	46	3.7	lower	1993
Twin Bluffs	B	49	3.9	lower	1993
Lodgepole Creek					
Rockslide	B	47	3.0	lower	1993
Little Lodgepole Mouth	B	47	2.9	lower	1993
Upper Clearing	B	44	3.1	lower	1993
Whimstick Creek					
Trail Crossing	B	48	6.8	lower	1994
Mouth of My Creek	B	25	4.7	lower	1994
McCalla Creek					
Mouth of Root Creek	B	63	7.8	lower	1994
McCoy Cabin	B	49	4.4	lower	1994

• Section was not snorkeled in 1994.

Table 2. Steelhead trout and chinook salmon densities (fish/100 for sections snorkeled in the Chamberlain Creek drainage in July and August 1994. STH 1&2 = age 1 and age 2 steelhead combined, CHN 0=young-of-the-year chinook, CHN 1 =yearling chinook.

Section	STH 1&2	CHN 0	CHN 1
MAINSTEM			
Deer Creek	0.7	0.5	0.0
McCalla Cutoff	0.0	0.0	0.0
Cut Bank	0.2	0.4	0.0
Lodgepole Camp	1.7	1.1	0.0
Dog Mouth	2.6	4.4	0.0
Below West Fork (CHA-1)	2.2	2.4	0.0
Below West Fork Con.	1.8	4.7	0.0
West Fork Mouth	4.1	21.2	0.1
Below L. Hotzel Fence	6.8	24.8	0.0
Hotzel	7.5	21.6	0.0
Upper Hotzel	3.7	35.5	0.6
Airstrip (CHA-4)	6.2	42.7	0.0
No Name Mouth	3.7	0.2	0.0
Aspen Grove	6.4	0.0	0.0
Smokehouse	2.9	0.0	0.0
Forks	0.0	0.0	0.0
Mean (N = 16)	3.1	10.0	0.0
TRIBUTARIES			
Rim Creek			
Mouth	0.0	0.0	0.0
South Fork Chamberlain Creek			
Mouth	0.0	0.0	0.0
Fish Creek			
Trail Crossing	2.7	0.0	0.0
Moose Creek			
Mouth	2.0	0.0	0.0
3-Blaze Trail Crossing	3.3	0.0	0.0
Mouth of Moose Jaw	4.1	0.0	0.0
Upper	1.7	0.0	0.0
Flossie Creek			
Trail Crossing	10.0	0.0	0.0
Old Beaver Dam	17.2	0.0	0.0

Table 2. Continued.

Section	STH 1&2	CHN 0	CHN 1
West Fork Chamberlain Creek			
Mouth	2.1	10.3	0.0
Bottom of Beal Meadow	6.1	15.9	1.0
Beal Cabin Fence	3.4	24.6	1.3
Sagebrush Fence	4.5	19.5	0.3
Stonebraker Airstrip	12.5	6.5	0.6
CHA-2	4.9	7.0	0.6
CHA-3	3.7	7.9	0.5
Beaver Stump	5.3	0.0	0.0
1 st Crossing	2.7	0.0	0.0
Spring	3.1	0.0	0.0
Old Packbridge	4.6	0.0	0.0
Tumbledown Bridge	2.8	0.0	0.0
Game Creek			
Trail Crossing	2.7	0.0	0.0
Diversion Ditch	2.3	0.0	0.0
Twin Bluffs	3.6	0.0	0.0
Lodgepole Creek			
Rock Slide	3.0	0.0	0.0
Little Lodgepole Mth.	4.3	0.0	0.0
Upper Clearing	2.1	0.0	0.0
Whimstick Creek			
Trail Crossing	3.0	0.0	0.0
Mouth of My Creek	8.5	0.0	0.0
McCalla Creek			
Mouth of Root Creek	4.1	0.0	0.0
McCoy Cabin	8.7	0.0	0.0
Mean (N=31)	4.5	2.9	0.1

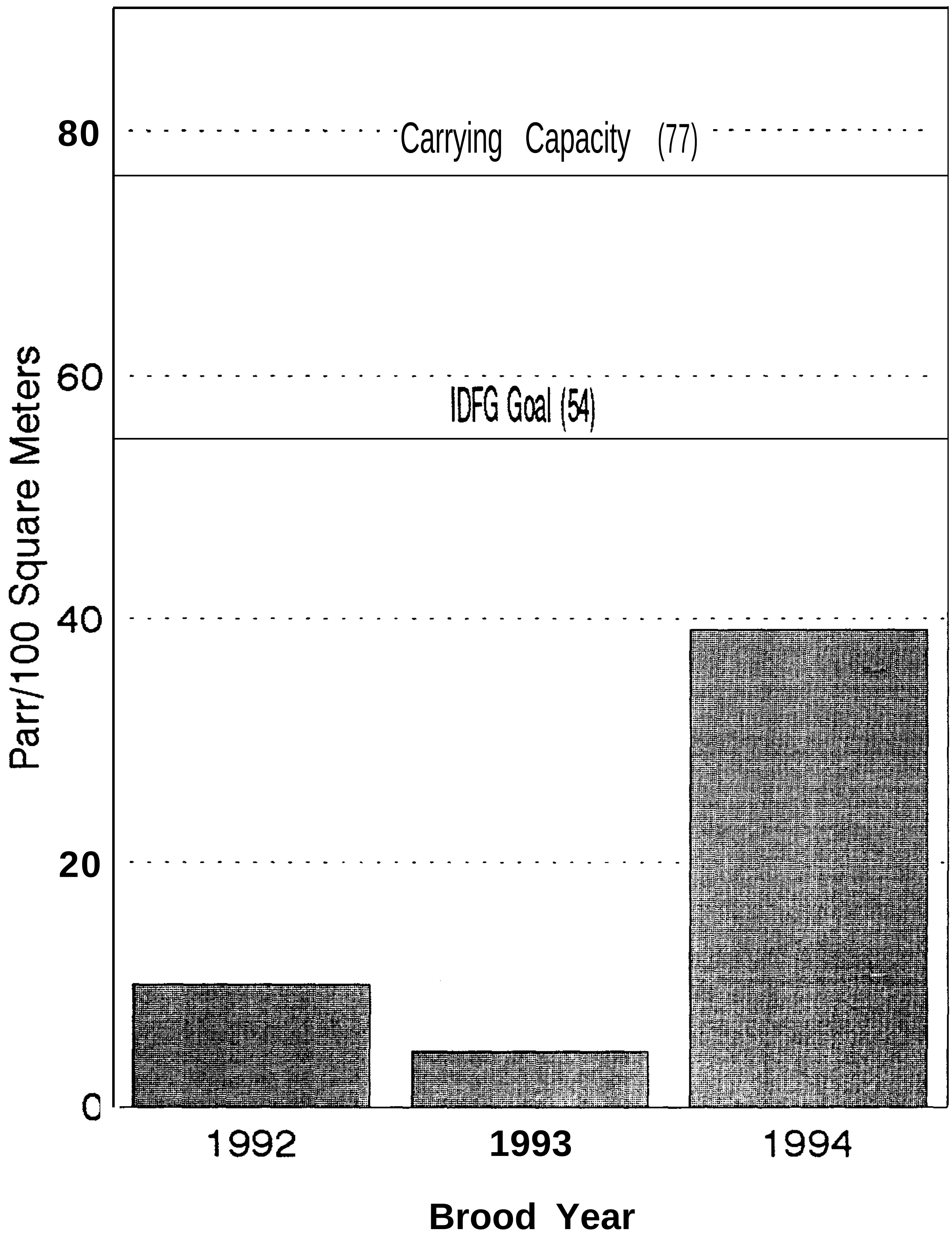


Figure 3. Chinook salmon parr density in Chamberlain Creek, 1992-1994.

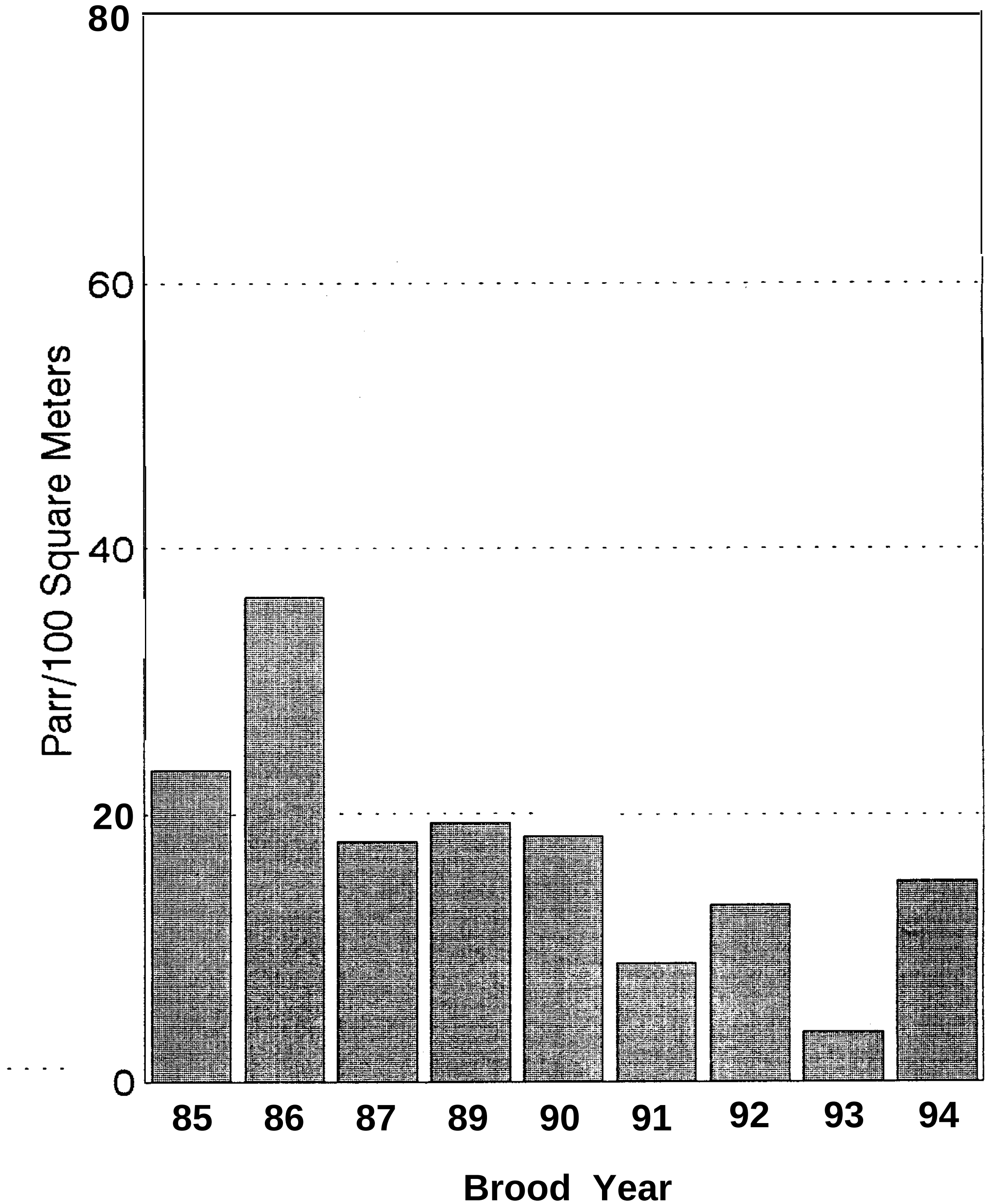


Figure 4. Chinook salmon parr density at four Chamberlain Creek drainage monitoring sites, 1985-1994.

This report was funded by the Bonneville Power Administration (SPA), U.S. Department of Energy, as part of BPA's program to protect, mitigate, and enhance fish and wildlife affected by the development and operation of hydroelectric facilities on the Columbia River and its tributaries. The views in this report are the author’s and do not necessarily represent the views of BPA.

For additional copies of this report, write to

Bonneville Power Administration
Public information Center - CKPS-?
P.O. Box 3621
Portland, OR 97208

Please include title, author, and DOE/BP number from the back cover in the request

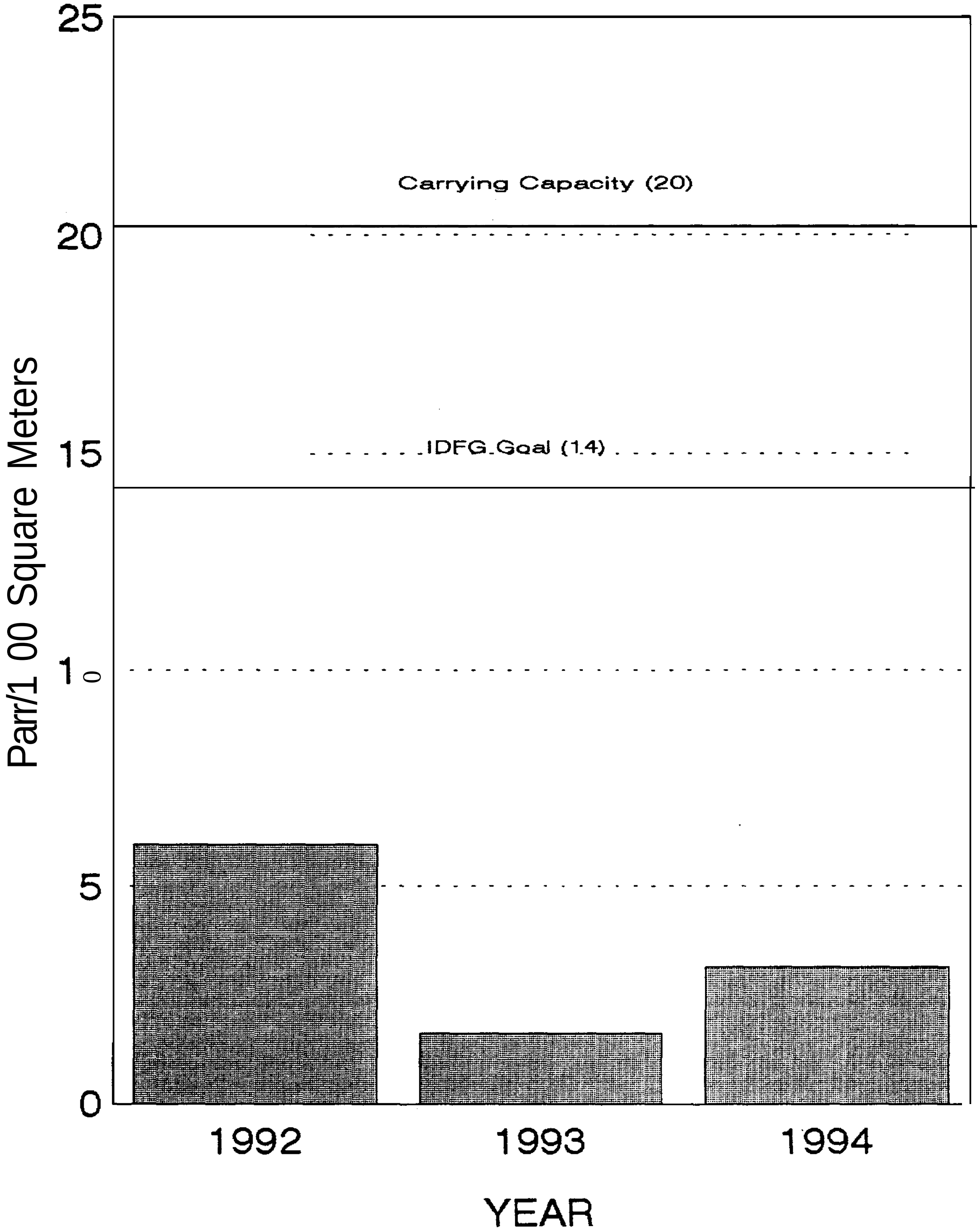


Figure 5 Steelhead trout parr density (age 1 and age 2 combined in Chamberlain Creek, 1992-1994.

density in the four monitoring stations shows a net decline since 1985 (Figure 6). These estimates of steelhead parr density are most likely biased high due to the difficulty in distinguishing steelhead parr from resident stocks of rainbow trout. Resident rainbow trout stocks are known to exist in Chamberlain Basin lakes and Chamberlain Creek and are frequently observed by snorkelers in the 8 in to 12 in classes. There are also small numbers of cutthroat trout in Chamberlain Basin that can be confused with steelhead parr in the 2 in to 3 in class due to their similarity in appearance.

Running Creek

Running Creek and its tributaries were snorkeled in August 1994. Section sizes, channel types, and the dates sites were established are listed in Table 3. The mainstem and tributaries of Running Creek are moderate to high gradient B type channels. Due to the lack of C type channels in Running Creek, the preferred rearing habitat of chinook salmon, moderate to high gradient B-channels were used to approximate PCC for chinook salmon and density ratings were adjusted for this channel type. Carrying capacity for chinook salmon is rated at 77 parr/100 m^2 and 20 parr/100 m^2 for steelhead trout. Snorkel summary data for 1994 are displayed in Table 4.

Chinook salmon parr - Age 0 chinook salmon were present in 5 of the 10 sections on the mainstem of Running Creek. Mean density of chinook salmon in the mainstem was 1.9 parr/100 m^2 (range: 0.0 to 13.0/100 M^2, N =10). The mainstem of Running Creek is at 2.5% of carrying capacity and 3.5% of the current IDFG goal. No chinook salmon parr were observed in the four tributaries snorkeled. No yearling chinook salmon were observed in the mainstem or the tributaries.

In 1994, chinook salmon parr were observed throughout the drainage on the mainstem, except for the uppermost section at the mouth of the South Fork and were similar to the distribution in 1991 (Rich et al. 1993). No chinook salmon parr were observed in the four tributaries snorkeled. The only tributary that has been a significant salmon producing stream is Eagle Creek. Mean densities of chinook salmon are up from 1992 (< 0.1 /100 m^2 in the mainstem and 0.1 /100 m^2 in the tributaries), but down from 1991 (3.5/100 m^2 in the mainstem and 0.0/100 m^2 in the tributaries) (Figure 7). The distribution of chinook salmon parr in 1992 was limited to areas near the mouth of Running Creek and Lynx Creek (Schrader and Petrosky 1994). The differences in densities and distribution are most likely due to low seeding levels and the relatively low numbers of snorkeling sites (18) in the drainage. The Running Creek drainage runs through a narrow canyon consisting of all B-type channel. Suitable chinook salmon spawning and rearing habitat is relatively sparse and widely distributed throughout the drainage making sampling difficult.

Steelhead trout parr - All sections snorkeled in the mainstem and the tributaries had steelhead parr present. The mean density of age 1 and age 2 steelhead in the mainstem was 5.9/100 m^2 (range: 3.5 to 9.6/100 m^2, N =10). PCC for the mainstem was at 29.5% of capacity and 42.1% of the current IDFG goal. Mean density in the tributaries was 1.4/100 m^2 (range: 0.3 to 3.1/100 m^2, N=8). PCC for the tributaries was 7% and 10% of the current IDFG goal. These densities are consistent with those in 1992 (5.6/100 M^2; range: 0 to 16.5/100 m^2; N =10, and 2.4/100 m^2 ;range: 0 to 6.4/100 m^2, N =8, respectively) (Figure 8).

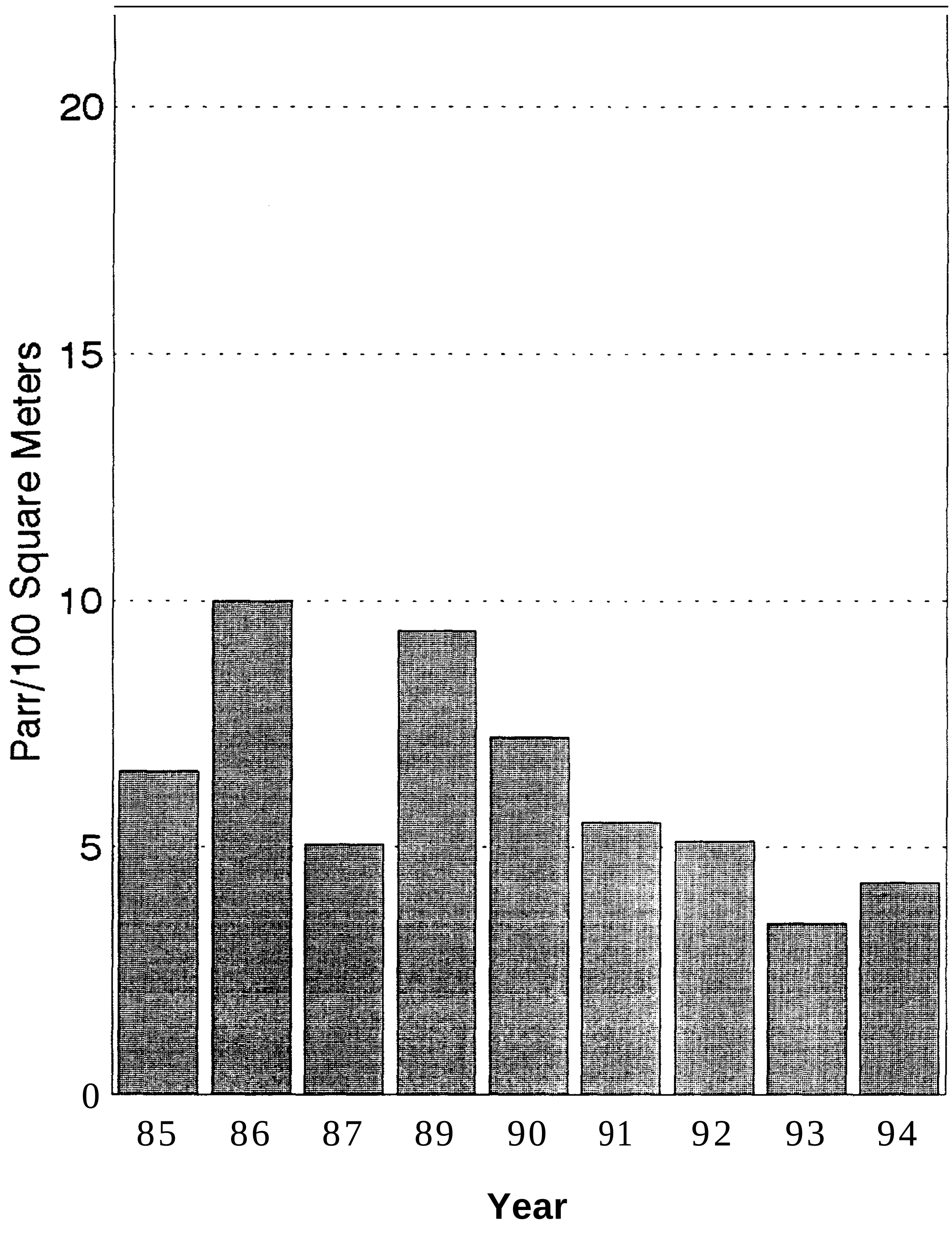


Figure 6. Steelhead trout parr density (age 1 and age 2 combined) at four Chamberlain drainage monitoring sites, 1985-l994.

Table 3. Physical measurements, channel type, and year of establishment for sections snorkeled in the Running Creek drainage in July and August 1994.

Section	Channel Type	Length (m)	Mean Width (m)	Year Established
		MAINSTEM		
Pack Bridge	B	88	9.75	1985
Cabin	B	85	14.50	1985
Eagle Creek Mouth	B	42	11.20	1992
Dry Wash	B	35	9.15	1991
Grouse Mouth	B	54	9.80	1991
Wilderness Boundary	B	62	7.00	1992
Trail Culvert	B	68	10.00	1992
Road Bridge	B	32	8.60	1991
York's Camp	B	94	9.20	1991
South Fork Mouth	B	33	5.20	1991
		TRIBUTARIES		
Eagle Creek				
Trail Crossing	B	41	8.00	1991
Diversion	B	36	5.80	1991
Grouse Creek				
Mouth	B	55	3.90	1991
Trail Crossing	B	37	4.70	1991
Lynx Creek				
Mouth	B	31	4.70	1992
Culvert	B	31	4.70	1991
South Fork Running Creek				
Mouth	B	27	4.60	1991
Culvert	B	67	4.90	1992

Table 4. Steelhead trout and chinook salmon densities (fish/l00 in sections snorkeled in Running Creek drainage in July and August of 1994. STH 1&2 =age 1 and age 2 steelhead combined, CHN 0 =young-of-the-year chinook salmon, CHN 1 = yearling chinook salmon.

Section	STH 1&2	CHN 0	CHN 1
MAINSTEM			
Pack Bridge	4.7	0.0	0.0
Cabin	3.8	0.5	0.0
Eagle Creek Mouth	4.2	0.0	0.0
Dry Wash	9.3	0.0	0.0
Grouse Mouth	5.2	0.0	0.0
Wilderness Boundary	9.6	4.1	0.0
Trail Culvert	8.6	0.2	0.0
Road Bridge	5.0	13.0	0.0
York's Camp	4.8	1.6	0.0
South Fork Mouth	3.4	0.0	0.0
Mean (N = 10)	5.9	1.9	0.0
TRIBUTARIES			
Eagle Creek			
Trail Crossing	3.0	0.0	0.0
Diversion	0.4	0.0	0.0
Grouse Creek			
Mouth	1.4	0.0	0.0
Trail Crossing	2.3	0.0	0.0
Lynx Creek			
Mouth	1.3	0.0	0.0
Culvert	1.3	0.0	0.0
South Fork Running Creek			
Mouth	0.8	0.0	0.0
Culvert	0.3	0.0	0.0
Mean (N = 8)	1.4	0.0	0.0

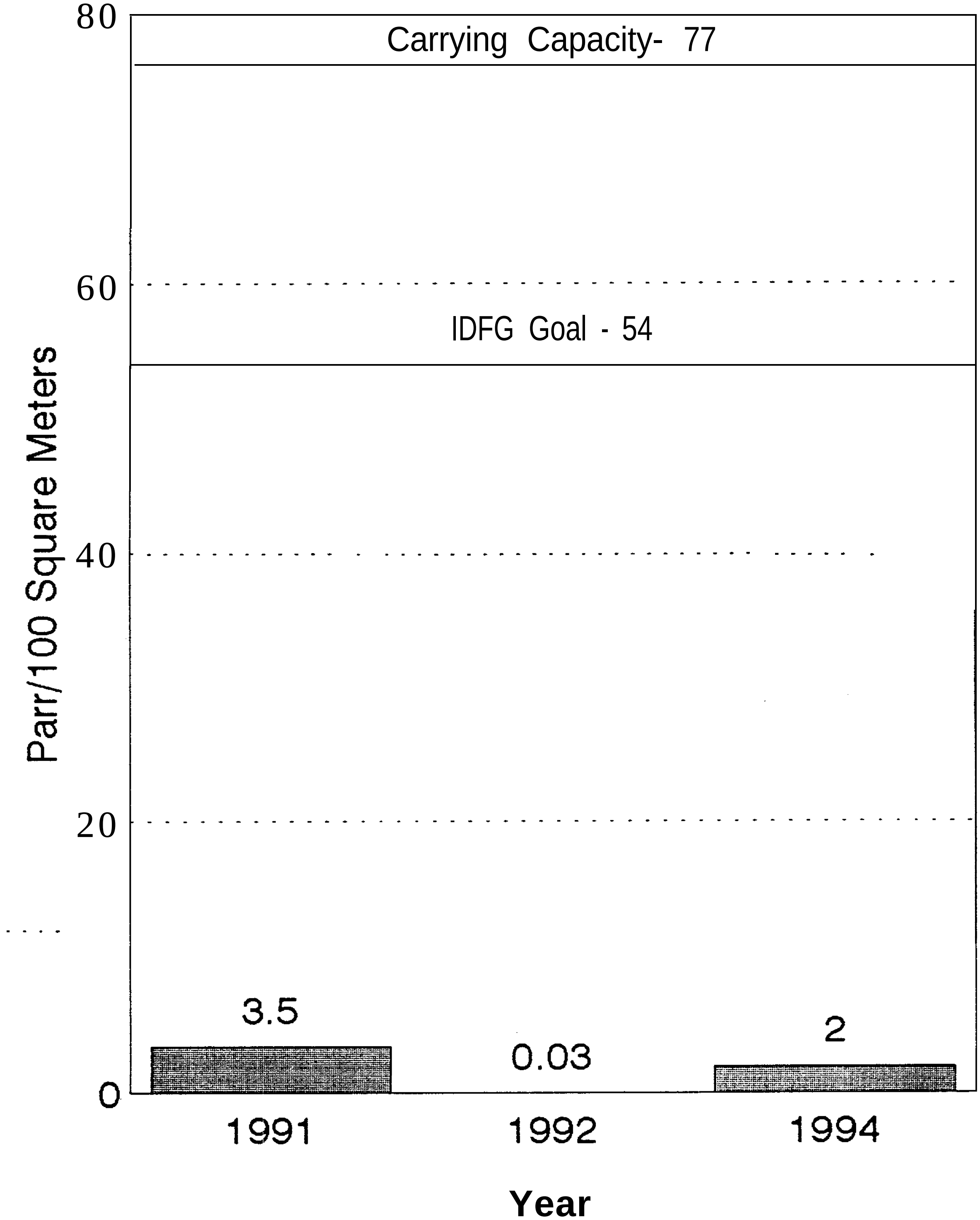


Figure 7. Chinook salmon parr density in Running Creek, 1991, 1992, and 1994.

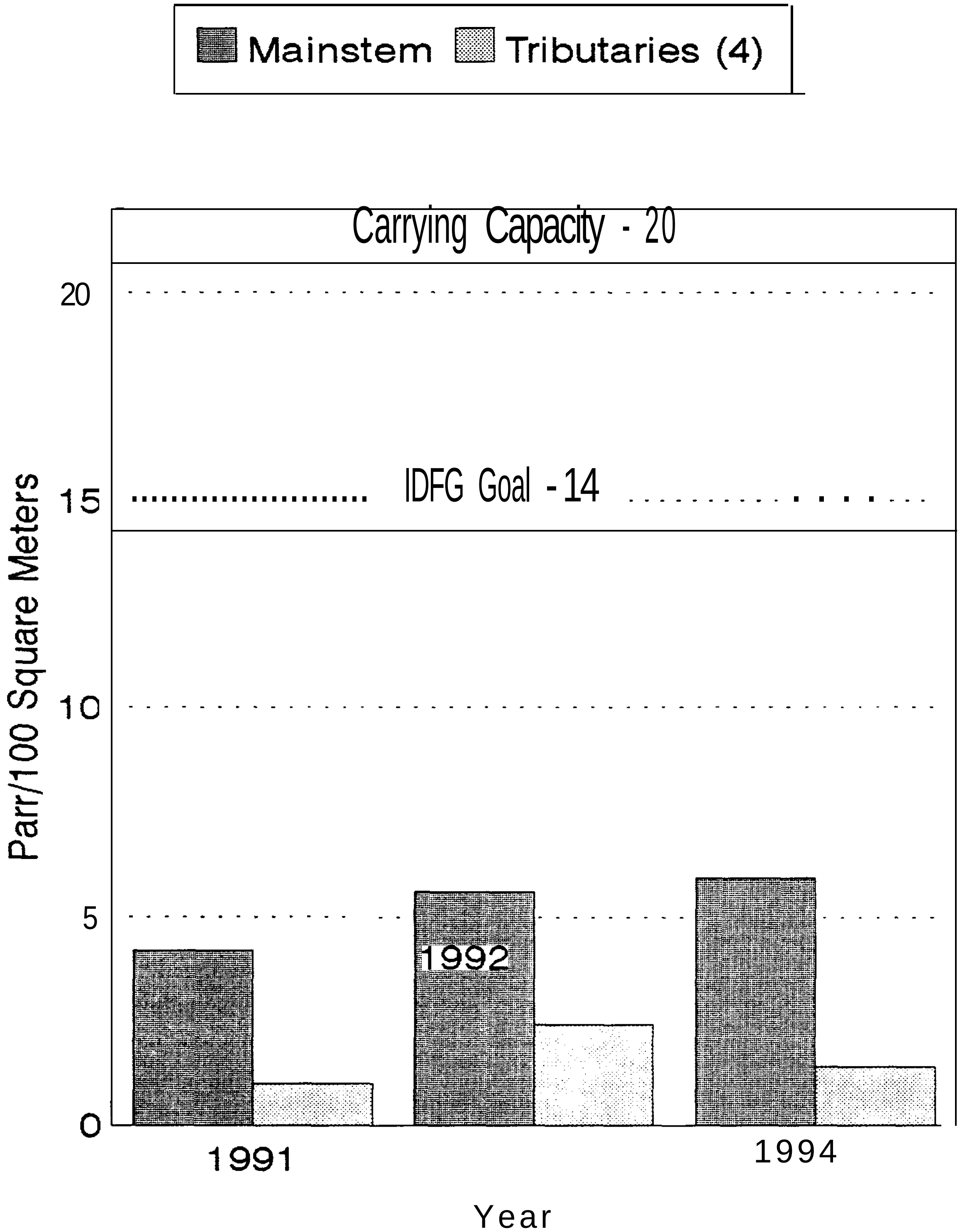


Figure 8. Steelhead trout parr density in Running Creek and its tributaries, 1991, 1992, and 1994.

Densities of steelhead trout are most likely biased high due to the presence of resident cutthroat trout which are difficult to distinguish from steelhead in the 2 in to 3 in size class. We are confident, however, that fish over 3 in long are identified correctly. This is typically when the distinguishing characteristics become apparent. There is also the possibility that cutthroat trout are hybridizing with residualized steelhead trout as some fish have characteristics that are typical of hybridization.

Rapid River

During the summer of 1994, Rapid River was snorkeled by IDFG project staff. Twelve stations were snorkeled all of which were B-channel (Table 5). Rated carrying capacity for steelhead in Rapid River B-channels is 20 fish/l00 m^2 of surface area. Average density of steelhead was 9.0 parr/100 m^2 (range: 4.4 to 26.7). Rapid River is currently at 45% of the rated carrying capacity and 64% of the current IDFG goal. Average density of age 0 chinook salmon was 1.6 parr/100 m^2.

Johnson Creek

During the summer months of 1994, Johnson creek was intensively snorkeled by an IDFG research group. Table 6 summarizes snorkel data from 19 sample sites in the middle-lower and lower sampling strata on Johnson Creek; 15 stations were B-channel and the remaining 4 stations were C-channel. Average density of age 1 and age 2 steelhead combined in B type channels was 2.2 parr/100 m^2 Average density of age 0 chinook salmon in C-channels was 34.5 parr/100 m^2

Table 5. Steelhead trout parr (age 1 and age 2 combined) and chinook salmon parr density (parr/100 m^2) for sections snorkeled in Rapid River, 1994.

Section	Channel Type	STH 1&2 Density	CHN 0 Density
Wyant	B	8.6	1.4
Cliff Hanger	B	7.1	0.9
Upper Bridge	B	11.0	0.0
One Pit	B	8.3	0.6
Lower Bridge	B	26.7	0.4
Cora Cliff	B	10.0	5.5
Castle Creek	B	4.4	0.7
Copper Creek	B	4.7	0.0
Rap 2	B	7.8	7.7
Paradise	B	3.8	0.2
Two Pits	B	9.9	1.6
Rap 1	B	5.2	0.7

Mean density in B-channel: steelhead =9/0/1 00 m^2, chinook = 1.6/1 00 m^2

Table 6. Steelhead trout parr (age 1 and 2 combined) and chinook salmon parr densities for sections snorkeled in Johnson Creek, 1994.

Section	Channel Type	STH 1&2 Density	CHN 0 Density
Below Boulder	B	8.0	13.9
Icehole	C	1.5	54.9
Above Wapiti	B	0.0	0.0
Above Cox	C	1.1	23.1
Bear Creek	B	0.0	0.0
Above Bear Creek	B	0.0	0.3
Above Icehole	C	0.2	51.6
End of Airstrip	C	0.1	8.3
Paved Bridge	B	0.0	6.7
MP 12	B	0.5	0.3
L 2	B	4.5	8.3
Below Hot Creek	B	2.4	4.0
Above Gauging	B	4.1	22.6
Above Golden	B	0.6	4.6
0.5 mi. above YPCG	B	1.8	16.0
Above EFSF	B	5.3	5.3
Airstrip Bridge	B	0.4	2.5
Boulder Pool	B	5.6	37.3
L 3	B	0.0	0.2

Marsh Creek

In 1994, 22 stations were snorkeled in Marsh Creek (Table 7). All stations sampled were C-channel. Mean density of age 1 and age 2 steelhead was 0.7 parr/100 m^2. Mean density of age 0 chinook salmon parr was 38.1 parr/100 m^2. Suitable rearing habitat for juvenile steelhead is lacking in upper Marsh Creek and juvenile steelhead typically move to lower Marsh Creek, presumably in search of more suitable rearing habitat.

Juvenile Emigration

Running Creek

During low flow conditions in the summer and fall trapping period, 592 juvenile steelhead were caught. A total of 269 steelhead were PIT-tagged and released above the trap; 107 of the released fish were subsequently recaptured yielding a 39.9% efficiency and an estimated total emigration of 1,483 juvenile steelhead trout.

The majority of the outmigration occurred between October l-31, with the largest daily movement (108 fish) on October 23, during a rain storm when 0.45 in of precipitation fell and

Table 7. Steelhead parr (age 1 and age 2 combined) and chinook salmon parr density for sections snorkeled in Marsh Creek, 1994.

Section	Channel Tvoe	STH 1&2 Density	CHN 0 Density
One	C	0.2	22.3
Two	C	0.3	31 .o
Three	C	1 .o	22.2
Four	C	0.8	52.7
Five	C	0.0	22.3
Six	C	0.3	3.2
Seven	C	0.0	2.1
Eight	C	0.0	26.2
Nine	C	0.3	38.0
Ten	C	1.3	92.8
4B	C	0.1	24.0
Eleven	C	3.3	52.3
Twelve	C	0.8	37.0
Thirteen	C	2.2	80.1
Fourteen	C	1.2	79.5
Fifteen	C	0.8	47.1
Sixteen	C	0.5	30.1
Seventeen	C	0.6	42.5
Eighteen	C	0.4	50.4
Nineteen	C	0.0	40.0
Twenty	C	0.0	27.6
5A	C	0.2	15.7

water temperature dropped from 6°C to 1°C (Figure 9). The small outmigration spikes during the summer seemed to be attributable mainly to precipitation and/or flow. After the spike on October 28 (63 fish), only 35 more fish were trapped through November 3, indicating that the outmigration was essentially over.

Rapid River

During the trapping period of August 3 to October 28, 383 juvenile steelhead were captured in the temporary downstream migrant weir. All juvenile steelhead except young-of-the-year were PIT-tagged and released. Initially all tagged fished were being released above the weir to determine efficiency. Due to some miscommunication, the weir attendant was away from the trap and hatchery personnel became concerned about the debris building up on the weir, so they pulled a section of weir pickets and allowed fish to pass below the weir. Because of this, the efficiency determination was discontinued and all subsequent tagged steelhead were released below the weir. No estimate of juvenile steelhead emigration was made.

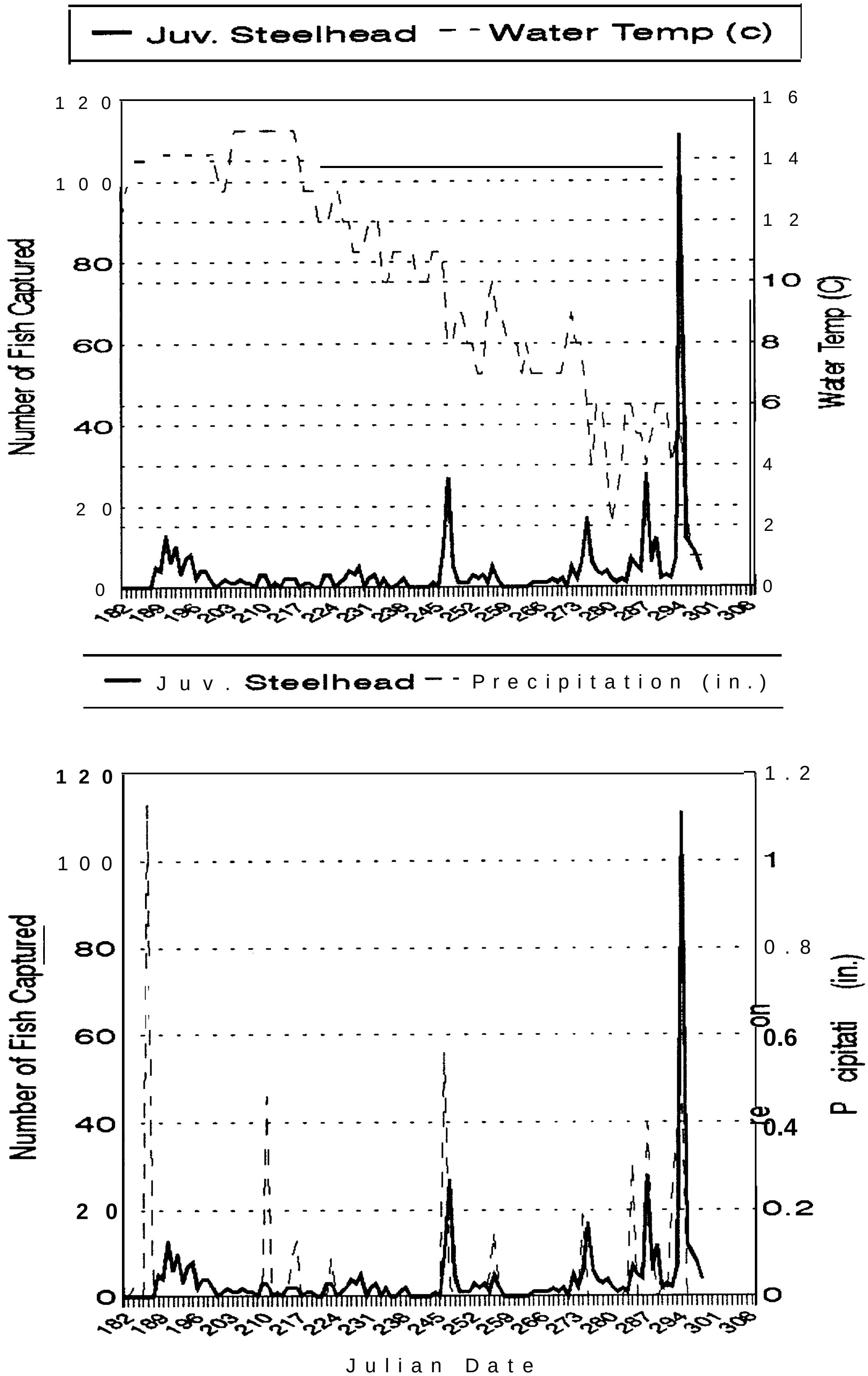


Figure 9. Juvenile steelhead outmigration timing, water temperature (^{o}C), and precipitation (inches) in Running Creek, 1994.

Timing of migration was not strongly correlated with flow, but did seem to show some correlation with water temperature. However, no strong relationships between fish movement and flow or temperature are apparent (Figure 10). Juvenile steelhead generally did not start to move until the first of September. A large movement of fish occurred between August 30 and September 20 with little change in flow or temperature. The largest single movement during the trapping period occurred on September 16 (49 steelhead). The remaining outmigration seemed more correlated with temperature and flow. The lag in movement during mid-October was most likely due to closure of the trap entrance from October 11-14. On the night of October 28, due to a mixture of high flow and debris, the weir attendant was unable to keep the weir free of debris. Concerned of a possible wash out, the weir attendant removed several sections of weir pickets and trapping was discontinued for the remainder of the season. It appears that fish were actively migrating during this period and the trapping records through October 28, were insufficient to show the complete juvenile steelhead fall movement.

Plans have been developed to install a 5 ft diameter screw trap above the migration barrier in the spring of 1995. We are confident the screw trap will remain operational through the complete fall outmigration even during increased flows and excessive debris.

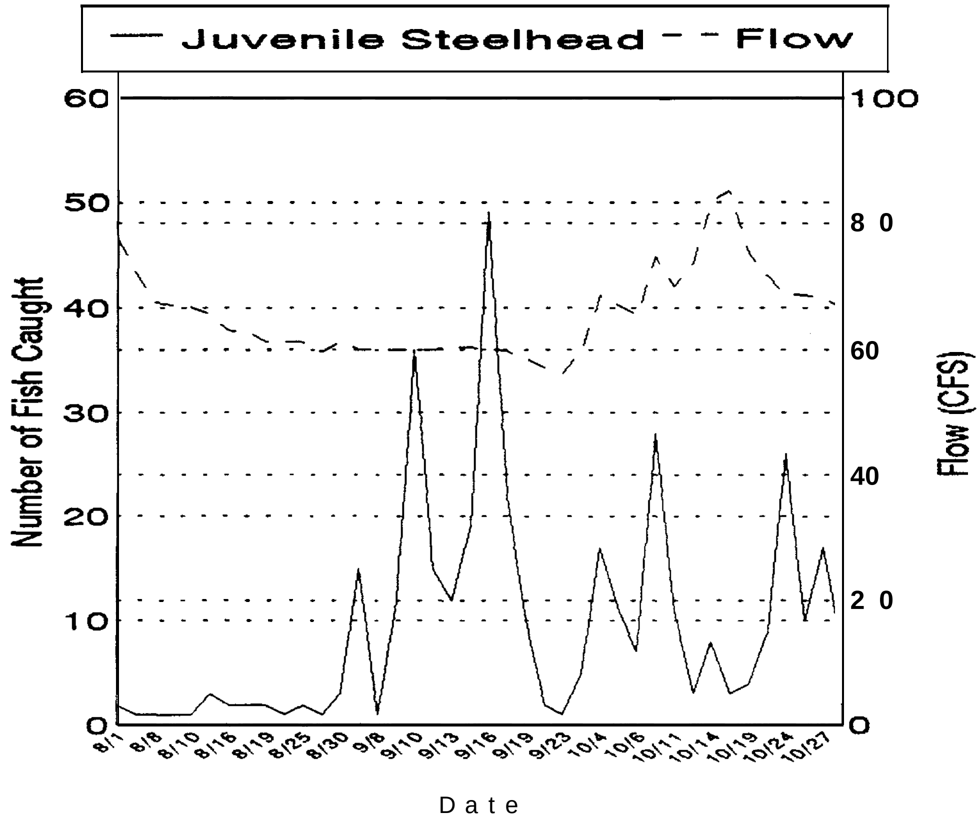
Scale samples were taken from all juvenile steelhead captured. Analysis of scales revealed a large overlap in length for two and three year old fish (Figure 11). Age 1 fish are generally distinguishable from other age classes and are typically less than 110 mm. Age 2 fish ranged from 130 mm to 190 mm, averaging about 160 mm fork length. Age 3 fish ranged from 160 mm to 240 mm, averaging about 180 mm fork length. This large overlap of two and three year old fish makes age class determination by length unreliable.

Age composition of juveniles passing below the weir in the fall of 1994 was determined by the number of fish in each year class taken as a percent. Age 1 fish made up 3.2% of the migration, age 2 fish made up 60.3 % of the migration, and age 3 fish made up the remaining 36.6%.

PIT Tagging

NMFS field staff collected and PIT-tagged wild juvenile chinook salmon in several drainages. Juvenile steelhead trout that were captured incidentally in Chamberlain, West Fork Chamberlain, and Rush creeks were also tagged at the request of IDFG project staff. A summary of NMFS tagging is displayed in Table 8. Research groups from IDFG also PIT-tagged wild/natural stocks of steelhead and chinook salmon in Running Creek, Marsh Creek and Rapid River: summaries are also displayed in Table 8. The information on the detection results from these fish that will be outmigrating in 1995 will be included in the IDFG 1995 Annual Report.

During the 1993 field season, field staff of NMFS and IDFG PIT-tagged wild/natural stocks of juvenile steelhead and salmon in several drainages in Idaho. Numbers of fish tagged, released, and detected at the Snake River and Columbia River dams are displayed in Table 9. Fish tagged in the summer of 1993 were recorded as 1994 outmigrants. We have found that fish tagged in the summer and fall at less than 135 mm fork length generally do not migrate to the ocean the following spring. Many of the juvenile steelhead tagged in 1993 were too small to migrate in the spring of 1994. Because the majority of the fish tagged in the aforementioned streams were smaller one or two year old fish and the numbers of fish tagged



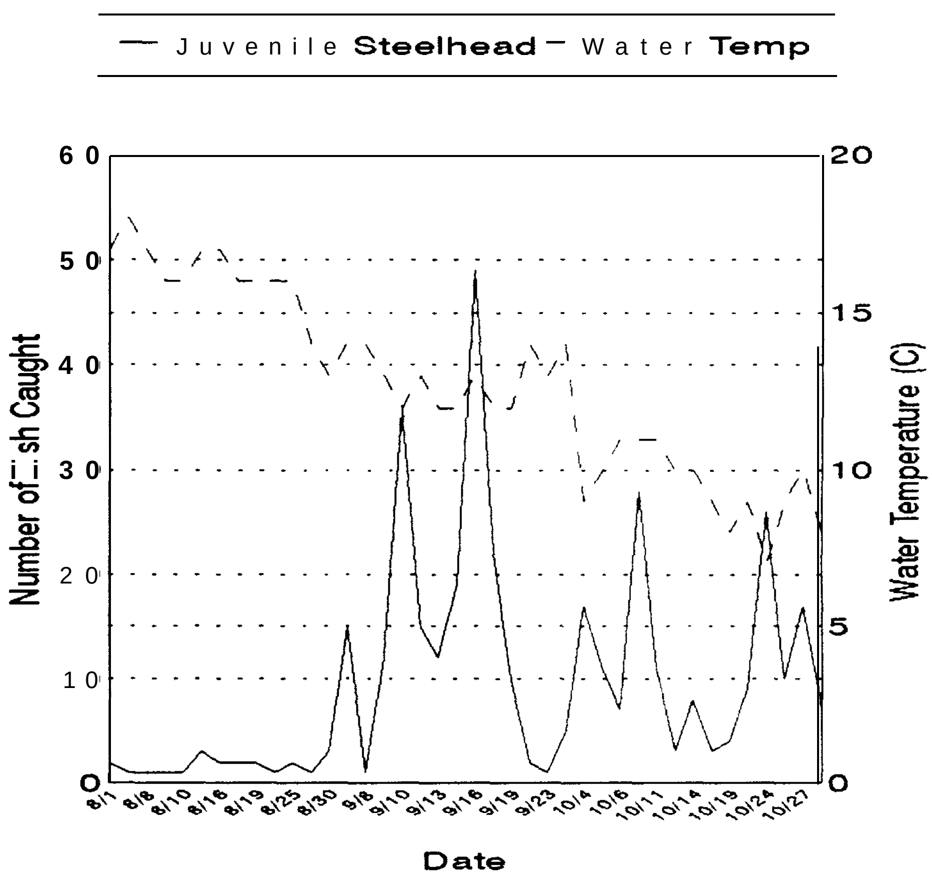


Figure 10. Juvenile steelhead outmigration timing, flow (CFS), and water temperature (^{0}C) at the Rapid River downstream trap, August 3 - October 28, 1994.

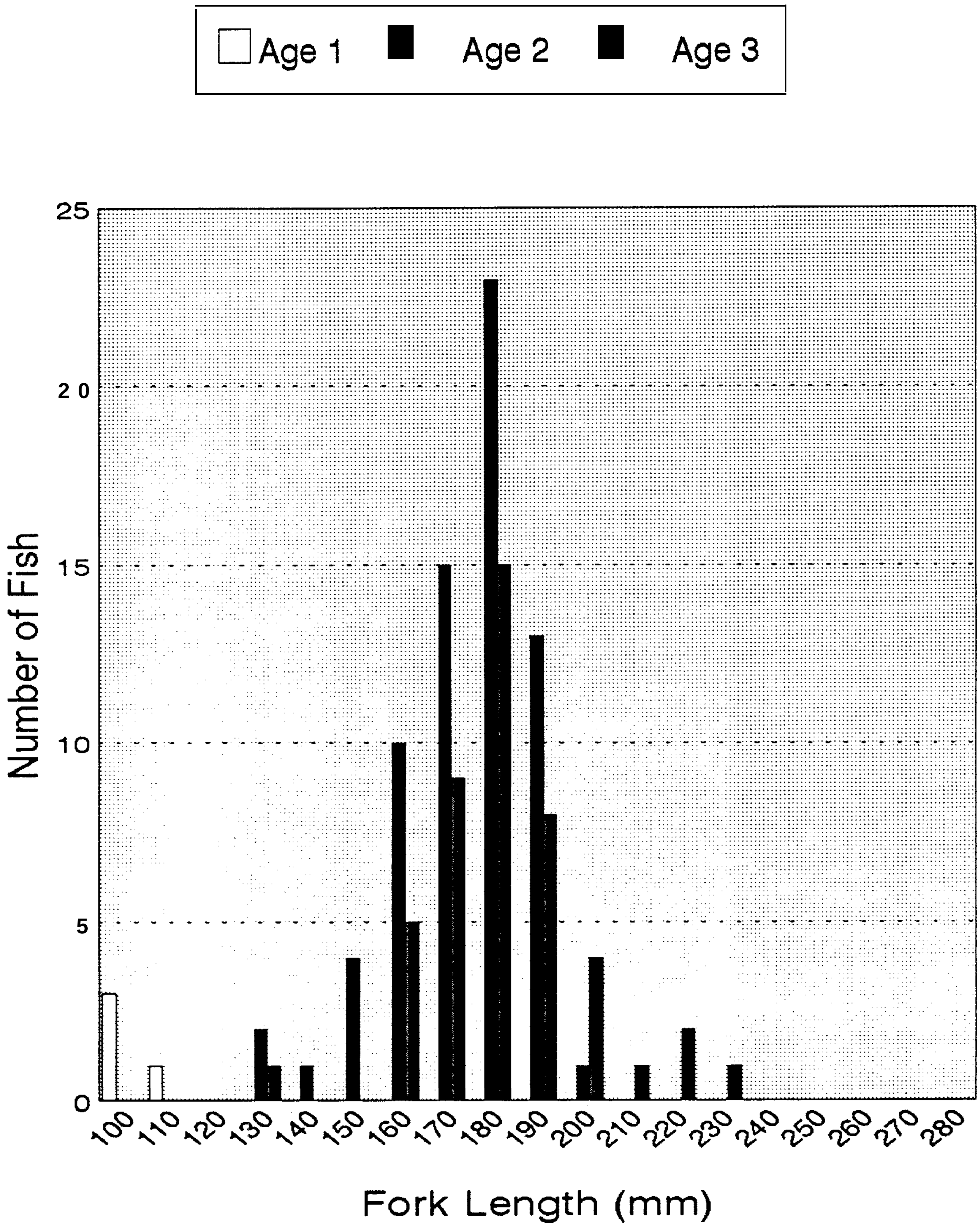


Figure 11. Juvenile steelhead length at age from scale samples taken at Rapid River, fall 1994.

Table 8. Summary of wild juvenile steelhead and chinook collection and PIT tagging by groups from NMFS and idfg during the 1994 summer field season. NMFS data is by Achord (unpublished).

Stream	Number Tagged and Released: Chinook (CHN)	Number Tagged and Released: Steelhead (STH)	Collection and Tagging Mortalities	Agency Tagging Fish
Chamberlain Creek	241	119	CHN=O,STH=O	NMFS
West Fork Chamberlain Creek	917	143	CHN = 0,STH = 0	NMFS
Marsh Creek	1,575	0	CHN=19	NMFS
Marsh Creek	3,298	282	STH=O	IDFG
Sulphur Creek	729	0	CHN=3	NMFS
Running Creek	4	313	CHN = 0,STH = 0	IDFG
Rush Creek	15	135	CHN = 0,STH = 0	NMFS
Rapid River	0	381	STH=1	IDFG

Table 9. Wild juvenile steelhead PIT Tag detections at lower Snake River and Columbia river dams. LGD = Lower Granite Dam, LGO = Little Goose Dam, LMD = Lower Monumental Dam, MCN = McNary Dam.

Stream	Tagging Agency	Number Tagged and Released	Number at Migratory Size	Number of Unique Detections	Percentage Detected at LGD	LGO	LMD	MCN
			STEELHEAD					
Summer Tagging								
Chamberlain Creek	NMFS/ IDFG	315	66	1	0.0	0.0	1.5	0.0
Running Creek	IDFG	35	15	2	0.0	6.6	6.6	0.0
Rush Creek	NMFS	53	10	1	10.0	0.0	0.0	0.0
Summer Totals		403	91	4	1.1	1.1	2.2	0.0
Fall Tagging								
Rapid River	IDFG	284	278	124	33.1	21.6	24.1	16.2
			CHINOOK					
Summer Tagging								
Chamberlain Creek	IDFG	76	NA	5	1.3	1.3	1.3	5.3
W.F. Chamberlain Ck.	IDFG	496	NA	49	6.9	2.6	2.6	2.6
Summer Total		572		54	6.1	2.5	2.5	2.5

and released were small, it was difficult to determine the percentage of fish migrating the following spring. Results of the 1994 PIT tag interrogations were used to determine the minimum size fish to be considered 1994 outmigrants. The data was adjusted by subtracting all fish tagged below a minimum size from the total number of fish tagged and released. We were unable to determine a minimum size for many streams due to a lack of PIT tag detections for those particular streams. In order to compare relative detection rates between streams, we used 135 mm as a minimum size for all streams in Table 9. This minimum size was derived from Rapid River detections. Additional fish will be tagged in the future to document timing and to determine a minimum size for each stream.

The number of unique detections represents the number of fish that were detected at one of the interrogation sites on the lower Snake and Columbia river hydroelectric complex. The percentage detected at individual projects represents all fish that were detected at each project, even if they had been detected at a previous project. Due to variations in flow and spill at each project, detection rates at successive projects do not necessarily reflect survival through the complex, but do give some indication of persistence through the complex, assuming that all tagged fish were released back to the river.

Chamberlain Creek and West Fork Chamberlain Creek

During the summer of 1993, a total of 315 juvenile steelhead were captured and PIT-tagged in the Chamberlain Creek drainage: 97 juvenile steelhead were tagged in Chamberlain Creek, 130 were tagged in West Fork Chamberlain Creek, 47 were tagged in Flossie Creek, and 41 were tagged in Moose Creek. West Fork Chamberlain Creek is the largest tributary on upper Chamberlain Creek and steelhead redd count surveys have documented the presence of adult steelhead in West Fork Chamberlain Creek. Flossie and Moose creeks are tributaries of Chamberlain Creek near the upper end of the drainage (Figure 1). PIT tag interrogations for the 1994 outmigration at the lower Snake River dams revealed one detection from Moose Creek. No fish were detected from Chamberlain Creek, West Fork Chamberlain Creek, or Flossie Creek. Moose Creek is located above the trend steelhead spawning area in Chamberlain Creek and it is suspected that many of the juvenile rainbow/steelhead in Moose Creek are resident rainbow trout. Flossie creek is located adjacent to the trend steelhead spawning area for Chamberlain Creek, but is also the outlet stream of Flossie Lake which is known to contain an abundant population of rainbow trout. It is suspected that many of the fish in Flossie Creek are resident rainbow trout. Of the 315 fish tagged in the Chamberlain Creek drainage, only 66 were over 135 mm in length. PIT tag interrogations in 1995 and 1996 will help reveal the success of the 1993 tagging and also help determine size and timing of outmigrating juvenile steelhead. We are planning to tag additional steelhead in the summer of 1995.

Running Creek

During the summer of 1993, IDFG project staff electrofished in Eagle Creek, a tributary on lower Running Creek, in an effort to PIT tag juvenile steelhead. Due to shortage of time, only 35 steelhead were tagged. Of those tagged, only 15 were above 135 mm. Two tags were detected at the dams in spring 1994. Additional effort will be placed on tagging larger groups of fish in 1995.

Rush Creek

During the summer of 1993, NMFS groups tagged 53 juvenile steelhead in Rush Creek. Of the 53 steelhead tagged, 10 were over 135 mm. Only one fish was detected at the dams in the spring of 1994.

Rapid River

In the fall of 1993, IDFG PIT-tagged 284 juvenile steelhead at the Rapid River bull trout weir downstream. All but 6 fish were over 135 mm in length and 124 fish were detected at the dams the following spring.

Arrival timing of juvenile steelhead at Lower Granite Dam indicates the majority of fish arrived between April 20 and May 10 (Figure 12). Due to low numbers of PIT tag detections, only Rapid River was used to demonstrate arrival timing at Lower Granite Dam. Additional PIT tag detections in 1995 and 1996 will help to confirm migration timing of wild steelhead stocks.

Adult Spawner Enumeration

Chamberlain Creek and West Fork Chamberlain Creek Weirs

The Chamberlain Creek weir was installed by two men on April 9, 1994. The weir was operational from April 9 through June 6 when a rain-on-snow event resulted in very high, debris-laden flows. The weir attendant became concerned with his safety while cleaning the weir at these high flows and cut the high support cable allowing the weir pickets to pivot on the lower cable and drop to a horizontal position where water and debris could pass without obstruction. The weir was placed back into operation on June 16 and remained operational until August 28 when the weir was removed. No adult salmon or steelhead were passed through the weir counting facilities. Spawning ground surveys revealed that a few salmon escaped above the weir. These fish could have passed when the weir was down from June 6-16 or could have passed between the lower weir pickets which had a spacing 1/2 in wider than the 2 in specified spacing between pickets. However, no steelhead redds were detected above the weir in the 1994 helicopter redd count. This was further confirmed by the low numbers of rainbow trout/steelhead fry observed by snorkelers during the summer of 1994. Next year the spacing on the lower pickets will be reduced by 1/2 in to alleviate the problem of fish passing between weir pickets.

The West Fork Chamberlain Creek weir was installed on April 14 after a considerable amount of snow and ice were removed from the stream banks. The weir was installed with relative ease and remained operational until September 5 and handled bank full flows on several occasions in April and May without significant problems. The solar panel and electronic/video counting facilities were installed alongside the weir. Due to a malfunction in the electronic counter, false signals caused the system to operate sporadically. After several unsuccessful

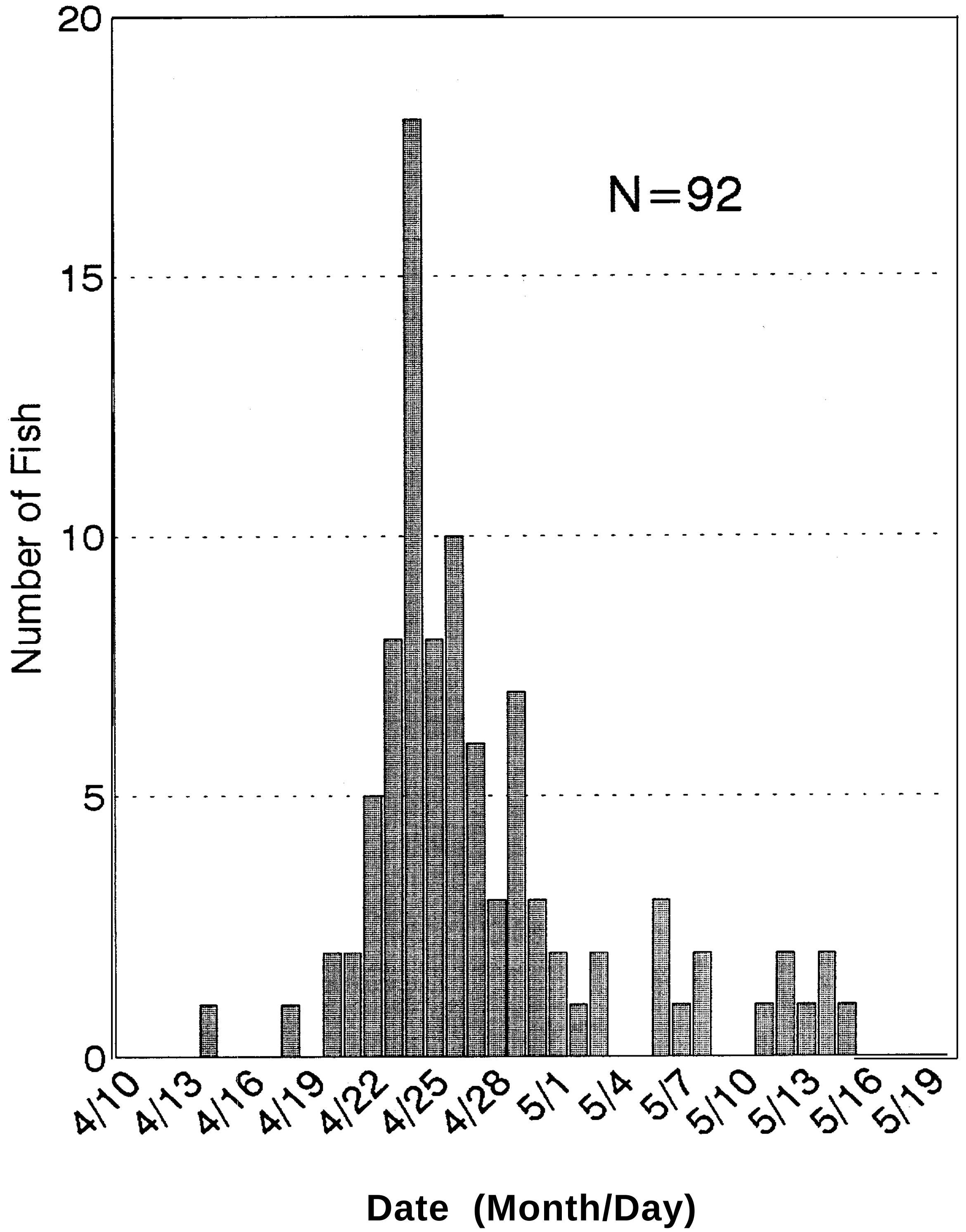


Figure 12. Wild juvenile steelhead arrival timing at Lower Granite Dam from Rapid River, spring 1994.

attempts of fixing the system in the field, the electronic/video system was removed from the site. The manual trap was reinstalled, but no salmon or steelhead were trapped and no redds were found above the weir during the redd counts. The electronic counter and tunnel were returned to Smith-Root to correct the problems and pending the results, will be reinstalled in the summer of 1995.

The potential adverse effects of operating the weirs and the relative performance are described as follows:

1. Impingement of downstream migrants - No juvenile or adult fish of any species were found impinged on either the West Fork weir or main Chamberlain weir. Juvenile salmon and steelhead were observed freely passing upstream and downstream through weir pickets, counting tunnel, and video apron.

2. Delay or stopping of upstream migrating adult salmon or steelhead - No adult salmon or steelhead were observed approaching the main Chamberlain weir. On August 7, a single adult male chinook salmon was observed approaching the West Fork weir and after a few minutes turned and moved downstream. Subsequent surveys from the weir downstream to the mouth of the West Fork did not locate the salmon and it was believed to have returned to main Chamberlain Creek where other salmon were present. The distribution of salmon redds in 1994 did not indicate any stoppage of salmon by the weirs (Figure 13). One redd was constructed within 300 m downstream of the Chamberlain Creek weir and one other was constructed approximately 25 m downstream of the weir, both of which were located in suitable spawning habitat.

3. Installation and operation causing adverse impact on fish habitat - No sedimentation occurred as a result of placing the sill beam, shore gabions, pickets, or counting facility. No bank erosion occurred at either weir and during the steelhead migration period the streams were flowing bank full. No substrate movement was detected at either weir.

4. Injury or death to chinook salmon - No adult of juvenile salmon were injured or killed as a result of project operations. One male adult chinook salmon died on August 1 prior to spawning approximately 1/2 mile downstream from the Chamberlain Creek weir. The fish was examined and found to have dissolved gas bubble symptoms. No juvenile salmon were collected through this project in 1994. NMFS staff in a separate effort collected and PIT-tagged juvenile chinook salmon in West Fork Chamberlain and Chamberlain creeks.

Running Creek Weir

The Running Creek weir was designed and manufactured in 1994. During the summer months of 1994, the sill beam was flown in by helicopter and installed by a three man crew at low flows on September 2. The weir panels and all corresponding hardware were flown in and stored at the weir location approximately 3/4 mile above the mouth of Running Creek. The weir is scheduled to begin operation on April 1, 1995 and will remain in operation through early September 1995 for both steelhead and chinook salmon runs. Tony Wright, manager of the Running Creek Ranch, will operate and maintain the weir during the 1995 operation.

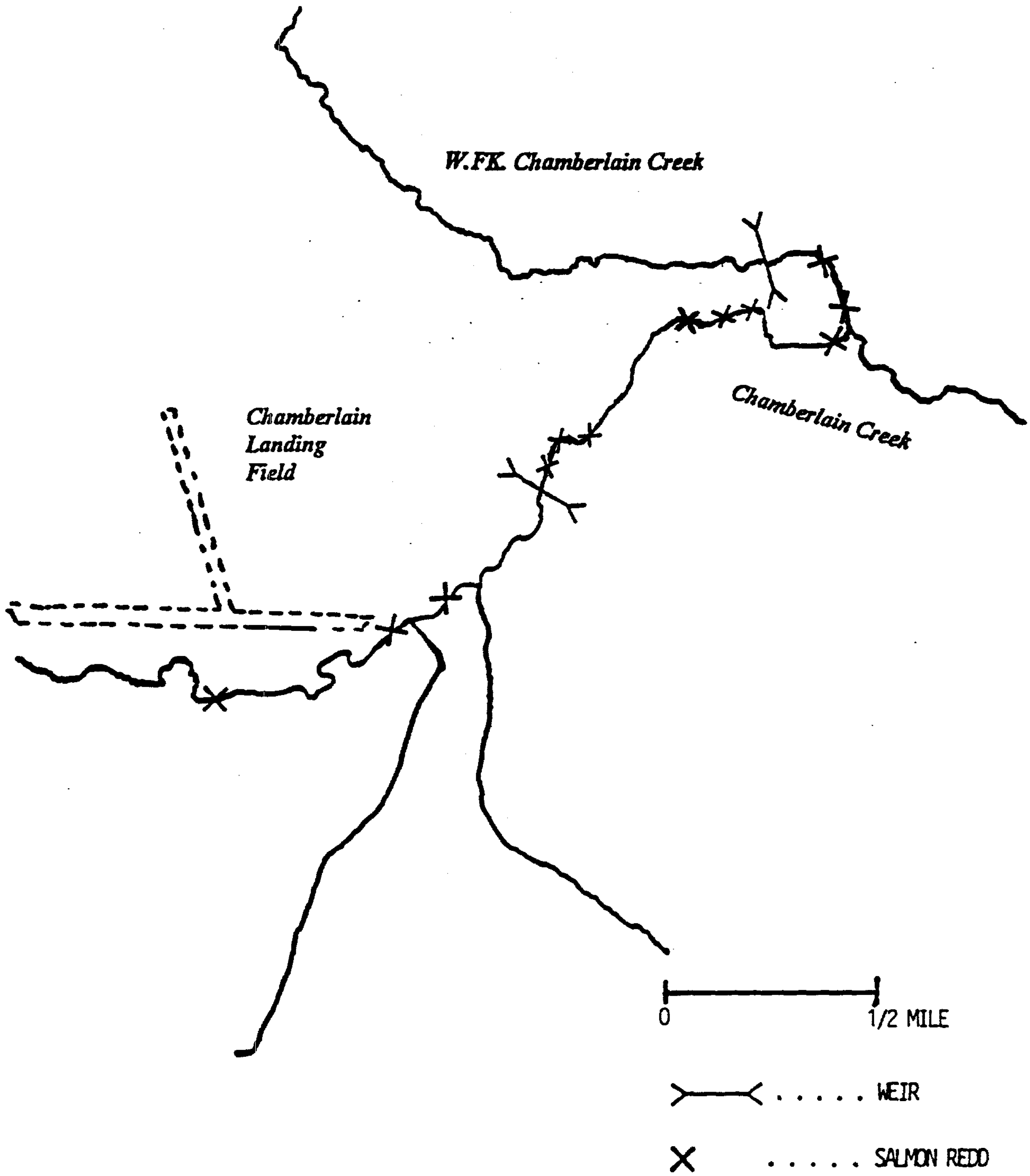


Figure 13. Weir and chinook salmon redd locations in Chamberlain Creek and West Fork Chamberlain Creek, summer 1994.

Rapid River Migration Barrier

During the spring spawning migration, 33 adult steelhead were counted at the Rapid River migration barrier and released upstream to spawn, 21 of which were females.

While attempting to determine spawner recruitment trends for Rapid River wild steelhead, it will be necessary to compile several years of production data over varied hydrologic and climactic conditions. Analysis of scale samples from adult spawners allows the determination of the brood year. By tracking adults back to their respective brood year, and achieving a complete adult spawner census, spawner recruitment relationships can be made. Scale collection and analysis over a long period is very costly and time consuming. It would be advantageous to determine any consistencies in age composition of fresh and saltwater rearing intervals that would allow assumptions for brood year determination without using scale aging techniques. Two basic conditions would have to be met. First, ocean age can be determined from length frequency criteria. Secondly, fresh water rearing age would have relatively constant proportion of two and three year old fish from each brood year. Due to the variation in fresh and saltwater rearing intervals, a minimum of three consecutive years of scale analysis is necessary to determine the number of spawners that were produced from a given brood year. In order to determine consistencies in fresh water rearing intervals it will be necessary to compile several consecutive years of scale sample analysis. Comparisons of scale date from year to year will give some idea of age class proportion, but does not take into account the strength of each year class.

Comparisons of saltwater age from scale samples and length frequency for 1993 and 1994 spawners were made (Figure 14). In 1993, one-ocean fish ranged in length from 54 cm to 58 cm, with an average length of 56.3 cm (N=6). Two-ocean fish ranged from 59 cm to 86 cm, with an average length of 74 cm (N = 18). In 1994, one-ocean fish ranged from 61 cm to 66 cm, with an average length of 62.8 cm (N=5). Two-ocean fish ranged from 63 cm to 85 cm, with an average length of 74.7 cm (N=14). When compared to the actual lengths of one- and two-ocean fish, length frequencies are consistent and generally show the same range of lengths. Although the cutoff length for one- and two-ocean fish shifted from approximately 62 cm in 1993 to 68 cm in 1994, the length frequency showed the same general range for each year.

Analysis of fresh water rearing intervals from the 1993 and 1994 adult scales revealed contrasting results (Figure 15 and Figure 16). In 1993, two year fresh water fish made up 41% of the sample, three year fresh water fish made up 52% of the sample, and four year fish made up the remaining 7% (N=27). In 1994, two year fresh water fish made up 21% of the sample and three year fish made up the remaining 79% (N=19). These relative ages are also confounded by the strength of each year class.

With this limited information, it appears ocean age can be determined from length frequency, but should be looked at on a year-to-year basis as the cutoff length between one- and two-ocean fish will change from year to year. Fresh water age composition was widely varied in 1993 and 1994, making it difficult to assume a fixed ratio of two and three fresh water fish. Analysis of adult scales indicate a significant proportion of the two year old fish leaving Rapid River in the fall spend an additional year in fresh water (Figure 15 and Figure 16). We will continue to take scale samples in future years to evaluate spawner recruitment relationships in Rapid River.

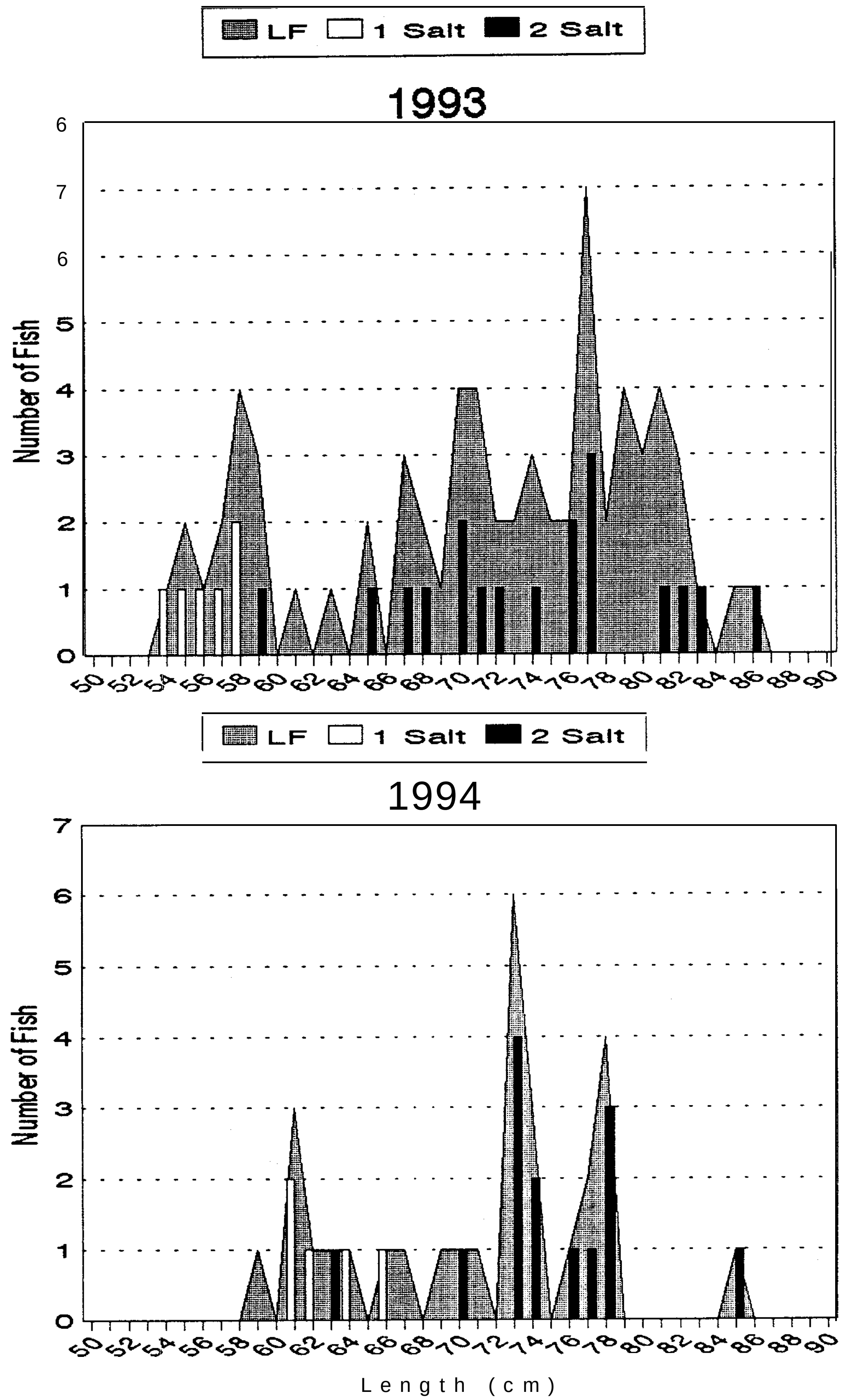
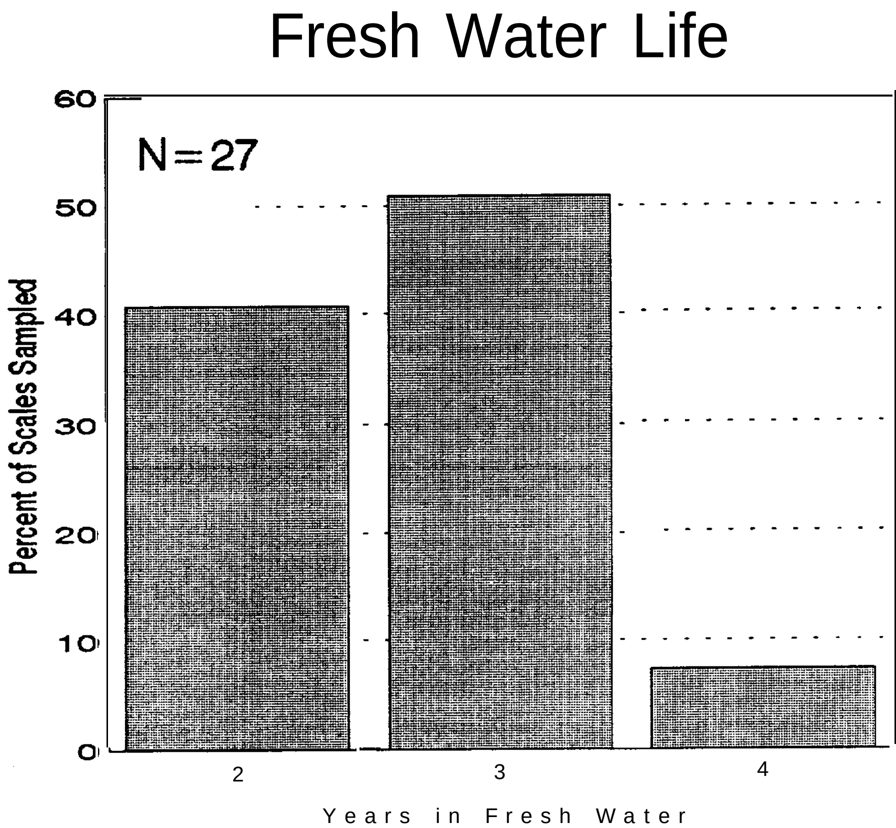


Figure 14. Rapid River adult steelhead length frequency and saltwater age, 1993 and 1994.



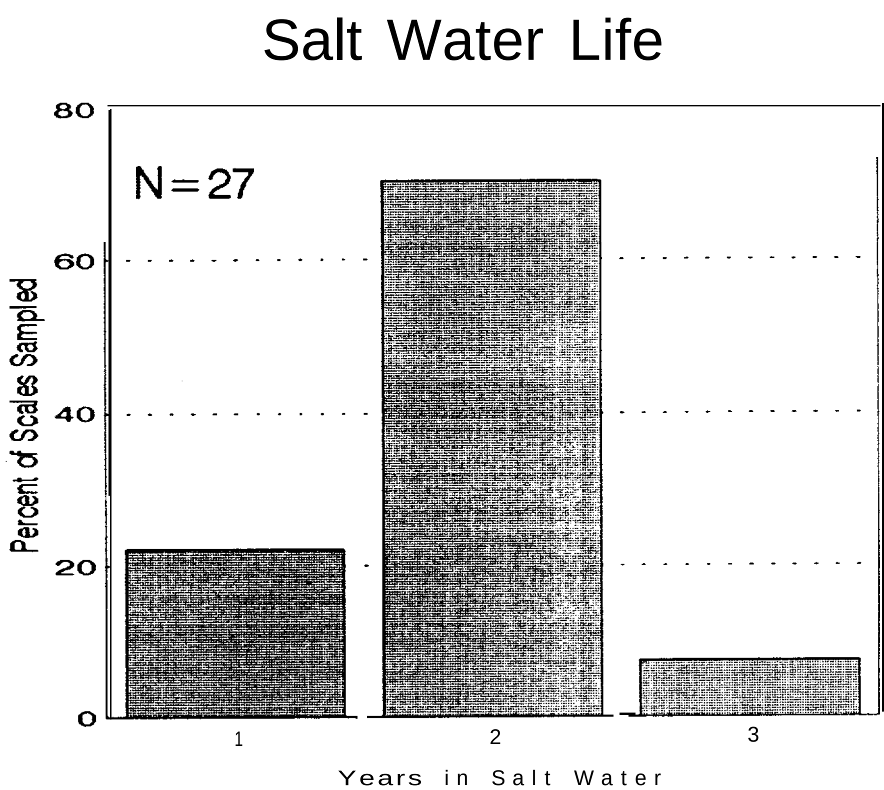


Figure 15. **Fresh water and saltwater age composition of adult wild steelhead based on scale samples taken at Rapid River, spring 1993.**

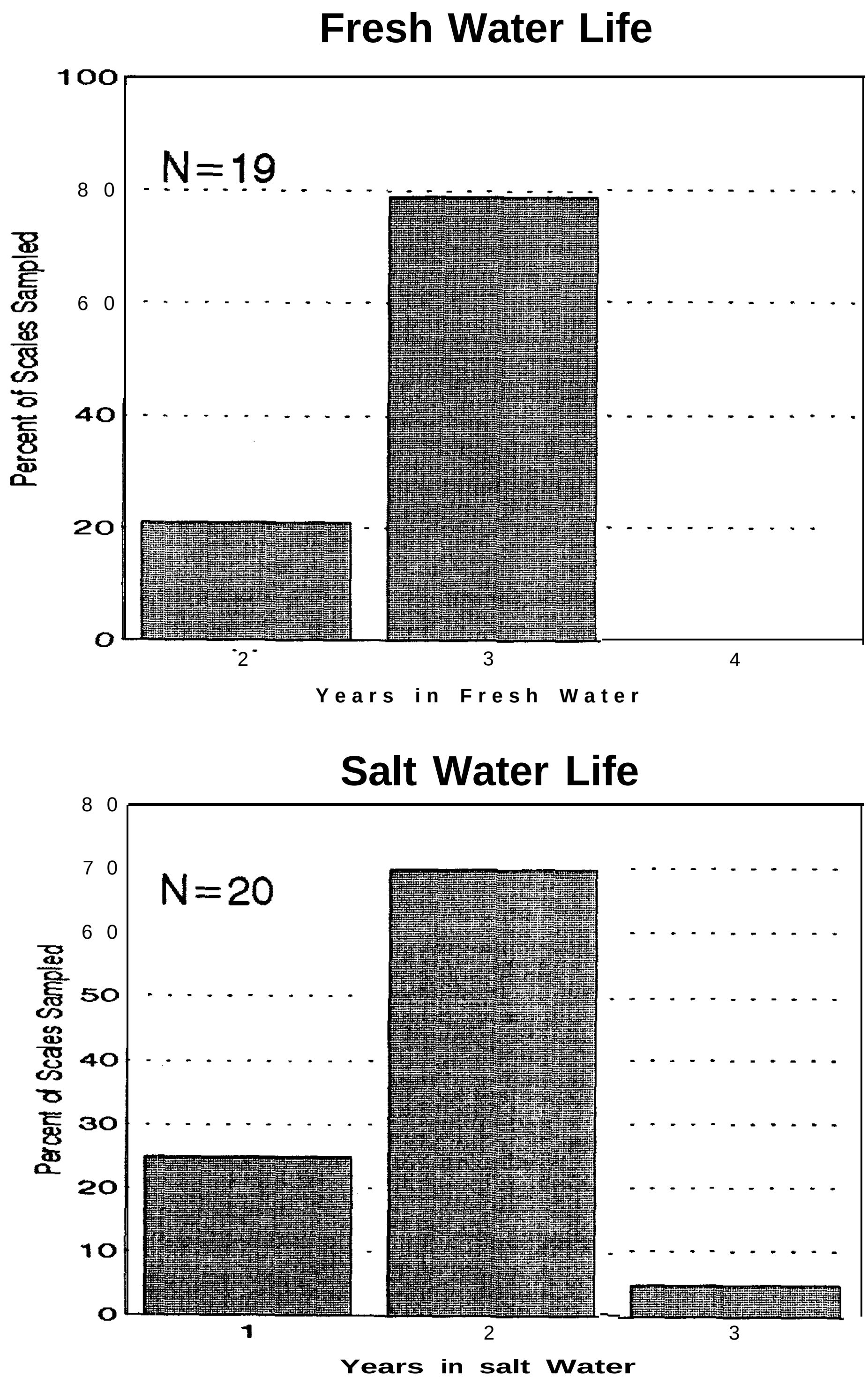


Figure 16. Fresh water and saltwater age composition of adult wild steelhead based on scale samples taken at Rapid River, spring 1994.

Rush Creek Weir Feasibility

The suitability of a weir site owned by the University of Idaho on lower Rush Creek to monitor steelhead escapement was investigated. The physical aspects of the site and the engineering feasibility appeared to be suitable. Conceptual plans were drawn illustrating a portable weir with large steel sill beams, detachable aluminum tripods, and aluminum picket panels similar to those used at Running Creek. In early May 1994, a presentation was given to the Frank Church River of No Return Wilderness planning committee outlining the need for steelhead and salmon production research and the desire to work at locations such as the Taylor Ranch to prevent additional wilderness impacts. The committee provided strong support for the proposed research at the Taylor Ranch and the other proposed sites.

Plans were reviewed on site with U.S. Forest Service and University of Idaho staff in June 1994, and staff comments indicated both agencies were positive regarding the proposal. Following the field reviews, a cooperative agreement was developed and sent to the U.S. Forest Service and University of Idaho administrators for signing on June 30, 1994.

No response was received from the University of Idaho concerning the request until mid-October 1994. The aforementioned delay prevented installation of the weir sill plate in the fall of 1994. The weir parts were constructed late in the fall of 1994 and installation plans were delayed until March 1995.

Captain John Creek Weir Feasibility

Preliminary surveys by IDFG engineering and biological staff revealed that the best site for an adult steelhead counting facility was located downstream from IDFG property on land owned by Mr. Elmer Earl. A design and conceptual plan was developed for the site which utilized an overflow velocity barrier anchored to a solid basalt rock formation on the left bank and bottom. Rock filled gabions would stabilize the right bank. The design was chosen to withstand the extreme high flow and debris load that can occur in Captain John Creek during the adult steelhead migration period (March through May). The conceptual drawings were presented to Mr. Earl in early March 1994, and Mr. Earl stated that there were some unresolved logging access problems with IDFG and he wanted to resolve those problems prior to entering into an agreement for the construction and operation of the steelhead weir.

IDFG staff will continue to monitor the agreement status between Mr. Earl and IDFG. When the access agreement is completed, the steelhead studies will be pursued.

Johnson Creek Weir Feasibility

A field reconnaissance trip in early May 1994 by engineering and biological staff resulted in the identification of a site on the upper end of Bryant Ranch which is below all of the spawning area on Johnson Creek. An additional site was identified on Burntlog Creek just upstream from the mouth. Physical size and engineering difficulty present problems at the

Bryant Ranch site and access is difficult at the Burntlog Creek site. From a biological standpoint, the Bryant Ranch site on Johnson Creek is preferred.

A conceptual plan for a portable weir was presented to the owners of the Bryant Ranch at their annual board of directors meeting in early July 1994. The owners were enthusiastic supporters and directed Barry Bryant to work with IDFG in developing detailed plans and a contractual agreement for the operation of a weir and screw trap.

This proposal was discussed with the U.S. Forest Service District Ranger, Ron Julian, and he had no problems with the plans and indicated portable weirs could probably be used on National Forest lands as well.

Big Creek Weir Feasibility

Engineering and biological staff visited the potential sites on private land and determined that none of the sites were suitable for a steelhead weir. No further studies of upper Big Creek are anticipated or recommended.

Redd Counts

An aerial redd count survey of key trend areas in the Salmon River and Clearwater River drainages was taken in May 1994. Results of the survey are displayed in Table 10.

A comparison of weir counts to redd counts demonstrates the applicability of using helicopter redd counts to determine the number of steelhead spawning sites in areas where adult enumeration is not possible (Table 11). The difference in weir and redd counts for Marsh Creek is suspected to be from poor visibility due to turbid water during the helicopter survey or from spawning sites located outside the survey area.

Adult Escapement Juvenile Production Relationships

With the current management strategy relying on a minimum adult escapement at Bonneville and Lower Granite dams, it is important to compare the escapement objectives at the dams with redd counts and the resultant parr production in specific drainages.

The percentage of the group-A escapement goals are consistent with parr production goals indicating that current group-A escapement objectives may be sufficient to produce the desired parr numbers (Table 12).

There is a large deficit between dam counts and parr production for group-B steelhead, indicating that escapement objectives at Bonneville and Lower Granite dams are set too low to achieve the desired parr production goal which is 70% of capacity (Table 12).

Table 10. Steelhead redd count trends for recent years in selected study streams in Idaho.

Section	1987	1988	1989	1990	1991	1992	1993	1994
South Fork Salmon River								
Johnson Creek	12	23	NC	23	64	27	66	28
South Fork-Poverty				62	76	31	75	30
South Fork Darling Cabin				25	39	17	49	25
South Fork-Oxbow				37	31	26	34	11
South Fork-Krassel					38	8	23	5
Middle Fork Salmon River								
Bear Valley Creek		27		62	32	26	28	17
Marsh Creek			11	23	1	10	7	1
Sulphur Creek		17		14	6	5	18	2
Loon Creek			7	38	17	8	NC	3
Camas Creek	27			55	26	3	NC	12
Big Creek				44	25	NC	NC	3
South Fork Camas				6	1	4	3	0
Salmon River								
Valley Creek				8	6	26	9	4
Alturas				6	NC	3	NC	NC
Upper Salmon River								
-Pole to Busterback				6	0	0	0	NC
-Busterback to Alturas Lake Creek				1	0	0	12	NC
-Alturas Lake to Hell Roaring Bridge				16	2	17	3	NC
-Hell Roaring Bridge to weir				33	13	12	21	NC
-Weir to Redfish Lake				101	24	26	79	30
East Fork Salmon River								
-Germania to weir				9	3	0	NC	NC
-Weir to Herd Creek				NC	15	10	NC	NC
Chamberlain Creek				6	1	0	1	0
West Fork Chamberlain Creek				5	0	3	5	0
South Fork Clearwater River								
Crooked River								
-Mouth to Weir			NC	NC	1	2	NC	0
-Weir to Meanders			NC	NC	9	8	0	0
-Meanders			NC	NC	25	5	1	1
-Meanders to Canyon			NC	NC	6	1	0	0
-Canyon to Bridge				128	4	3	1	0
-Bridge to Orogrande				91	5	1	2	2
Lochsa River								
White Sand Creek			NC	10	7	20	NC	12
Storm Creek				11	0	3	NC	3
Crooked Fork				33	7	10	NC	8
Fish Creek				9	0	3	NC	5
Selway River								
Bear Creek				15	2	4	NC	6
East Fork Moose							NC	3

Table 11. Comparison of aerial steelhead redd counts to weir counts in four Idaho streams, May 1994.

Stream	Weir Counts: Male	Weir Counts: Female	Redd Count in Trend Area
West Fork Chamberlain	0	0	0
Chamberlain Creek	0	0	0
Marsh Creek	3	3	1
Crooked River	2	3	3

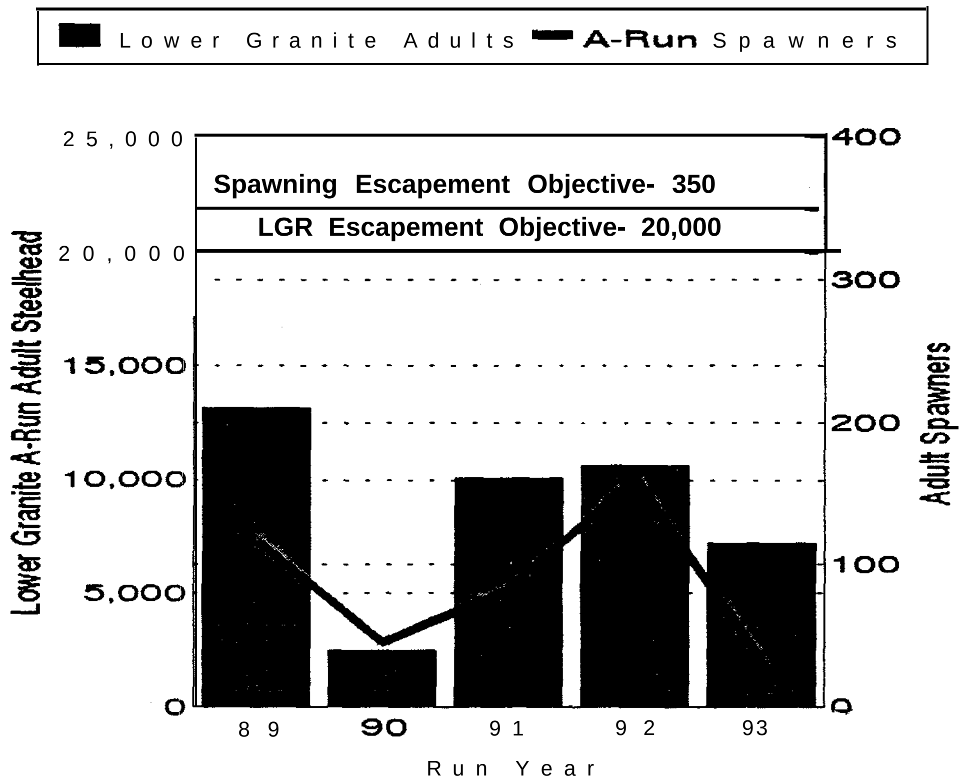
Table 12. Percent of adult wild steelhead escapement objectives and resultant parr production objectives achieved for group-A and group-B steelhead in Idaho, 1985-l992 [a].

Group A Objectives			Group B Objectives		
General Parr Monitoring					
Bonneville Dam Counts 1985-l 989	Lower Granite Dam Counts 1985-1989	Resultant Parr Production 1987-1991	Bonneville Dam Counts 1985-l 989	Lower Granite Dam Counts 1985-l 989	Resultant Parr Production 1987-1991
107%	84%	95%	144%	71%	17%
Intensive Parr Monitoring					
Bonneville Dam Counts 1990-l 992	Lower Granite Dam Counts 1990-l 992	Resultant Parr Production 1992-l 994	Bonneville Dam Counts 1990-l 992	Lower Granite Dam Counts 1990-1992	Resultant Parr Production 1992-l 994
60%	33%	46%	137%	32%	9%

[a] Rapid River data was used for group-A comparisons. Johnson, Sulphur, and Running creeks data were used for group-B comparisons.

Initially, steelhead parr production levels were documented by enumerating parr in representative monitoring sites that were few in number in each production stream with broad coverage of the major anadromous production streams. Each study stream had two to three sample sections designated to be snorkeled each year. This type of monitoring data collected in B-type channels, preferred by steelhead parr, was used during the period 1987-1991 to estimate seeding levels for group-A and group-B populations (Table 12). In 1992 an intensive parr monitoring (IPM) program began on representative key production streams to more precisely evaluate the seeding levels attained in representative Idaho steelhead production areas. New snorkel stations were added to each study stream and its tributaries to provide more complete coverage. Although the number of sample stations is low during the years of general parr monitoring (GPM), comparisons of IPM data with GPM data generally show the same abundance trends.

Comparison of group-B adult steelhead escapement objectives at Lower Granite Dam with resultant redd count objectives at specific study streams indicate that both objectives are set too low to obtain desired juvenile production (Figure 17). When looked at as a percentage of the objectives obtained, the Lower Granite Dam and resultant redd count objectives track together fairly well. However, even if both objectives were obtained, resultant juvenile production would probably still fall well below the current juvenile production objective. Current dam escapement objectives were selected based on limited production information. As the production database improves, it is becoming apparent that escapement goals at dams are set too low to achieve production goals.



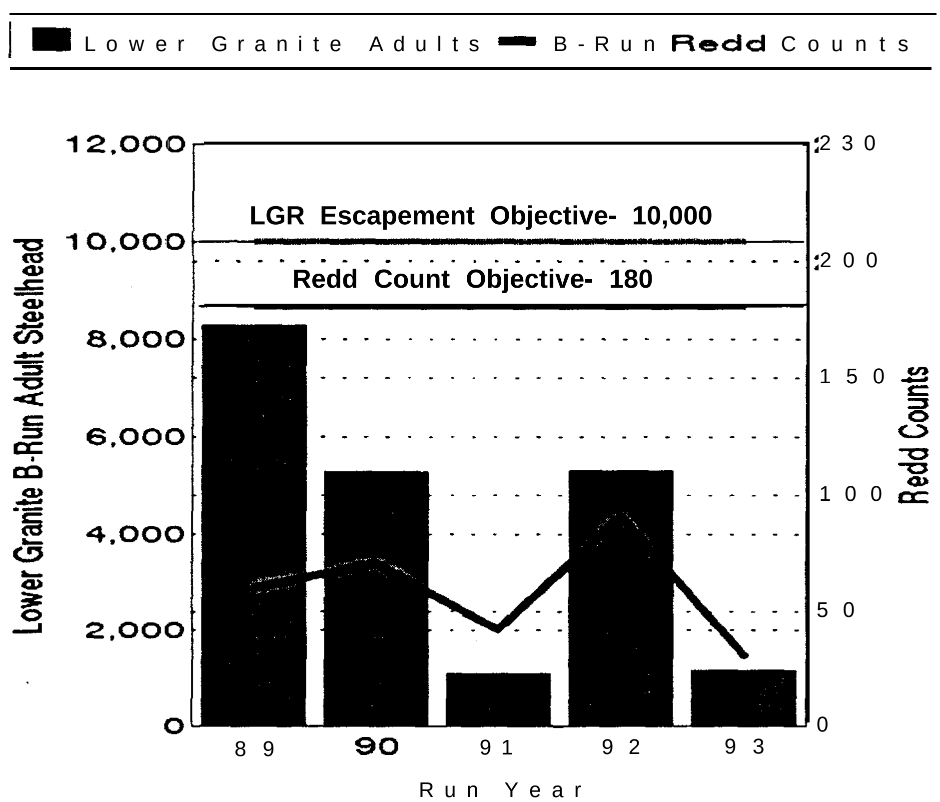


Figure 17. **Lower Granite Dam escapement:spawning escapement relationship for adult A-run and B-run steelhead. B-run data represents Johnson Creek, Marsh Creek and Sulphur Creek. A-run data represents Rapid River.**

RECOMMENDATIONS

Recently developed plans for recovery of endangered salmon runs and the threat of listing Snake River steelhead populations under the Endangered Species Act (ESA) bring focus to the need for monitoring responses of wild populations of salmon and steelhead to various recovery efforts. Wild populations that are located within wilderness areas where habitat quality is unquestioned will be especially important. It is recommended that adult escapement be monitored precisely with weirs or migration barriers and resultant juvenile production be monitored by downstream migrant traps and/or snorkeling in key representative production streams for the foreseeable future. The following streams are proposed for such studies:

Rapid River - group-A steelhead, Salmon River
Captain John Creek - group-A steelhead, Snake River
Rush Creek - group-A steelhead, Salmon River
Chamberlain Creek - unknown group, Salmon River
Running Creek - group-B steelhead, Clearwater River
Fish Creek - group-B steelhead, Clearwater River
Marsh Creek - group-B steelhead, Salmon River
Johnson Creek - group-B steelhead, Salmon River

Comparative escapement and resultant juvenile production data for Idaho streams should be presented to Columbia River Compact agencies to inform them of the inadequacy of Snake River and Columbia River group-B escapement objectives. There is a critical need to modify Columbia River Compact group-B wild steelhead escapement objectives. The escapement objective of 13,300 at Bonneville Dam and 10,000 at Lower Granite Dam results in extremely low seeding levels for Idaho's group-B steelhead production streams.

Efforts to refine and fully develop electronic/video fish counting systems that can pass adult salmon and steelhead above a weir without delay should continue. It is recommended that a more simple alternative electronic triggering system be developed that could replace the Smith-Root fish counting tunnel. Sequential interruption of two infrared light beams will be investigated as an alternative means to trigger video operation.

Low numbers of migrating fish and faulty operation (spurious counts) of the Smith-Root counting tunnel prevented an adequate test of the Fuhrman time-lapse video system. Preliminary indications were that the video system was capable of providing high quality visual images of upstream migrating salmon and steelhead that could be used to determine sex and estimate size of the fish.

The weirs functioned over a wide range of flows and generally were satisfactory. The spacing on the lower legs of the Chamberlain weirs was approximately 1/2 in wider than designed and could allow smaller adult salmon to pass between the pickets. It is recommended the picket spacing at the Chamberlain weirs be reduced by 1/2 in prior to installation in 1995. No washing occurred around the sill beams, but some movement of substrate did occur under the video apron.

ACKNOWLEDGMENTS

We would like to thank the Hornocker Wildlife Institute for their cooperation and the use of the facilities at the Taylor Ranch on Running Creek.

We would also like to thank Russ Kiefer for his helpful comments and edits on the annual report.

LITERATURE CITED

Petrosky, C.E., and T.B. Holubetz. 1987. Evaluation and monitoring of Idaho habitat enhancement and anadromous fish natural production. Project 83-7. Annual Report, fiscal year 1986, to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, Oregon.

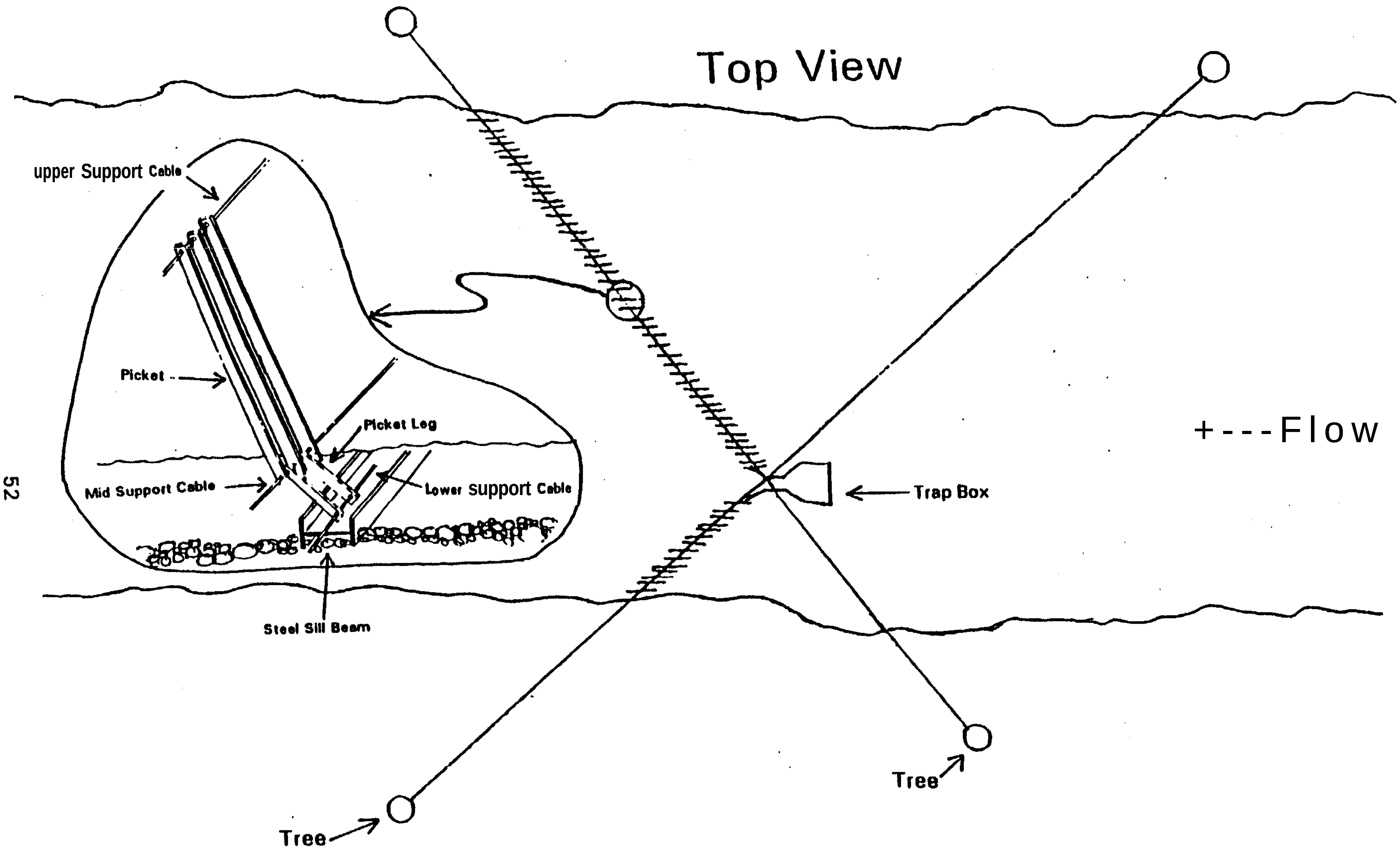
Rich, Bruce A., and Charles E. Petrosky. 1994. Idaho habitat and natural production monitoring: Part 1. Project 91-73. Annual Report, 1993, to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, Oregon.

Rich, B.A., W.C. Schrader, and C.E. Petrosky. 1993. Idaho habitat and natural production monitoring: Part 1. Project 91-73. Annual Report, 1992, to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, Oregon.

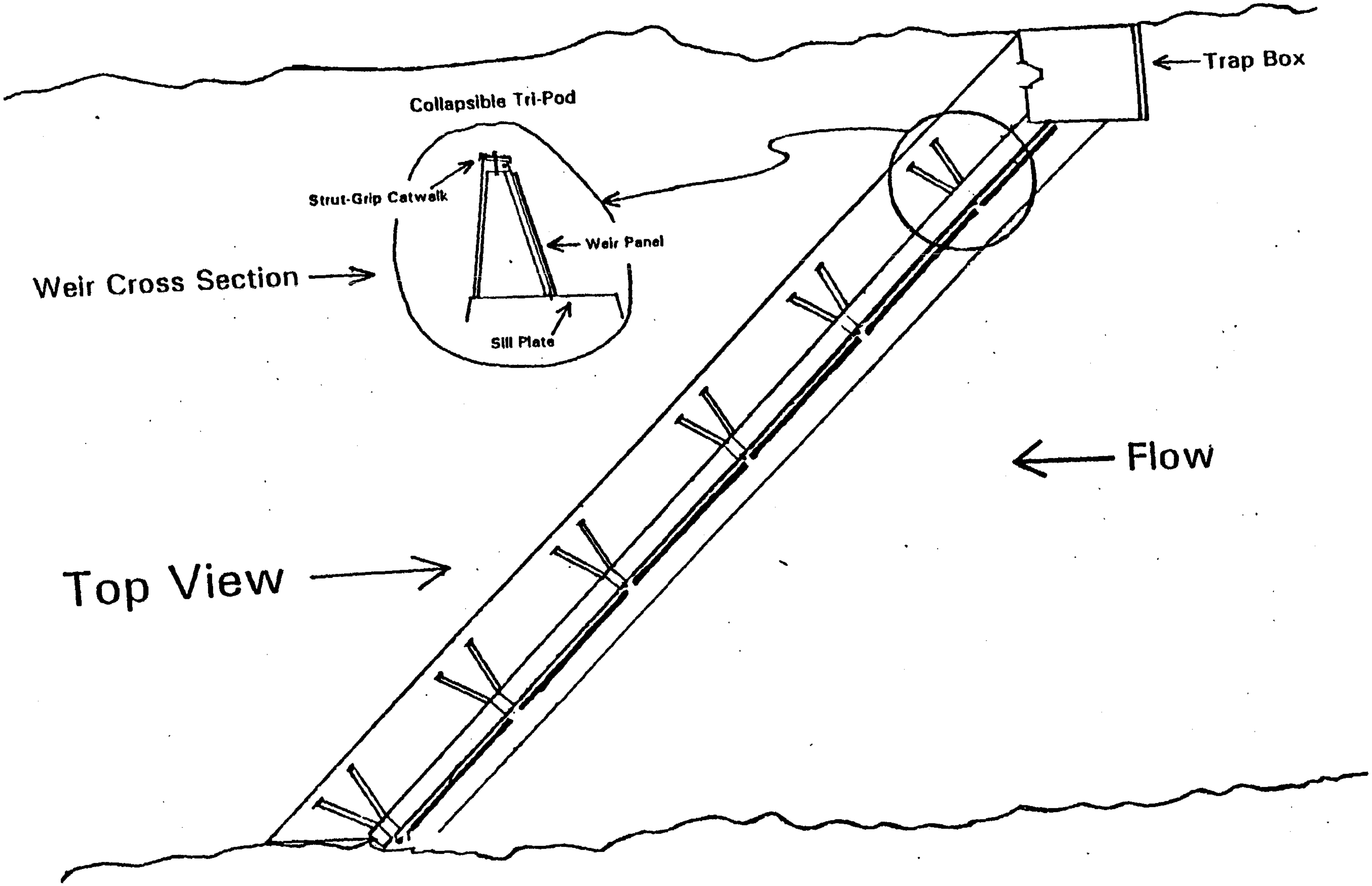
Rosgen, D.L. 1985. A stream classification system. North American Riparian Conference. Tucson, Arizona. April 16-18, 1985.

Schrader, W.C., and C.E. Petrosky. 1994. Idaho habitat and natural production monitoring, Part III, Wild Production Monitoring. Project 91-73. Annual Report, 1992, to the U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife. Portland, Oregon.

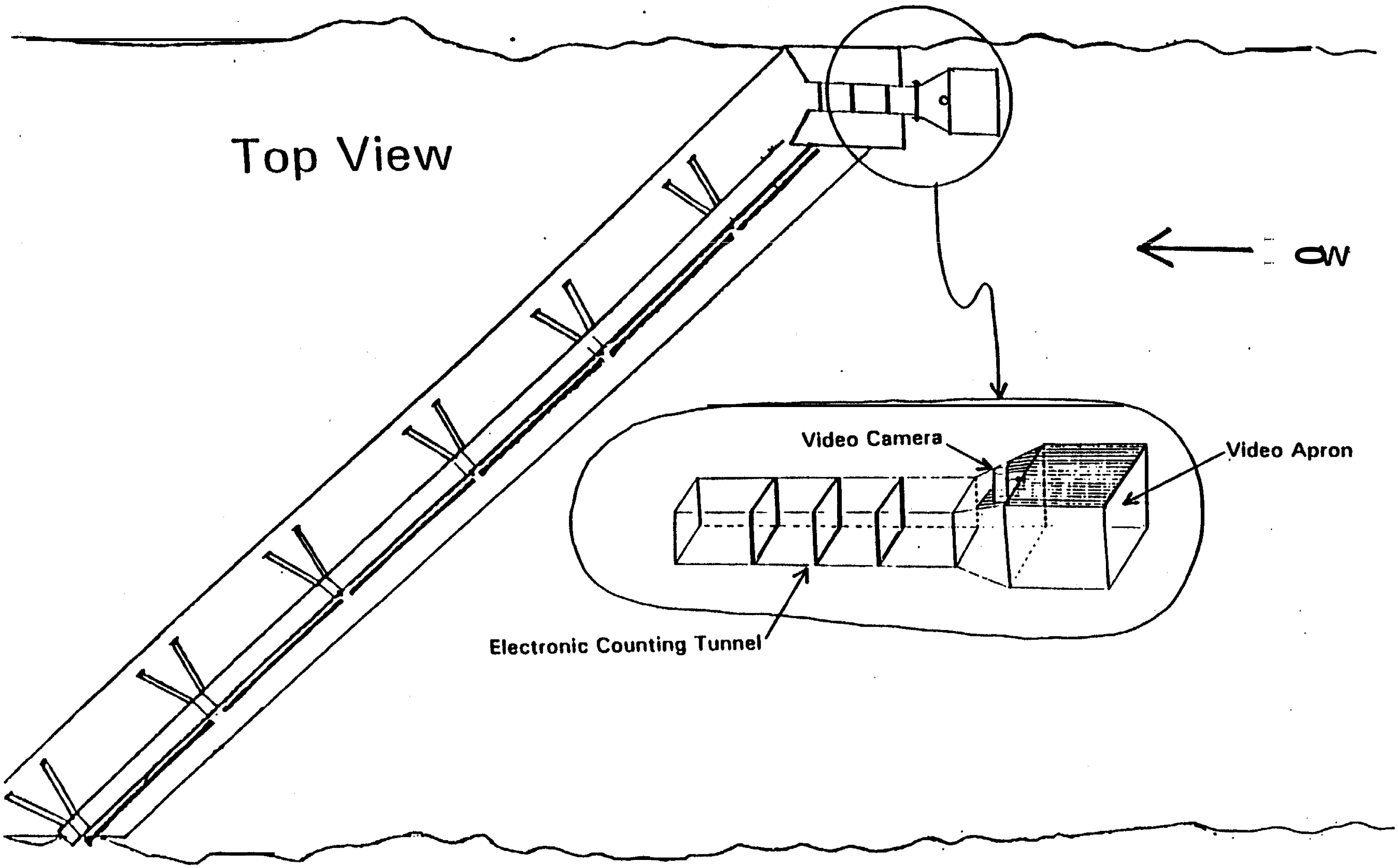
APPENDICES



Appendix Al. Schematics of temporary adult salmon and steelhead cable-suspended picket weir used in Chamberlain and West Fork Chamberlain creeks, Weir designed for minimum impact on fish and habitat. Drawing not to scale.



Appendix A2. Schematics of temporary adult salmon and steelhead weir in manual trapping mode for use in streams located in wilderness areas. Weir designed for minimum impact on fish and habitat. Drawing not to scale.



Appendix A3. Schematics of temporary adult salmon and steelhead weir in passive video monitoring mode for use in streams located in wilderness areas. Weir designed for minimum impact on fish and habitat. Drawing not to scale.

Submitted by:

Terry B. Holubetz
Fisheries Research Biologist

Brian D. Leth
Fisheries Technician

Approved by:

IDAHO DEPARTMENT OF FISH AND GAME

Steven M. Huffaker, Chief
Bureau of Fisheries

Allan R. Van Vooren
Fisheries Research Manager