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IDAHO HABITAT/NATURAL PRODUCTION MONITORING
PART III

ANNUAL REPORT 1993

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INTRODUCTION

Effective management of wild anadromous fisheries is partly dependent on defining relationships between escapement and production. These productivity relationships (or reproduction curves) may take one of several mathematical forms as described by Ricker (1975), depending on the nature of density-dependent mechanisms that control the population. Inherent in developing any relationship, however, is specifying the fish population of interest and what is meant by "escapement" and "production" by that population. This report summarizes Project 91-73 efforts and future direction to index adult-to-parr relationships for Idaho chinook salmon Oncorynchus tshawytscha and steelhead trout O. mykiss, and identifies related monitoring efforts that could be integrated into an indicator population monitoring program (NPPC 1992).

A long-term monitoring program is necessary to index escapement and production for indicator populations at any life stage of interest. The short-term focus of this project has been on development of adult-to-parr reproduction curves for the following reasons: 1) in Idaho, parr (especially steelhead) are monitored more readily and widely than other life stages such as adults or smolts; 2) parr densities show some promise as a means to partition escapements by drainage or production class; 3) improved definition of parr carrying capacity is needed to refine escapement objectives; and 4) egg-to-parr (or egg-to-smolt) survival currently better describes density dependence than adult-to-adult survival because of the large and variable density independent mortality effects occurring in the downstream migration corridor. As anadromous fish populations are restored and adult-to-parr curves are developed for Idaho populations, managers can refine harvest and escapement objectives to optimally utilize the production potential of spawning and rearing habitat.

Adult time series data developed for adult-to-parr relationships can ultimately be used to analyze adult recruitment by brood year and smolt migration year (Petrosky and Schaller 1992). Comparison of adult recruitment success by smolt migration year for indicator populations throughout the Columbia Basin will be invaluable in tracking future progress of the Fish and Wildlife Program to reduce hydrosystem mortalities.

In Idaho, various "classes" and "cells" have been defined for parr monitoring purposes (Rich et al. 1993; Rich et al. 1992; Scully and Petrosky 1991; Scully et al. 1990; Petrosky and Holubetz 1985-88). The eight "classes" are: wild and natural spring and summer chinook salmon, and wild and natural A-run and B-run summer steelhead trout. "Wild/natural" designations are based on supplementation histories, whereas "spring/summer" and "A-run/B-run" designations are based on time of arrival at Bonneville Dam. We use these same "classes" in this report.

The "cells" refer to the various drainages in which these classes are distributed. These designations will, in the future, correspond to drainages identified in the Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Idaho fisheries managers desire to see reproduction curves developed that represent these eight classes. Our goal is to develop some of these curves, particularly for wild populations, and to summarize curve development by other projects. In the future, we will also ascertain how variable these relationships are between classes and cells, and to determine what is needed for ongoing development. These goals are consistent with Objective 3 of our Annual Work Statement: to document status and trends ofclasses of wild and natural chinook salmon and steelhead trout populations.

Reproduction curves, as defined here, have not been developed for Idaho populations except the Lemhi River spring chinook (Bjornn 1978). However, several research and management projects are working towards this objective (Kiefer and Apperson 1988; Kiefer and Forster 1990-92; Kiefer and Lockhart 1993; Bowles and Leitzinger 1991; Byrne, in press). Work is also progressing to incorporate escapement and production data from these projects into the Coordinated Information System (CIS).

Field work and planning began-in 1990 and continued through 1992 to develop some of these curves. Rich et al. (1993) identified and recommended appropriate populations, drainages, and specific locations to build fish weirs to monitor escapements (Task 3.5, Objective 3 of Annual Work Statement). Intensive parr sampling above most of the recommended weir locations began in 1991 (Rich et al. 1993), and we report results of our 1992 sampling. We also summarize three brood years of data for Rapid River wild A-run steelhead trout.

Although using weir counts to correlate with parr densities is a different and more intense approach than using redd counts (Task 3.3 and 3.4, Objective 3 of Annual Work Statement), we anticipate both methods will be needed in the future to help defineIdaho escapement/production relationships. In this report, “escapement” will mean enumeration at a weir rather than redd counts unless otherwise noted.

METHODS

Summary of Idaho Anadromous Fish Weirs

We summarized sampling programs at all existing and proposed anadromous fish weirs in Idaho as of fall 1992. We included only permanent or semi-permanent structures where long-term data could be collected, and we excluded the sockeye salmon O. nerka weir below Redfish Lake. We stratified the summary two ways: 1) by class (wild/natural spring/summer chinook salmon and A-run/B-run steelhead trout); and 2) by cell or drainage. We used the same class and drainage classifications as the Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992) and the Integrated System Plan for Salmon and Steelhead Trout Production in the Columbia River Basin (CBFWA 1991). Classification as "wild" or "natural" is consistent with those in IDFG (1992).

Our summary is based on these comprehensive plans as well as research plans for chinook salmon and steelhead trout supplementation (Bowles and Leitzinger 1991; Byrne, in press), intensive smolt monitoring (Kiefer and Lockhart 1993), and general parr monitoring (Rich et al. 1993). We also used information obtained by personal communication with IDFG and other agency and tribe personnel.

Included in the summary are escapement objectives above the existing and proposed weirs. These objectives are based on interim smolt production goals that would optimally utilize the production potential (70% of smolt carrying capacity as defined in IDFG 1992). Needed escapements were back calculated from smolt production goals using: 1) assumed egg-to-smolt survival rates of 1.5% for steelhead trout and 6.0% for chinook salmon; and 2) calculated fecundities and sex ratios for appropriate drainages from the Idaho five-year plan (IDFG 1992). Needed escapements assume no prespawn mortality and that all females spawn completely. Smolt carrying capacity above existing weirs was taken directly from the Idaho five year plan (IDFG 1992); smolt capacity above proposed weirs was estimated using the Northwest Power Planning Council's (NPPC) Presence/Absence Database. Bowles and Leitzinger (1991) have also estimated chinook salmon smolt capacities above some of these weirs using the same database.

Our recommendations are based on this summary. Our criteria were to provide coverage for all classes and most major drainages, yet minimize cost and duplication of efforts. This was a useful approach as we identified some chinook salmon weirs that could be modified to monitor steelhead trout.

Parr Density Above Weirs

Chinook salmon and steelhead trout parr densities were sampled above all existing or proposed weirs during mid-summer (generally, July 1 to August 15) 1992. Sampling was conducted by a variety of agency and tribe research and management projects (Table 1): 1) Idaho Supplementation Studies (ISS) (which includes studies conducted by IDFG, Nez Perce Tribe [NPT], Shoshone-Bannock

Tribes [SBT], Idaho Fisheries Research Office [IFRO], and Idaho Cooperative Fish and Wildlife Research Unit [ICFWRU]); 2) Nez Perce Tribal Hatchery (NPTH); 3) Salmon River Habitat Evaluation (SRHE) conducted by SBT; and 4) IDFG's Idaho Habitat/Natural Production Monitoring project (which includes Intensive Smolt Monitoring [ISM], General Parr Monitoring [GPM], and Wild Production Monitoring [WPM] subprojects).

Streams were sampled using standard techniques developed by GPM (Petrosky and Holubetz 1985; 1986) and outlined in Appendix E of the ISS Experimental Design (Bowles and Leitzinger1991). Streams were systematically sampled by habitat complexes (containing at least one pool-riffle sequence). Fish populations were sampled by snorkeling in all streams except the Lemhi River, where electrofishing was used. Physical habitat variables that were measured include length, width, depth, surface substrate composition, gradient, and water temperature, conductivity, and visibility (Rich et al. 1993).

Escapement Above Weirs

General

Brood year (BY) 1991 wild and natural escapements to all existing weirs in Idaho (Table 2) are currently being summarized in annual IDFG and U.S. Fish and Wildlife Service (USFWS) hatchery run reports. The recently renovated Marsh Creek and Lemhi River weirs will begin operating in 1993, and results will be reported in 1994 by ISS. In addition, Kiefer and Lockhart (in press) report BY 91 steelhead trout escapements to the Crooked River weir. For this report, we summarize wild A-run steelhead trout escapements to the Rapid River weir during 1989-91. Escapement information from various sources will be assimilated into the CIS beginning in 1993.

Rapid River Wild A-Run Steelhead Trout (BY 89-91)

The Rapid River weir is located in the Little Salmon River drainage, and operated by the IDFG hatchery program, under funding from Idaho Power Company. Because it is a velocity barrier, all fish migrating up Rapid River are trapped. The weir traps hatchery spring chinook salmon for the Rapid River hatchery as well as wild summer chinook salmon and wild A-run steelhead trout. Adults from the latter two populations are counted, measured, sexed, and hauled to release above the weir. Scales were collected in 1990 and 1991 but have not been analyzed; they were not collected in 1989. Hatchery steelhead trout strays were hauled back to the Little Salmon River and released.

Table 1. Agency and tribal projects that intensively sampled chinook salmon and steethead trout parr densities in mid-summer 1992. Streams are where the 21 existing or proposed weirs are located (see Table 2).

IDFG				NPT		SBT		IFRO	ICFWRU
ISS	ISM	GPM	WPM	ISS	NPTH	ISS	SRHE	ISS	ISS
Pahsimeroi River	Upper Salmon River	Red River	Rapid River	None	Lolo Creek	South Fork Salmon River	East Fork Salmon River	Clear Creek	Lemhi River
Marsh Creek	Crooked River		Chamberlain Creek		Newsome Creek				
Johnson Creek			West Fork Chamberlain Creek		Slate Creek				
Lochsa River			Rush Creek						
North Fork Salmon River			Running Creek						
Sulphur Creek									

IDFG =Idaho Department of Fish and Game; NPT = Nez Perce Tribe; SBT = Shoshone-Bannock Tribes; IFRO = Idaho Fisheries Research Office; ICFWRU = Idaho Cooperative Fish and Wildlife Research Unit; ISS = Idaho Supplementation Studies; ISM = Intensive Smolt Monitoring; GPM = General Parr Monitoring; WPM = Wild Production Monitoring; NPTH Nez Perce Tribal Hatchery; SRHE = Salmon River Habitat Evaluation.

Table 2. Agency and tribal projects that operate existing weirs or will operate proposed weirs in Idaho as of fall 1992. Only the 21 permanent or semi-permanent anadromous fish weirs are included.

IDFG					NPT			SBT	USFWS
ISS	ISM	WPM	Hatchery	ISS	NPTH	ISS	SRHE	ISS	Hatchery
			Existing						
Marsh Creek Lemhi River[c]	Crooked River[a]	None	Pahsimeroi River Upper Salmon River Crooked River[a] Red River[b] Rapid River South Fork Salmon River[b] East Fork Salmon River	None	None	None	None	None	Clear Creek
			Proposed						
Johnson Creek North Fork Salmon River	None	Sulphur Creek Chamnberlain Creek West Fork Chamberlain Creek Rush Creek Running Creek	Lochsa River[b]	None	Lolo Creek[b] Newsome Creek[b] Slate Creek[b]	None	None	None	None

IDFG = Idaho Department of Fish and Game' NPT = Nez Perce Tribe; SBT = Shoshone-Bannock Tribes; USFWS = U.S. Fish and Wildlife Service; ICFWRU = Idaho Cooperative Fish and Wildlife Research Unit; ISS = Idaho Supplementation Studies; ISM = Intensive Smolt Monitoring; WPM = Wild Production Monitoring; NPTH = Nez Perce Tribal Hatchery; SRHE = Salmon River Habitat Evaluation.

[a] IDFG/ISM trap steelhead trout at Crooked River; IDFG/Hatchery trap chinook salmon.
[b] Weir currently designed or operated to trap chinook salmon only; no current plans to trap steelhead trout.
[c] Operated by Idaho Coop. Fish and Wildlife Unit in 1993 only.

Reproduction Curves

General -

Developing reproduction curves for the eight classes of Idaho chinook salmon and steelhead trout will be addressed in the future as long-term information is collected; we present three years of data for Rapid River wild A-run steelhead trout in this report. In the future, the information will be assimilated through CIS and the indicator population monitoring program (NPPC 1992).

Rapid River Wild A-Run Steelhead Trout

We plotted brood year escapement indices and subsequent age 1 parr densities above the weir for Rapid River wild A-run steelhead trout. We used BY 89-91 escapement information (Rapid River Fish Hatchery, in press), assumed adult length-at-age data (K. Ball, IDFG memo of 3/18/91), and assumed fecundity data from subbasin planning files (S. Kiefer, IDFG, personal communication) to estimate total egg deposition. Fecundity data are based on Pahsimeroi Fish Hatchery A-run steelhead trout, a transplanted Snake River population, for one-ocean (4,344 eggs) and two-ocean females (6,313 eggs). One-ocean males are considered 67 cm fork length(FL) and less; one-ocean females are 65 cm FL and less. Egg deposition estimates assume no prespawn mortality and that all females spawned completely.

We began intensive parr sampling to estimate abundance and mean densities in the drainage above the weir in 1990 and continued in 1991 (Rich et al. 1993) and 1992 (see above).

From a management perspective, we believe the most useful form of the reproduction curve would relate eggs to parr on a density basis; this is necessary so the curve can be applied to other drainages that have a different production area but similar habitats. Egg density in Rapid River was calculated using our best estimate of total production area above the weir. Most of the known distribution of parr (Mike Radko, U.S. Forest Service [USFS], unpublished data) is included in this area: the mainstem to Paradise Creek and a small portion of the West Fork Rapid River below the falls. The area estimate is based on digitized map measurements of length found in the NPPC Presence/Absence Database and on average stream widths measured in 1992.

Egg-to-Parr Survival Rates

We used the above parr density and escapement information for Rapid River to estimate egg-to-age 1 and age 1-to-age 2 survival rates for wild A-run steelhead trout. Egg-to-age 1 survival was calculated using BY 89-91 egg density and subsequent 1990-92 age 1 average density estimates. Age 1-to-age 2 survival was calculated using 1990-91 age 1 densities and subsequent 1991-92 age 2 densities. We anticipate future work in the drainage may refine our estimate of total production area, egg densities, and resulting egg-to-age 1 survival rates.

Data Management and Analysis

We used Lotus 1-2-3 spreadsheets to manage our parr density data and Rapid River escapement data. Survival calculations and statistical analyses were made within the spreadsheets; statistical procedures follow Zar (1984). Parr density data will eventually be entered into the GPM database (using DBASE II PLUS) and will be incorporated into the region-wide Coordinated Information System (CIS). Databases for escapement information are being developed through CIS.

RESULTS AND DISCUSSION

Summary of Idaho Anadromous Fish Weirs

Existing and Proposed Weirs

As of fall 1992, we identified 21 existing and proposed weirs that will be operated by a variety of agencies and tribes (Table 2, Figures 1 and 2). Weirs in Idaho are used, or will be used, to obtain hatchery broodstock or to monitor wild/natural escapement. Currently, the IDFG and USFWS hatchery programs operate eight of 10 existing weirs, except that the Crooked River weir is also operated by ISM for steelhead trout. The remaining two existing weirs (Marsh Creek and Lemhi River) were recently renovated and will be operated by ISS to monitor escapements beginning in spring 1993 (Eric Leitzinger, IDFG, and Chris Peery, ICFWRU, personal communication). Eleven additional weirs have been proposed: two by IDFG/ISS, five by this subproject (IDFG/WPM), one by IDFG hatcheries, and three by NPTH.

Although eight of the existing weirs are operated to obtain hatchery broodstock, a portion of the chinook salmon run and all wild/natural steelhead trout are passed to spawn naturally. Hatchery chinook salmon smolts released at hatchery weirs were marked beginning in spring 1992 and plans are to pass all unmarked wild/natural adults in the future (IDFG 1002). All hatchery steelhead trout smolts are also marked. Hence, hatchery weirs will provide much of the necessary escapement information to develop reproduction curves for natural populations in the future.

Of the 10 existing weirs that trap adult chinook salmon, eight also trap returning steelhead trout (Table 3); steelhead trout are not trapped at the South Fork Salmon River and Red River weirs due to high water and access problems in the spring. Of these eight, only four have provided complete and consistent counts of steelhead trout in the past: Pahsimeroi River, Lemhi River, Rapid River, and East Fork Salmon River. The former two are located in unique, spring-fed drainages that have large irrigation withdrawals; the latter two are velocity densities. **We anticipate** future work in the **drainage** may refine our **estimate** of total production **area**, egg densities, and resulting egg-to-age 1 **survival** rates.

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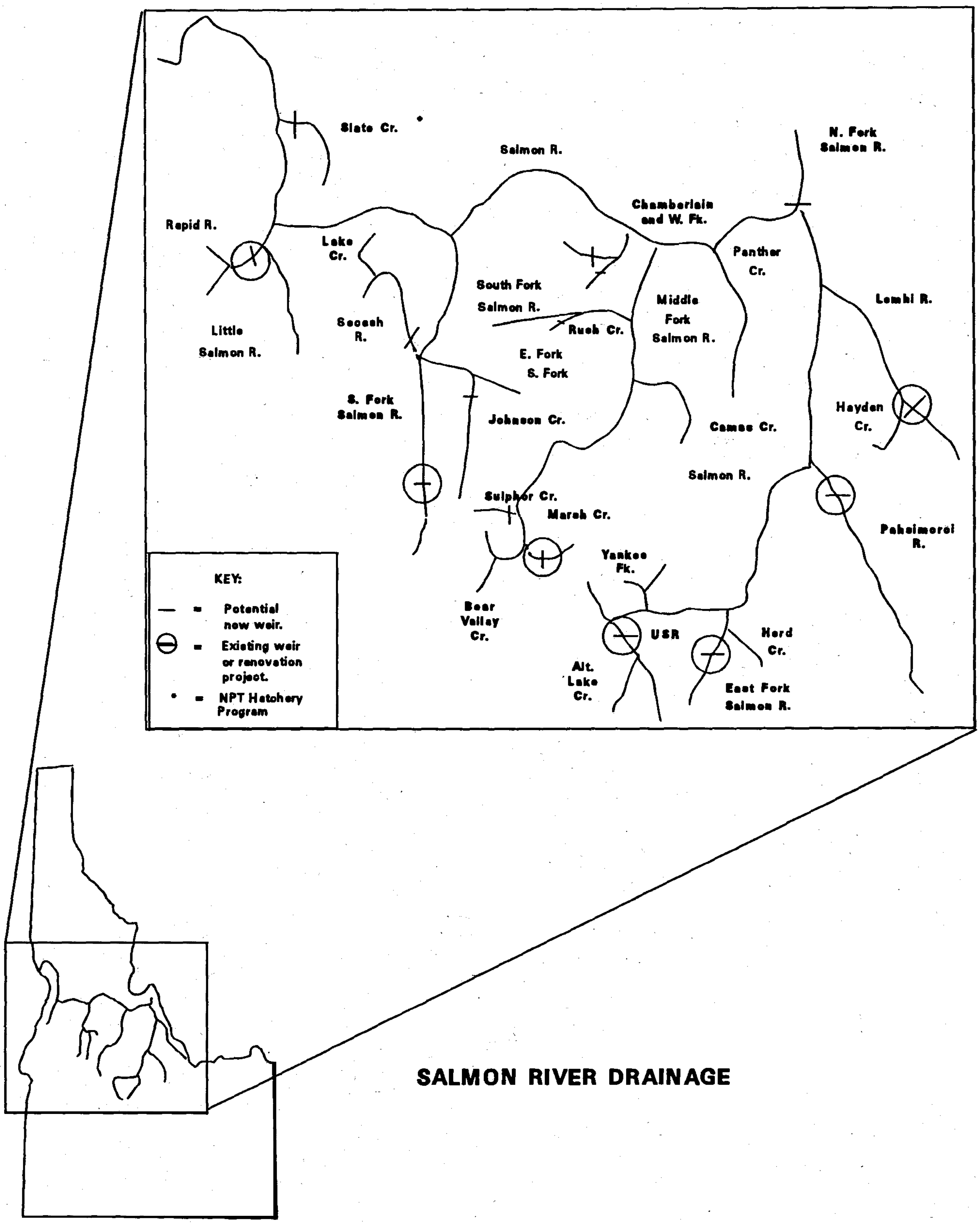

Figure 1. Existing and proposed anadromous fish weirs in the Salmon River drainage, Idaho, as of fall 1992.

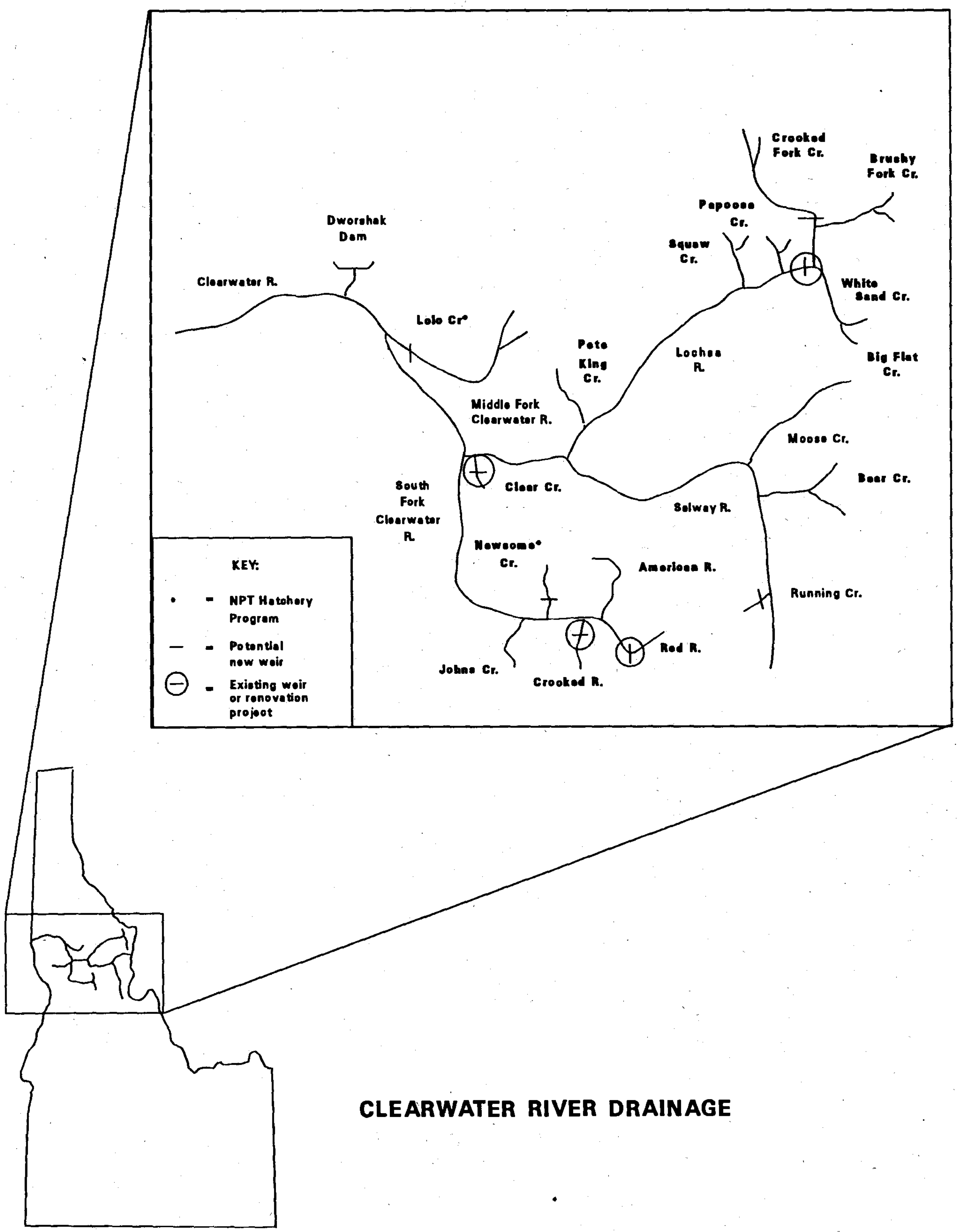

Figure 2. Existing and proposed anadromous fish weirs in the Clearwater River drainage, Idaho, as of fall 1992.

barriers that can trap during high spring runoff. Of the remaining four that trap steelhead trout, weir panels are generally pulled during peak runoff (2 to 3 weeks) at the Upper Salmon River (Sawtooth) and Crooked River weirs (Tom Rogers, IDFG, personal communication). We are unsure if steelhead trout can be effectively trapped at the recently renovated Marsh Creek or Clear Creek (Kooskia) weirs.

Notably lacking in our summary are existing weirs that trap wild chinook salmon or wild steelhead trout (Tables 3 to 8). Only one weir currently traps these wild populations in Idaho: Rapid River in the Little Salmon River drainage. It is a velocity barrier that traps hatchery spring chinook salmon, wild summer chinook salmon, and wild A-run steelhead trout. Adults from the latter two groups are counted, measured, sexed, and released above the weir.

The Marsh Creek weir in the headwaters of the Middle Fork Salmon River was recently renovated to trap wild spring chinook salmon for chinook supplementation research. Modification of the adult trap will be necessary to effectively trap wild B-run steelhead trout here. Also, the weir is high in the drainage and most steelhead trout rearing habitat is below the weir. Chinook salmon and steelhead trout adults will be trapped here beginning in spring 1993 (Eric Leitzinger, IDFG, personal communication).

In conclusion, the lack of wild escapement information at existing Idaho weirs is due to the primary function of most of these weirs: to collect hatchery broodstock and supplement naturally reproducing populations of chinook salmon and steelhead trout. By definition, these classes become "natural" rather than "wild" (IDFG 1992). Exceptions are the Rapid River and recently renovated Marsh Creek weirs.

An additional eleven chinook salmon weirs have been proposed, seven of which would also attempt to trap returning steelhead trout (Tables 2 and 3); there are no plans to trap steelhead trout at the three NPTH weirs (Lolo, Newsome, and Slate creeks) or the IDFG/Hatchery weir at Powell (Lochsa River). Of the seven that would trap steelhead trout, two (North Fork Salmon River and Johnson Creek) are proposed by ISS primarily for chinook salmon supplementation research; current plans are to also trap steelhead trout if possible (Eric Leitzinger, IDFG, personal communication). This project proposes the remaining five weirs to trap both chinook salmon and steelhead trout.

Recommendations

1. To provide additional wild chinook salmon and wild steelhead trout escapement information for developing reproduction curves, we are proposing five weirs be built by this project at the following locations:
    a. Running Creek at the Running Creek Ranch. Running Creek is located in the upper Selway River drainage in the Clearwater River subbasin. The weir would trap natural spring chinook salmon and wild B-run steelhead trout. It would be located near the mouth of Running Creek on property owned by the Wildlife Research Institute. We have a verbal agreement

Table 3. Number of existing and proposed permanent weirs by species and class in Idaho as of fall 1992. Chinook salmon and steelhead trout classes represent those identified in the Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992). All weirs that trap steelhead trout also trap chinook salmon.

Species and class	Number existing	Number proposed	Total
Chinook Salmon			
Wild Spring	1	4	5
Natural Spring	6	6	12
Wild Summer	1	1	2
Natural Summer	2	0	2
Total	10	11	21
<u>Steelhead Trout</u>			
Wild A-Run	1	2	3
Natural A-Run	3	1	4
Wild B-Run	1′	4	5
Natural B-Run	3	0 .	3
Total			15

Table 4. Existing and proposed permanent weirs for spring chinook salmon in Idaho as of fall 1992. Potential smolt capacity is for drainage above weir. Adult escapements assume no prespawn mortality and all females spawn completely.

Sub-basin	Drainage	Sub-drainage	Weir type[b]	Weir operator	NPPC smolt capacity (thousand)'	IDFG smolt capacity (thousand)'	70% IDFG smolt capacity (thousand)'	Eggs needed (thousand)[d]	Fecundity'	Escapement Goat' Females	Total
					Spring Chinook Salmon. Wild						
Salmon	Salmon Canyon	Chamberlain Creek	Proposed	IDFG-WPM	111.7	67.0	46.9	781.6	6,404	123	238
Salmon	Salmon Canyon	West Fork Chamberlain Creek	Proposed	IDFG-WPM	31.3	18.8	13.1	218.8	6,404	35	
Salmon	Middle Fork	Rush Creek	Proposed	IDFG-WPM	39.1	23.5	16.4	273.8	6,121	45	82
Salmon	Middle Fork	Sulphur Creek	Proposed	IDFG-WPM	145.5	87.3	61.1	1,018.8	6,121	167	304
Salmon	Middle Fork	Marsh Creek	Permanent picket	IDFG-ISS	106.6	63.9	44.8	745.9	6,121	122	222
					Spring Chinook Salmon. Natural						
Salmon	Lower	Slate Creek	Proposed	NPT-Hatchery	151.2	90.7	63.5	1,058.4	3,832	277	549
Salmon	Upper	North Fork	Proposed	IDFG-ISS	175.2	105.1	73.6	1,226.2	5,531	222	533
Salmon	Lemhi River	Headwaters	Permanent picket	IDFG-ISS	353.8	212.3	148.6	2,476.8	4,805	516	1,043
Salmon	East Fork	Headwaters	Velocity barrier	IDFG-Hatchery	312.1	187.3	131.1	2,184.7	5,531	395	952
Salmon	Upper	Headwaters (Sawtooth)	Permanent panel	IDFG-Hatchery	713.0	427.8	299.4	4,990.8	5,527	903	2,174
Clearwater	Lower	Lolo Creek	Proposed	NPT-Hatchery	332.2	199.3	139.5	2,325.3	3,829	608	1,204
Clearwater	South Fork	Newsome Creek	Proposed	NPT-Hatchery	116.6	70.0	49.0	816.2	3,833	213	422
Clearwater	South Fork	Crooked River	Permanent panel	IDFG-Hatchery	85.5	51.3	35.9	598.5	3,837	156	310

TABLES

Table 4. (continued)

Sub-basin	Drainage	Sub-drainage	Weir type	Weir operator	NPPC smolt capacity (thousand)[a]	IDFG smolt capacity (thousand)[b]	70% IDFG smolt capacity (thousand)[c]	Eggs needed (thousand)[d]	Fecundity[e]	Escapement Goal[f] Females	Escapement Goal[f] Total
Clearwater	South Fork	Red River	Permanent panel	IDFG-Hatchery	90.6	54.3	38.0	634.0	3,842	165	328
Clearwater	Middle Fork	Clear Creek (Kooskia)	Floating	USFWS-Hatchery	44.0	26.4	18.5	307.7	3,620	85	137
Clearwater	Lochsa River	Headwaters (Powell)	Proposed	IDFG-Hatchery	526.0	315.6	220.9	3,682.0	3,831	961	1,906
Clearwater	Selway River	Running Creek	Proposed	IDFG-WPM	171.1	102.6	71.8	1,197.5	3,832	313	620

a From Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992), for existing weirs, or NPPC Presence/Absence Database for proposed weirs. All estimates are based on information generated through development of subbasin plans and the Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin (CBFWA 1991).

b NPPC smolt capacity x 1.0 for steelhead trout, x 0.6 for spring and summer chinook salmon.

c Interim smolt production goal based on maximizing harvest.

d Assured egg-smolt survival = 1.5% for steelhead trout, 6.0% for 23hinook salmon.

e Fecundities calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

f Sex ratios calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Table 5. Existing and proposed permanent weirs for summer chinook salmon in Idaho as of fall 1992. Potential smolt capacity is for drainage above weir. Adult escapements assume no prespawn mortality and all females spawn completely.

Sub-basin	Drainage	Sub-drainage	Weir type	Weir operator	NPPC smolt capacity (thousand)'	IDFG smolt capacity (thousand)'	70% IDFG smolt capacity (thousand)'	Eggs needed (thousand)[d]	Fecundity'	Escapement Goal' Females	Total
Summer Chinook Salmon. Wild											
Salmon	Little Salmon	Rapid River	Velocity barrier	IDFG-Hatchery	100.1	60.1	42.0	700.7	4,969	141	406
Salmon	South Fork	Johnson Creek	Proposed	ISS IDFG-	345.5	207.3	145.1	2,418.5	3,564	679	1,202
Summer Chinook Salmon. Natural											
Salmon	South Fork	Headwaters	Temporary picket	IDFG-Hatchery	157.0	94.2	66.0	1,099.3	3,676	299	691
Salmon	Pahsimeroi River	Headwaters	Permanent picket	IDFG-Hatchery	257.6	154.6	108.2	1,803.3	4,982	362	1,046

▪ From Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992), for existing weirs, or NPPC Presence/Absence Database for proposed weirs. All estimates are based on information generated through development of subbasin plans and the Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin (CBFWA 1991).

• NPPC smolt capacity x 1.0 for steelhead trout, x 0.6 for spring and summer chinook salmon.

• Interim smolt production goal based on maximizing harvest.

• Assumed egg-smolt survival = 1.5% for steelhead trout, 6.0% for chinook salmon.

▪ Fecundities calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Sex ratios calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Table 6. Existing and proposed permanent weirs for A-run steelhead trout in Idaho as of fall 1992. Potential smolt capacity is for drainage above weir. Adult escapements assume no prespawn mortality and all females spawn completely.

Sub-basin	Drainage	Sub-drainage	Weir type	Weir operator	NPPC smolt capacity (thousand)[a]	IDFG smolt capacity (thousand)	70% IDFG smolt capacity (thousand)[c]	Eggs needed (thousand)[d]	Fecundity[e]	Escapement Goal Females	Escapement Goal Total
				Steelhead Trout. Wild A-Run							
Salmon	Little Salmon	Rapid River	Velocity barrier	IDFG-Hatchery	22.5	22.5	15.8	1,051.6	5,155	204	357
Salmon	Salmon Canyon	Chamberlain Creek	Proposed	IDFG-WPM	12.3	12.3	8.6	575.1	5,143	112	197
Salmon	Salmon Canyon	West Fork Chamberlain Creek	Proposed	IDFG-WPM	6.8	6.8	4.7	315.7	5,143	62	109
Steelhead Trout. Natural A-Run											
Salmon	Upper	North Fork	Proposed	IDFG-ISS	32.7	32.7	22.9	1,526.1	5,161	296	518
Salmon	Lemhi River	Headwaters	Permanent picket	IDFG-ISS	41.2	41.2	28.8	1,922.9	5,163	373	653
Salmon	Pahsimeroi River	Headwaters	Permanent panel	IDFG-Hatchery	29.9	29.9	20.9	1,396.6	5,153	271	474
Salmon	Upper	Headwaters (Sawtooth)	Permanent panel	IDFG-Hatchery	81.1	81.1	56.7	3,782.7	5,161	733	1,284

[a] From Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992), for existing weirs, or NPPC Presence/Absence Database for proposed weirs. All estimates are based on information generated through development of subbasin plans and the Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin (CBFWA 1991).

[b] NPPC smolt capacity x 1.0 for steelhead trout, x 0.6 for spring and summer chinook salmon.

[c] Interim smolt production goal based on maximizing harvest.

[d] Assumed egg-smolt survival = 1.5% for steelhead trout, 6.0% for chinook salmon.

[e] Fecundities calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

[f] Sex ratios calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Table 7. Existing and proposed permanent weirs for B-run steelhead trout in Idaho as of fall 1992. Potential smolt capacity is for drainage above weir. Adult escapements assume no prespawn mortality and all females spawn completely.

Sub-basin	Drainage	Sub-drainage	Weir type	Weir operator	NPPC smolt capacity (thousand)'	IDFG smolt capacity (thousand)°	70% IDFG smolt capacity (thousand)'	Eggs needed (thousand)°	Fecundity'	Escapement Goal' Females	Escapement Goal' Total
Steelhead Trout. Wild B-Run											
Salmon	South Fork	Johnson Creek	Proposed	IDFG-ISS	61.1	61.1	42.8	2,850.8	6,474 '	441	697
Salmon	Middle Fork	Rush Creek	Proposed	IDFG-WPM	12.1	12.1	8.5	566.4	6,545	87	113
Salmon	Middle Fork	Sulphur Creek	Proposed	IDFG-WPM	22.4	22.4	15.7	1,044.1	6,545	160	207
Salmon	Middle Fork	Marsh Creek°	Permanent picket	IDFG-ISS	9.6	9.6	6.7	447.3	6,545	69	89
Clearwater River	Selway	Running Creek	Proposed	IDFG-WPM	32.0	32.0	22.4	1,495.0	6,763	222	333
Steelhead Trout. Natural B-Run											
Salmon	East Fork	Headwaters	Velocity barrier	IDFG-Hatchery	42.4	42.4	29.7	1,978.8	5,719	346	547
Clearwater	South Fork	Crooked River	Permanent panel	IDFG-ISM	22.2	22.2	15.5	1,034.3	6,760	153	229
Clearwater	Middle Fork	Clear Creek (Kooskia)	Floating	USFWS-Hatchery	14.4	14.4	10.1	672.0	6,788	99	149

■ From Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992), for existing weirs, or NPPC Presence/Absence Database for proposed weirs. All estimates are based on information generated through development of subbasin plans and the Integrated System Plan for Salmon and Steelhead Production in the Columbia River Basin (CBFWA 1991).

- NPPC smolt capacity x 1.0 for steelhead trout, x 0.6 for spring and summer chinook salmon.
- Interim smolt production goal based on maximizing harvest.
- Assumed egg-smolt survival = 1.5% for steelhead trout, 6.0% for chinook salmon.

Fecundities calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Sex ratios calculated for appropriate weir or drainage from Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

9 Unsure if can effectively trap steelhead trout.

Table 8. Number of existing and proposed permanent weirs by drainage in Idaho as of fall 1992. Note some salmon weirs are not designed or operated to trap adult steelhead trout. Drainages conform to the Idaho Anadromous Fish Management Plan, 1992-1996 (IDFG 1992).

Drainage	Sub-drainage	Existing	Proposed	Total	Species/ Class[a]
		Snake River Subbasin			
Lower	------			0	------
		Salmon River Subbasin			
Lower	Slate Creek[b]				CHN-NSP STH-NA
Little Salmon	Rapid River	X			CHN-WSU STH-WA
Salmon Canyon	Chamberlain West Fork			2	CHN-WSP STH-WA
South Fork	Johnson Creek Headwaters[b]	 X	X 	2	CHN-WSU CHN-NSU STH-WB
Middle Fork	Rush Creek Sulphur Creek Marsh Creek	 X	X X 	3	CHN-WSP STH-WB
Lemhi River	Headwaters	X		1	CHN-NSP STH-NA
Pahsimeroi River	Headwaters	X		1	CHN-NSU STH-NA
East Fork	Headwaters	X		1	CHN-NSP STH-NB
Yankee Fork	------			0	------
Upper	North Fork Headwaters (Sawtooth)	 X	X 	2	CHN-NSP STH-NA
Total		7	7	14	

Table 8. (continued)

Drainage	Sub-drainage	Existing	Proposed	Total	Species/ Class[a]
	Clearwater River Subbasin				
Lower	Lolo Creek[b]		X	1	CHN-NSP STH-NB
South Fork	Newsome Creek[b]		X		
	Crooked River	X			CHN-NSP
	Red River[b]	X		3	STH-NB
Middle Fork	Clear Creek (Kooskia)	X		1	CHN-NSP STH-NB
Lochsa River	Headwaters (Powell)[b]		X	1	CHN-NSP STH-NB
Selway River	Running Creek		X	1	CHN-NSP STH-WB
Total		3	4	7	
Grand Total		10	11	21	

[a] CHN = Chinook salmon, W = Wild, N = Natural, SP = Spring, SU = Summer; STH = Steelhead trout, W = Wild, N = Natural, A = A-Run, B = B-Run.
[b] Weir currently designed or operated to trap chinook salmon only; no current plans to trap steelhead trout.

from Dr. Maurice Hornocker to build on the property. Intensive parr sampling began here in 1991.

b. Chamberlain Creek at the Hotzel Ranch and West Fork Chamberlain Creek at the Stonebreaker/Beal Ranch. Chamberlain Creek is a tributary of the mainstem Salmon River between the Middle Fork Salmon and South Fork Salmon rivers. The weirs would trap wild-spring chinook salmon and wild steelhead trout. Chamberlain Creek steelhead trout are classified as A-run; however, the supporting adult length-frequency data are scarce. Unlike our other proposed weirs, these would be located high in the drainage on adjacent properties owned by IDFG. Intensive parr sampling began here in 1992.

c. Rush Creek at the Taylor Ranch. Rush Creek is a tributary of Big Creek, which is a major tributary of the lower Middle Fork Salmon River. The weir would trap wild spring chinook salmon and wild steelhead trout. Rush Creek steelhead are classified as B-run; however, some field observations suggest adult lengths more similar to A-run (Anderson, IDFG, personal communications). It would be located at the mouth of Rush Creek on property owned by the University of Idaho. We have verbal agreement to `build the weir, subject to design, from Dr. Jeff Yeo. Intensive parr sampling began here in 1991.

d. Sulphur Creek at the Morgan Ranch. Sulphur Creek is a tributary of the upper Middle Fork Salmon River. The weir would trap wild spring chinook salmon and wild B-run steelhead trout. It would be located at the mouth of Sulphur Creek on private property. At this time we have not reached an agreement to build the weir with the landowners. Intensive parr sampling began here in 1992 by IDFG/ISS.

If constructed, these five weirs will provide the bulk of wild chinook salmon and steelhead trout terminal escapement information for Idaho (Tables 4 to 7). Additional long-term wild escapement information would be collected at Rapid River, Johnson Creek (if constructed), and Marsh Creek.

All five proposed weirs are in wilderness areas that have essentially pristine watersheds. They would be located on private or state property adjacent to back country airstrips. Locations or methods may change after site surveys and cost estimates are made in spring 1993.

2. Continue to monitor escapements (both wild/natural and hatchery) above the existing hatchery weirs: a) chinook salmon and steelhead trout at Sawtooth, East Fork Salmon River, Pahsimeroi, Rapid River, Crooked River, and Kooskia; and b) chinook salmon at Red River and South Fork Salmon River. Collect time of arrival, sex, size, and mark information for each fish. This work is planned by IDFG and USFWS hatcheries, and IDFG/ISM for steelhead trout at Crooked River.

3. Begin monitoring chinook salmon and steelhead trout escapements above the recently renovated Marsh Creek and Lemhi River weirs in spring 1993. Collect the same information as hatcheries for both species. This work is planned by IDFG/ISS.

Parr Density Above Weirs

Slate Creek (Lower Salmon River)

Intensive parr sampling was done by NPT/NPTH beginning in 1992. Data are being analyzed and will be reported by them this year.

Rapid River (Little Salmon River)

Intensive parr sampling was done by this sub-project in 1992; intensive sampling began in 1990 and continued in 1991 (Rich et al. 1993). We sampled 13 sections in 1992 (Table 9; Figure 3), 12 of which were in the production area; the remaining one was above the falls on the West Fork Rapid River. Sections averaged 73.7 m in length (range 33.7-102.1) and 10.40 m in width (range 6.48-12.40; Table 10). Overall, age 0 chinook salmon densities averaged 1.1 fish/100 m^2 (range 0.0-11.2), and age 1 steelhead trout averaged 7.4 (range 0.9-13.9; Table 11).

Chinook Salmon Parr-Densities of age 0 chinook salmon in mainstem and West Fork sections in 1992 were low. In the mainstem in 1992 they averaged 1.2 fish/100 m^2 (range 0.0-11.2; n = 11; Table 11), which was greater than Rich et al. (1993) estimated in 1990 (0.1; range 0.0-1.0; n = 13) or 1991 (0.1; range 0.0-0.4; n = 7). No chinook salmon were observed in the West Fork Rapid River in any year.

Although mean densities were low and similar between years, chinook salmon parr were distributed differently in 1992 and 1990 compared to 1991 (Rich et al. 1993). In 1991, parr were observed above the West Fork Rapid River, whereas in 1992 and 1990, they were all observed below the West Fork Rapid River and near the Rapid River Fish Hatchery (Table 11). One yearling was observed just above the West Fork in 1992. Sampling dates were similar (July 17-19, 1990; July 15-16, 1991; July 14-16, 1992), but sampling locations were not identical (Table 9). The difference between years may be partly due to low numbers of returning adults; at such low seeding levels parr probably remain near sparse and scattered spawning beds and may be more difficult to detect by sampling.

Future stratification of age 0 parr densities may reduce the high overall CV observed in 1992 (281%; Table 11).

Steelhead Trout Parr-Densities of age 1 steelhead trout in mainstem and West Fork Rapid River sections in 1992 were greater than those observed in 1990 and 1991. In the mainstem in 1992, they averaged 7.5 fish/100 m^2 (range 0.9-13.9; n = 11; Table 11), almost twice that Rich et al. (1992) estimated in 199.0 (4.0; range 2.4-6.7; n = 13) or 1991 (3.4; range 1.4-6.5; n = 7). Density in the West Fork Rapid River monitoring section RAP-1 was 6.0 in 1992, also higher than in 1990 (5.0) or 1991 (1.0).

Table 9. Parr density sections snorkeled in the Rapid River drainage during July 15-16, 1991 and July 14-16, 1992 and proposed sections for 1993. Sections are ordered going upstream.

1990	1991	1992	1993 (Proposed)
		Mainstem	
	----	RAP-2[a]	RAP-2
	7	Lower Pack Bridge[b]	Lower Pack Bridge
	----	Cliff Hanger[c]	Cliff Hanger
	6	One Fire Pit[b]	One Fire Pit
	5	Upper Pack Bridge[b]	Upper Pack Bridge
	4	Two Fire Pit[b]	Two Fire Pit
	3	----[d]	----
	2	Cora Cliffs[b]	Cora Cliffs
	1	Wyant Camp[b]	Wyant Camp
	----	Castle Pack Bridge[c]	Castle Pack Bridge
	----	Copper Pack Bridge[c]	Copper Pack Bridge
	----	Paradise Cabin[c]	Paradise Cabin
		Tributaries	
West Fork			
	RAP-1[a]	RAP-1	RAP-1
	----	Above Falls[c]	----
Total:	8	13	12

[a] Monitoring section.
[b] Renamed in 1992.
[C] New section in 1992.
[D] Not found nor done in 1992.

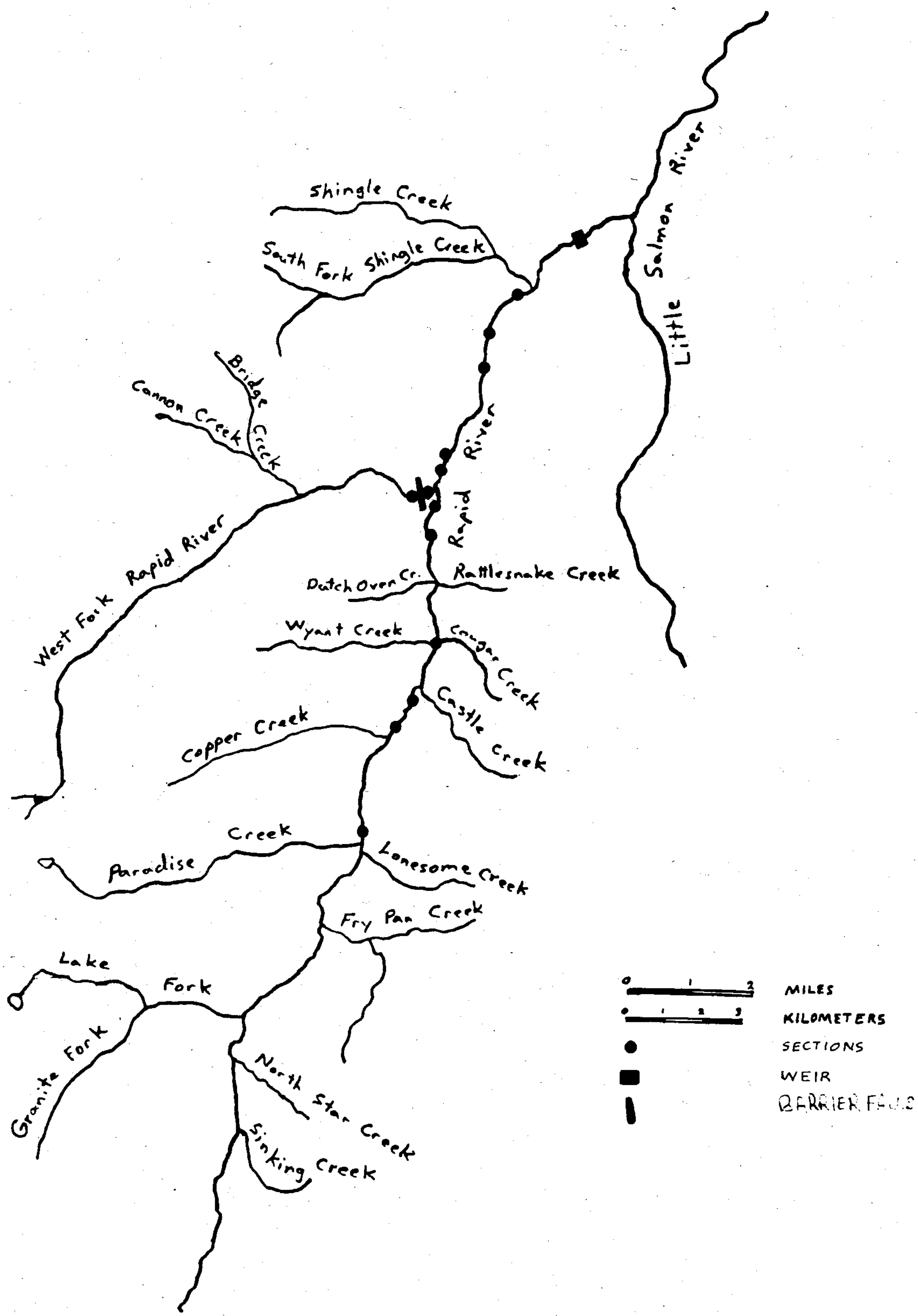

Figure 3. Location of existing weir and sections sampled in the Rapid River drainage 1992.

Table 10. Physical characteristics of parr density sections snorkeled in the Rapid River drainage during July 1992. All sections were in B-type channels (Rosgen 1985). Sections are ordered going upstream.

Section	Length (m))	Mean width (m)	Water temperature (°C)	Conductivity (µS)	Gradient ($)
			Mainstem		
RAP-2[a]	102.1	12.08	15	--	1.0
Lower Pack Bridge[b]	41.1	8.45	14	150	1.6
Cliff Hanger[c]	96.1	11.80	13	150	0.9
One Fire Pit[b]	68.9	11.75	10	150	1.2
Upper Pack Bridge[b]	33.7	9.87	9	150	1.8
Two Fire Pit[b]	57.1	8.80	14	160	2.1
Cora Cliffs[b]	92.0	10.73	13	150	1.4
Wyant Camp[b]	61.6	12.40	9	150	2.4
Castle Pack Bridge[c]	93.3	9.73	12	--	1.3
Copper Pack Bridge[c]	64.8	11.00	12	140	2.2
Paradise Cabin[c]	79.1	11.68	13	120	4.1
Mean:	71.8	10.75	12	147	1.8
Sample size (n):	11	11	11	9	11
			Tributaries		
West Fork					
RAP..-1[a]	94.6	6.48	11	120	1.8
Above Falls[c]	61.6	5.60	10		0.9
Mean:	94.6	6.48	11	120	1.8
Sample size (n)[d]:	1	1	1	1	1
Grand mean:	73.7	10.40	12	144	1.8
Sample size (n):	12	12	12	10	12

[a] Monitoring section,
[b] Renamed in 1992.
[c] New section in 1992.
[d] Excluding Above Falls section as outside of production area.

Table 11. Steelhead trout and chinook salmon parr densities for sections snorkeled in the Rapid River drainage during July 1992. STH = steelhead trout, WCT = westelope cutthroat trout, CHN = chinook salmon. Sections are ordered going upstream.

	STH/WCT	STH	STH	STH	CHN	CHN
Section	0	1	2	1&2	0	1
Mainstem						
RAP-2[a]	2.0	13.9	4.2	18.1	11.2	0.
Lower Pack Bridge[b]	9.8	11.8	5.2	17.0	1.4	0.
Cliff Hanger[c]	1.7	3.3	1.2	4.4	1.1	0.
One Fire Pit[b]	2.1	5.7	3.5	9.1	0.0	0.
Upper Pack Bridge[b]	0.9	7.2	4.2	11.4	0.0	0.
Two Fire Pit[b]	1.2	9.4	4.4	13.7	0.0	0.
Cora Cliffs[b]	2.6	9.6	4.0	13.6	0.0	0.
Wyant Camp[b]	0.1	6.7	3.1	9.8	0.0	0.
Castle Pack Bridge[c]	1.2	9.5	2.3	11.8	0.0	0.
Copper Pack Bridge[c]	0.0	4.4	4.1	8.4	0.0	0.
Paradise Cabin[c]	0.0	0.9	2.1	2.9	0.0	0.
Mean (n = 11):	2.0	7.5	3.5	10.9	1.2	0.
CV($):	140	51	34	43	268	190
Tributaries						
West Fork						
RAP-1[a]	2.6	6.0	3.8	9.8	0.0	0.
Above Falls[c]	0.6	7.0[e]	8.1[e]	15.1	0.0	0.
Mean (n = 1)[d]:	2.6	6.0	3.8	9.8	0.0	0.
CV (%):						
Grand Mean (n = 12):	2.0	7.4	3.5	10.8	1.1	0.
CV (%):	130	50	32	42	281	200
90% CI (t):	1.4	1.9	0.6	2.3	1.7	0. 1

[a] Monitoring section.
[b] Renamed in 1992.
[c] New section in 1992.
[d] Excluding Above Falls section as outside of production area.
[e] Assumed to be resident rainbow trout.

Although steelhead trout parr density varied by section in all years, greater densities were observed near the Rapid River Hatchery in 1991 and 1992 (Table 11; Rich et al. 1993). This may be due to annual differences in parr movement or adult spawning distributions. Sampling dates were similar between years (see above), but sampling locations were not identical. Parr were not observed by USFS survey crews in Paradise Creek or in the mainstem above Fry Pan Creek (Figure 3) in 1991 (Mike Radko, USFS, unpublished data). We believe fish above the West Fork Rapid River falls are resident rainbow trout o. mykiss.

Future stratification of age 1 parr densities may give a more accurate estimate of average parr density and, for 1992 data, would reduce the overall CV (50%).

Chamberlain Creek/West Fork Chamberlain Creek (Salmon River Canyon)

Intensive parr sampling was done by this sub-project beginning in 1992. We sampled 27 sections (Table. 12; Figure 4) that averaged 89.1 m in length (range 38.4-163.6) and 5.92 m in width (range 2.10-12.45; Table 13). Overall, age 0 chinook salmon densities averaged 5.7 fish/100 m^2 (range 0.0-30.9), and age 1 steelhead trout averaged 3.4 (range 0.0-7.4; Table 14).

Chinook Salmon Parr-Densities of age 0 chinook salmon in mainstem and tributary sections were low, but were the largest we observed in 1992. In the mainstem, they averaged 5.0 fish/ 100 m^2 (range 0.0-18.5; n = 11), and in the tributaries they averaged 6.2 (range 0.0-30.9; n = 16; Table 14).

Chinook salmon parr were not distributed throughout the upper Chamberlain Greek drainage (Table 14). In the mainstem, all parr were observed below the airstrip pack bridge (just above section CHA-4); parr were not observed in the Red Top meadows farther upstream. Only in the West Fork Chamberlain Creek tributary did we observe additional parr. We suggest two reasons for this distribution pattern: 1) at such low seeding levels, parr probably remain near the premium spawning beds (in C-type channels) below the airstrip pack bridge and in the West Fork Chamberlain Creek meadows; and 2) larger-size spawning substrate is not available in the other C-type channels higher in the drainage (i.e. Red Top and Moose Jaw Meadows; Table 13), and adults currently may not spawn there.

Future stratification of age 0 parr densities may reduce the high overall CV observed in 1992 {160%; Table 14).

Steelhead Trout Parr-Densities of age 1 steelhead trout in mainstem and tributary sections in 1992 were low. *In* the mainstem they averaged 3.3 fish/100 m^2 (range 1.1-7.4; n = 11; Table 14). Average density *in* the tributaries was similar (mean = 3.4; range 0.0-7.0; n = 16).

Steelhead trout parr were distributed more uniformly than chinook salmon parr throughout the upper Chamberlain Creek drainage (Table 14). Our results may be somewhat confounded by our difficulty distinguishing juvenile cutthroat trout O. clarki from juvenile steelhead trout. However, we observed juvenile cutthroat trout only in the mainstem below the airstrip pack bridge.

Table 12. Parr density sections snorkeled in the upper Chamberlain Creek drainage during July 23, 1991 and July 27-31, 1992 and proposed sections for 1993. Sections are ordered going upstream.

1991	1992	1993 (Proposed)
	Mainstem	
----	Dog Mouth	Dog Mouth
CHA-1[a]	CHA-1	CHA-1
----	West Fork Mouth	West Fork Mouth
----	Hotzel	Hotzel
CHA-4[a]	CHA-4	CHA-4
----	No Name Mouth	No Name Mouth
----	Smokehouse	Smokehouse
----	Lower Red Top	Lower Red Top
----	Fish Mouth	Fish Mouth
----	Upper Red Top	Upper Red Top
----	Forks	Forks
	Tributaries	
West Fork		
----	Mouth	Mouth
----	Beal Meadow	Beal Meadow
----	Sagebrush Fence	Sagebrush Fence
CHA-2[a]	CHA-2	CHA-2
CHA-3[a]	CHA-3	CHA-3
----	First Crossing	First Crossing
----	Spring	Spring
----	Tumbledown	Tumbledown
Game Creek		
----	Trail Crossing	Trail Crossing
Flossie Creek		
----	Trail Crossing	Trail Crossing
Moose Creek		
----	Mouth	Mouth
----	Lower Moose Jaw	Lower Moose Jaw
----	Upper	Upper
Fish Creek		
----	Trail Crossing	Trail Crossing
Rim Creek		
----	Mouth	Mouth
South Fork		
----	Mouth	Mouth
Total: 4	27	27

[a]Monitoring section.

TABLES

Table 13. Physical characteristics of parr density sections snorkeled in the upper Chamberlain Creek drainage during July 1992. Channel types are by Rosgen (1985). Sections are ordered going upstream.

Section	Channel type	Length (m)	Mean width (m)	Water temperature (°C)	Conductivity (µS)	Gradient (%)
Mainstem						
Dog Mouth	B	96.5	10.25	18	--	0.8
CHA-1	B	136.0	8.72	20	70	- -
West Fork Mouth	C	91.6	9.70	18	--	0.6
Hotzel	C	129.0	8.00	19		1.0
CHA-4	C	96.0	9.90	17	60	
No Name Mouth	B	53.9	12.45	13	--	0.5
Smokehouse	B	94.1	9.63	16	--	0.6
Lower Red Top	C	115.8	7.78	11	--	<0.1
Fish Mouth	C	142.5	7.28	14	--	0.2
Upper Red Top	C	163.6	8.10	9	--	0.6
Forks	B	71.0	5.10	12	--	3.5
Mean:		108.2	8.81	15	65	0.9
Sample size (n):		11	11	[illegible]	2	9
Tributaries						
West Fork						
Mouth	B	94.	3.53	17	--	0.8
Beal Meadow	C	99.	4.03	20	70	0.6
Sagebrush Fence	C	129.0	5.98	15	--	0.3
CHA-2	C	116.1	4.82	14	--	0.4
CHA-3	B	82.	5.30	--		0.8
First Crossing	B	70.	3.48	--	--	0.8
Spring	B	52.	4.12	--	--	1.6
Tumbledown	B	57.	2.33	--	--	1.2
Game Creek						
Trail Crossing		53.	2.75	10	--	2.6
Flossie Creek						
Trail Crossing	B	88.	2.43	17	--	1.8
Moose Creek						
Mouth	B	[illegible]	5.08	13	--	3.8
Lower Moose Jaw	C	[illegible]15.0	3.53	13	--	0.6
Upper	B	52.	5.38	13	--	2.4
Fish Creek						
Trail Crossing		[illegible]8.	2.10	11	--	3.1
Rim Creek						
Mouth		52.	5.60	12	--	3.0
South Fork						
Mouth	B	52.	2.35	12	--	9.9
Mean:		76.	[illegible].93	14	70	2.1
Sample size (n):		16	16	12	1	16
Grand mean:		89.	5.92	15	67	1.7

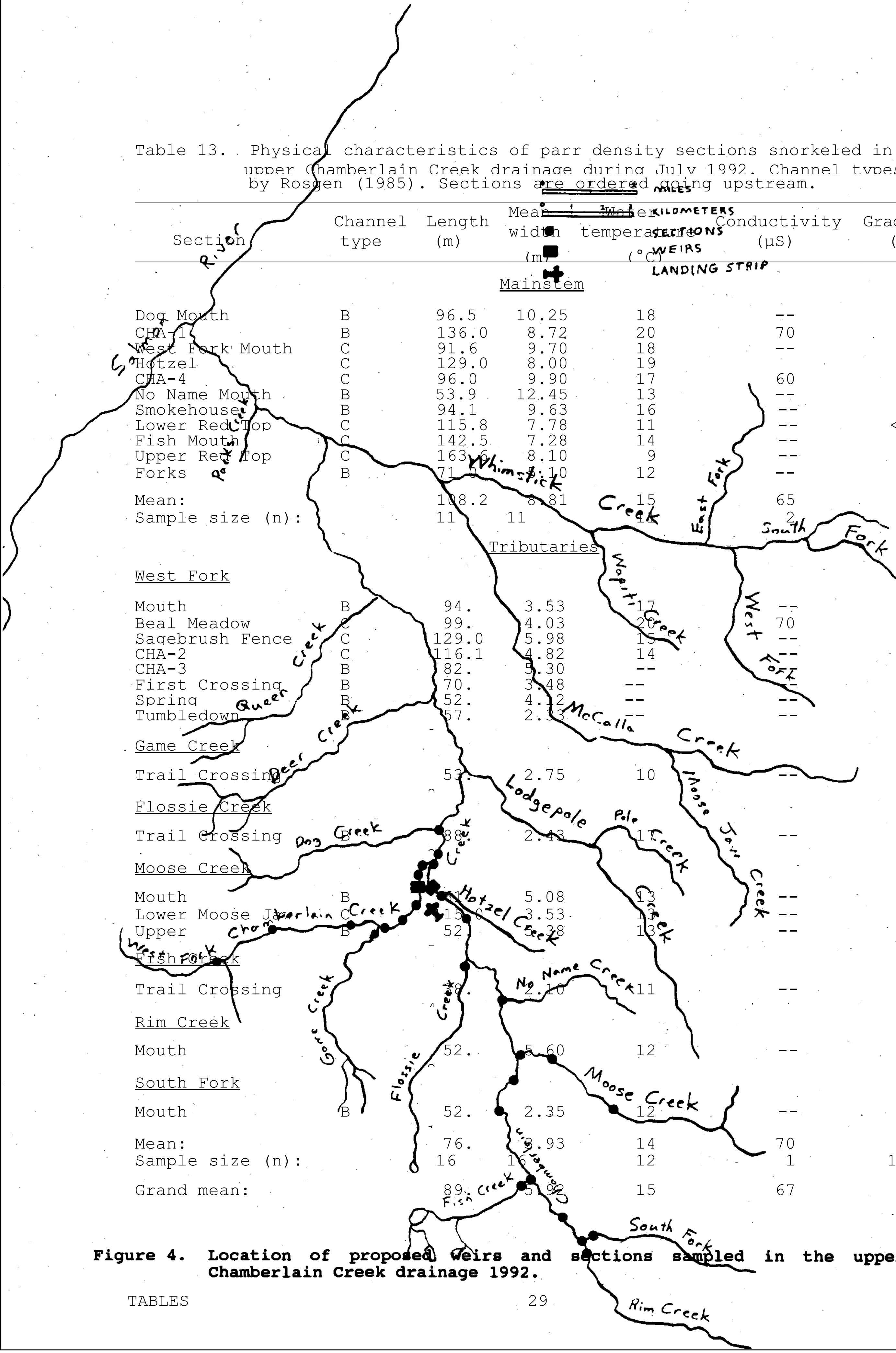

Figure 4. Location of proposed weirs and sections sampled in the upper Chamberlain Creek drainage 1992.

Sample size (n):	27	27	23	3	25

Table 14. Steelhead trout and chinook salmon parr densities for sections snorkeled in the upper Chamberlain Creek drainage during July 1992. STH = steelhead trout, WCT = westslope cutthroat trout, CHN = chinook salmon. Sections are ordered going upstream.

Section	STH/WCT 0	STH 1	STH 2	STH 1&2	CHN 0	CHN 1
Mainstem						
Dog Mouth	5.0	5.0	1.5	6.5	5.6	0.
CHA-1	2.4	3.5	2.1	5.6	8.2	0.
West Fork Mouth	2.1	3.4	0.8	4.2	18.5	0.
Hotzel	6.6	7.4	0.8	8.1	12.6	0.
CHA-4	1.7	1.7	1.2	2.8	10.4	1.
No Name Mouth	3.0	4.2	1.3	5.5	0.0	0.
Smokehouse	7.5	3.3	0.7	4.0	0.0	0.
Lower Red Top	2.6	2.6	1.2	3.8	0.0	0.
Fish Mouth	3.4	3.3	2.4	5.7	0.0	0.
Upper Red Top	5.5	1.2	0.9	2.1	0.0	0.
Forks	0.0	1.1	0.8	1.9	0.0	0.
Mean (n = 11):	3.6	3.3	1.2	4.6	5.0	0.
CV (%):	63	54	45	42	130	332
Tributaries						
West Fork						
Mouth	18.0	5.4	0.6	6.0	12.0	0.
Beal Meadow	4.5	7.0	1.0	8.0	21.3	0.
Sagebrush Fence	12.1	4.5	1.2	5.7	27.1	0.
CHA-2	7.0	6.2	1.2	7.5	30.9	0.
CHA-3	4.8	4.3	0.2	4.6	3.4	0.
First Crossing	4.5	5.3	-1.2	6.5	3.7	0.
Spring	2.8	3.7	0.5	4.2	0.0	0.
Tumbledown	1.5	2.2	0.0	2.2	0.0	0.
Game Creek						
Trail Crossing	4.1	0.7	0.0	0.7	0.0	0.
Flossie Creek						
Trail Crossing	5.6	6.5	0.9	7.5	0.0	0.
Moose Creek						
Mouth	3.2	4.5	0.6	5.1	0.0	0.
Lower Moose Jaw	- 1.0	1.2	1.2 -	2.5	0.0	0.
Upper	0.4	0.4	0.4	0.7	0.0	0.
Fish Creek						
Trail Crossing	36.0	1.2	0.0	1.2	0.0	0.
Fish Creek						
Mouth	0.3	0.7	0.3	1.0	0.0	0.

Table 14. (continued)

Section	STH/WCT 0	STH 1	STH 2	STH 1&2	CHN 0	CHN 1
Tributaries (continued)						
South Fork						
Mouth	0.0	0.0	0.8	0.8	0.0	0.0
Mean (n = 16):	6.6	3.4	0.6	4.0	6.2	0.1
CV (%):	138	72	72	67	173	275
Grand mean (n = 27):	5.4	3.4	0.9	4.2	5.7	0.1
CV (%):	134	64	66	56	160	327
90% CI (t):	2.4	0.7	0.2	0.8	3.0	0.1

At this time, we see no compelling reason to stratify age 1 parr densities to estimate means and variances. Although the overall CV is large (64%), the 90% CI (± 0.7) is small due to the large sample size (n = 27; Table 14). We will reassess stratification needs after analyzing data collected in the future.

Johnson Creek (South Fork Salmon River)

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Headwaters (South Fork Salmon River)

Intensive parr sampling was done by SBT/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Rush Creek (Middle Fork Salmon River)

Intensive parr sampling was done by this sub-project in 1992; intensive sampling began in 1991 (Rich et al. 1993). We sampled 12 sections (Table 15; Figure 5) that averaged 63.8 m in length (range 45.8-83.0) and 5.86 m in width (range 2.60-9.13; Table 16). Overall, age 0 chinook salmon densities averaged 0.2 fish/100 m^2 (range 0.0-1.7), and age 1 steelhead trout averaged 2.6 (range 0.0-13.3; Table 17).

Chinook Salmon Parr-Densities of age 0 chinook salmon in mainstem sections in 1992 were very low; no chinook salmon were observed in the single tributary we sampled. Mainstem densities averaged 0.2 fish/100 m^2 (range 0.0-1.7; n = 10; Table 17).

The only sections where we observed chinook salmon parr in 1992 were near the mouth of Rush Creek; Rich et al. (1993) did not observe parr in the drainage in 1991 (n = 14). Sampling dates were similar (August 5-8, 1991 and August 11-12, 1992), but sampling locations were not identical (Table 15). At very low seeding levels parr probably remain near sparse and scattered spawning beds and may be more difficult to detect by sampling.

Future stratification of age 0 parr densities may reduce the high overall CV observed in 1992 (309%; Table 17).

Steelhead Trout Parr-Densities of age 1 steelhead trout in mainstem and tributary sections were low in 1992. In the mainstem, they averaged 1.4 fish/100 m^2 (range 0.0-4.0; n = 10; Table 17), the same as observed by Rich et al. (1993) in 1991 (mean = 1.4; range 0.0-3.4; n = 12). Average density in the South Fork tributary was 8.9 (range 4.4-13.3; n = 2); no age 1 parr were observed there in 1991.

Table 15. Parr density sections snorkeled in the Rush Creek drainage during August 5-8, 1991 and August 11-12, 1992 and proposed sections for 1993. Sections are ordered going upstream.

1991	1992	1993 (Proposed)
	Mainstem	
12	Mouth[a]	Mouth
11	Diversion[a]	Diversion
----	Island[b]	Island
----	Above Crossing[b]	Above Crossing
10	----[d]	----
----	----	Lewis Mouth[c]
9	----[d]	----
8	----[d]	----
7	----[d]	----
6	----[d]	----
----	Log Jam Bar[b]	Log Jam Bar
----	Cliff Hanger[b]	Cliff Hanger
5	----[d]	----
4	West Fork Mouth[a]	West Fork Mouth
----	Range Mouth[b]	Range Mouth
3	South Fork Mouth[a]	South Fork Mouth
2	Telephone Mouth[a]	Telephone Mouth
1	----[d]	----
	Tributaries	
Lewis Creek		
Mouth	----[d]	Mouth
South Fork		
1	Mouth[a]	Mouth
----	Upper[b]	Upper
Total: 14	12	14

[a] Renamed in 1992.
[b] New section in 1992.
[c] New section in 1993.
[d] Not found nor done in 1992.

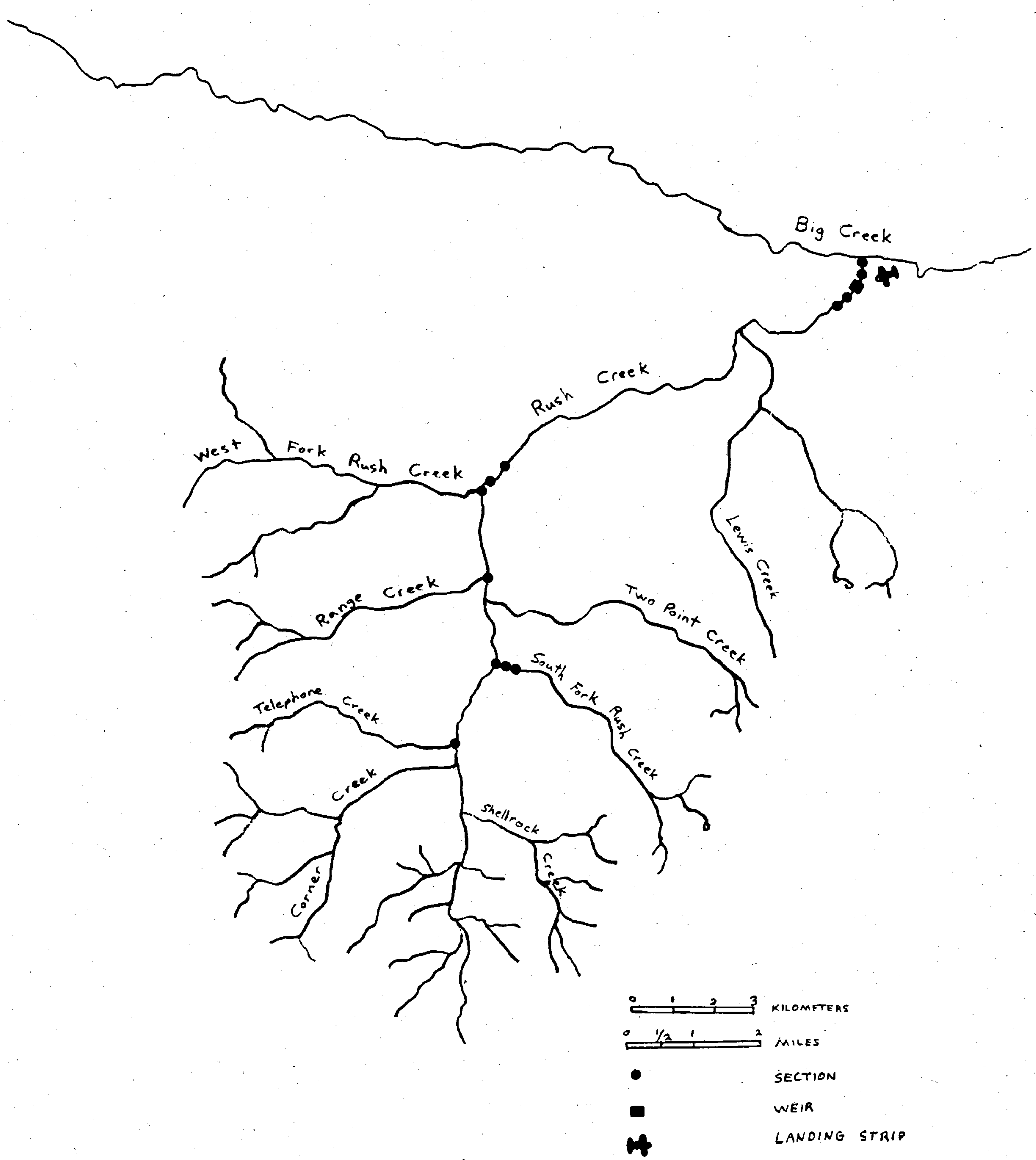

Figure 5. Location of proposed weir and sections sampled in the Rush Creek drainage 1992.

Table 16. Physical characteristics of parr density sections snorkeled in the Rush Creek drainage during August 1992. All sections were in B-type channels (Rosgen 1985). Sections are ordered going upstream.

Section	Length (m)	Mean width (m)	Water temperature (°C)	Conductivity (uS)	Gradient (%)
Mainstem					
Mouth[a]	82.0	8.35	13	110	1.9
Diversion[a]	68.2	6.88	14	110	1.5
Island[b]	67.1	8.55	12	110	0.6
Above Crossing[b]	71.8	9.13	13	110	1.0
Log Jam Bar[b]	83.0	5.82	12	--	1.2
Cliff Hanger[b]	76.0	6.60	10	--	1.0
West Fork Mouth[a]	54.7	5.93	15	--	1.8
Range Mouth[b]	47.0	5.25	9	120	4.6
South Fork Mouth[a]	61.2	4.53	17	90	1.3
Telephone Mouth[a]	56.3	3.95	14	80	1.4
Mean:	66.7	6.50	13	104	1.6
Sample size (n):	10	10	10	7	
Tributaries					
South Fork					
Mouth[a]	52.0	2.60	12	130	3.8
Upper[b]	45.8	2.75	12	130	3.9
Mean:	48.9	2.68	12	130	3.9
Sample size (n):	2	2	2	2	2
Grand mean:	63.8	5.86	12.8	110	2.0
Sample size (n):	12	12	12	9	12

[a] Renamed in 1992.
[b] New section in 1992.

Table 17. Steelhead trout and chinook salmon parr densities for sections snorkeled in the Rush Creek drainage during August 1992. STH = steelhead trout, WCT = westslope cutthroat trout, CHN = chinook salmon. Sections are ordered going upstream.

Section	STH/WCT 0	STH 1	STH 2	STH 1&2	CHN 0	CHN 1
Mainstem						
Mouth[a]	0.9	0.7	0.4	1.2	0.	0.
Diversion[a]	3.2	1.7	0.4	2.1	1.	0.
Island[b]	0.5	0.0	0.0	0.0	0.	0.
Above Crossing[b]	0.6	0.0	0.3	0.3	0.	0.
Log Jam Bar[b]	1.0	2.9	1.4	4.4	0.	0.
Cliff Hanger[b]	0.0	1.8	1.0	2.8	0.	0.
West Fork Mouth[a]	0.0	0.3	0.3	0.6	0.	0.
Range Mouth[b]	0.0	4.0	0.8	4.9	0.	0.
South Fork Mouth[a]	0.0	2.5	1.8	4.3	0.	0.
Telephone Mouth’	0.4	0.0	0.0	0.0	0.	0.
Mean (n = 10):	0.7	1.4	0.6	2.1	0.	0.
CV (%):	147	102	94	94	281	-
Tributaries						
South Fork						
Mouth’	0.0	4.4	0.0	4.4	0.	0.
Upper°	0.0	13.3	2.3	15.6	0.	0.
Mean (n = 2):	0.0	8.9	1.2	10.0	0.	0.
CV (%):	-	71	141	79	-	-
Grand mean (n = 12):	0.6	2.6	0.7	3.4	0.	0.
CV (%):	166	140	105	126	309	-
90% CI (t):	0.5	1.9	0.4	2.2	0. 3	0. 0

[a] Renamed in 1992.
[b] New section in 1992.

Steelhead trout parr were distributed uniformly throughout the Rush Creek drainage in 1992 (Table 17); in 1991, densities decreased above the West Fork Rush Creek (Rich et al. 1993). Our results are confounded by our difficulty distinguishing juvenile cutthroat trout from juvenile steelhead trout in Rush Creek. Although we observed juvenile cutthroat trout throughout the drainage, their densities generally increased with decreasing steelhead trout densities.

Future stratification of age 1 parr densities combined with a larger sample size, may reduce the high overall CV observed in 1992 (140%; Table 17).

Sulphur Creek (Middle Fork Salmon River)

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Marsh Creek (Middle Fork Salmon River)

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

North Fork Salmon River (Upper Salmon River)

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Lemhi River

Intensive parr sampling was done by IDFG/ISS beginning in 1991; ICFWRU/ISS continued limited sampling in 1992. Data are being analyzed and will be reported by them this year.

Pahsimeroi River

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being.analyzed and will be reported by them this year.

East Fork Salmon River

Intensive parr sampling was done by SBT/SRHE beginning in 1992. Data are being analyzed and will be reported by them this year.

Sawtooth (Upper Salmon River)

Intensive parr sampling was done by IDFG/ISM in 1992 (Kiefer and Lockhart 1993); sampling began in 1987 (Kiefer and Apperson 1988) and continued through 1991 (Kiefer and Forster 1990, 1991, 1992; Kiefer and Lockhart 1993). Data are being analyzed and will be reported by them this year.

Lola Creek (Lower Clearwater River)

Intensive parr sampling was done by NPT/NPTH beginning in 1992. Data are being analyzed and will be reported by them this year.

Newsome Creek (South Fork Clearwater River)

Intensive parr sampling was done by NPT/NPTH beginning in 1992. Data are being analyzed and will be reported by them this year.

Crooked River (South Fork Clearwater River)

Intensive parr sampling was done by IDFG/ISM in 1992 (Kiefer and Lockhart 1993); sampling began in 1987 (Kiefer and Apperson 1988) and continued through 1991 (Kiefer and Forster 1990, 1991, 1992; Kiefer and Lockhart 1993). Data are being analyzed and will be reported by them this year.

Red River (South Fork Clearwater River)

Intensive parr sampling was done by IDFG/GPM beginning in 1992. Data are being analyzed and will be reported by them this year.

Clear Creek (Middle Fork Clearwater River)

Intensive parr sampling was done by IFRO/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Powell (Lochsa River)

Intensive parr sampling was done by IDFG/ISS beginning in 1992. Data are being analyzed and will be reported by them this year.

Running Creek (Selway River)

Intensive parr sampling was done by this sub-project in 1992; intensive sampling began in 1991 (Rich et al. 1993). We sampled 18 sections (Table 18; Figure 6) that averaged 50.3 m in length (range 27.2-94.5) and 8.29 m in width (range 3.62-14.75; Table 19). Overall, age 0 chinook salmon densities averaged 0.1 fish/100 m^2 (range 0.0-0.7), and age 1 steelhead trout averaged 3.4 (range 0.3-14.2; Table 20).

Chinook Salmon Parr-Densities of age 0 chinook salmon in mainstem and tributary sections were the lowest we observed in 1992. We counted only two parr in the mainstem, and overall mainstem densities averaged <0.1 fish/100 m^2 (range 0.0-0.3; n = 10; Table 20); densities in 1991 averaged 3.5 (range 0.0-27.0; n = 13; Rich et al. 1993). We counted a single parr in Lynx Creek, and overall tributary densities averaged 0.1 fish/100e (range 0.0-0.7; n = 8); no parr were observed in any tributary in 1991.

The only sections where we observed chinook salmon parr in 1992 were near the mouths of Running Creek and Lynx Creek (Table 20). In contrast, Rich et al. (1991) observed parr throughout the mainstem, and particularly in the uppermost sections; they did not observe chinook salmon parr in any tributary. Sampling dates were similar (July 23-26, 1991 and July 7-10, 1992), but sampling locations were not identical (Table 18). We suggest that the difference between years may be partly due to low numbers of returning adults; at such low seeding levels parr probably remain near sparse and scattered spawning beds and may be more difficult to detect by sampling.

Future stratification of age 0 parr densities may reduce the high overall CV observed in 1992 (316%; Table 20). However, it will be difficult to make accurate and precise estimates at such low seeding levels.

Steelhead Trout Parr-Densities of age 1 steelhead trout in mainstem and tributary sections were low in 1992, but greater on average than in 1991 (Rich et al. 1993). In the mainstem, they averaged 4.6 fish/100 m^2 (range 0.5-14.2; n = 10; Table 20) in 1992 and 2.9 in 1991 (range 0.0-8.5; n = 13). Average density in tributaries was 2.0 in 1992 (range 0.3-5.6; n = 8) and 0.7 in 1991 (range 0.0-1.5; n = 10).

Steelhead trout parr were distributed uniformly throughout the Running Creek drainage in 1992 (Table 20), whereas no parr were observed in the upper tributaries (Lynx Creek and South Fork) in 1991 (Rich et al. 1993). Our results are confounded by our difficulty distinguishing juvenile cutthroat trout from juvenile steelhead trout. For example, only juvenile cutthroat trout were observed in Lynx Creek and the South Fork in 1991, and in high densities, but we observed mostly juvenile steelhead trout in 1992. Throughout the drainage in both years, juvenile cutthroat trout densities generally increased with decreasing steelhead trout densities.

Future stratification age 1 parr densities may reduce the high overall CV observed in 1992 (120%; Table 20).

Table 18. Parr density sections snorkeled in the Running Creek drainage during July 23-26, 1991 and July 7-10, 1992 and proposed sections for 1993. Sections are ordered going upstream.

1991	1992	1993
	Mainstem	
RUN-1[a]	RUN-1[a]	RUN-1[e]
----	Cabin[b]	Cabin
RUN-2[a]	RUN-2[e]	RUN-2[e]
----		Two Fords[c]
Fissure	----[d]	
Dry Wash	Dry Wash	Dry Wash
Below Grouse	----[d]	
Grouse	Grouse Mouth[a]	Grouse Mouth
Island		
----	Wilderness Boundary[b]	Wilderness Boundary
----	Trail Culvert[b]	Trail Culvert
Bridge	Road Bridge[a]	Road Bridge
Outfitter Camp	Yorks Camp[a]	Yorks Camp
Mouth South Fork	South Fork Mouth[a]	South Fork Mouth
Headwater .	----	----
Upper Canyon 1	----	----
Upper Canyon 2	----	----
----	-----	Below Falls[c]
----	----	Above Falls[c]
	Tributaries	
Eagle Creek		
Lower	Trail Crossing[a]	Trail Crossing
Diversion	Diversion	Diversion
Second Crossing	----[d]	----
Island	----[d]	----
Grouse Creek		
Mouth	Mouth	Mouth
Below Falls	Trail Crossing[a]	Trail Crossing
Lynx Creek		
----	Mouth[b]	Mouth
Pool	----[d]	----
Culvert	Culvert	Culvert
South Fork		
Lower	Mouth[a]	Mouth
Upper	----[d]	----
----	Culvert[b]	Culvert
Total: 23	18	21

[a] Renamed in 1992.
[b] New section in 1992.
[c] New section in 1993.
[d] Not found nor done in 1992.
[e] Monitoring section.

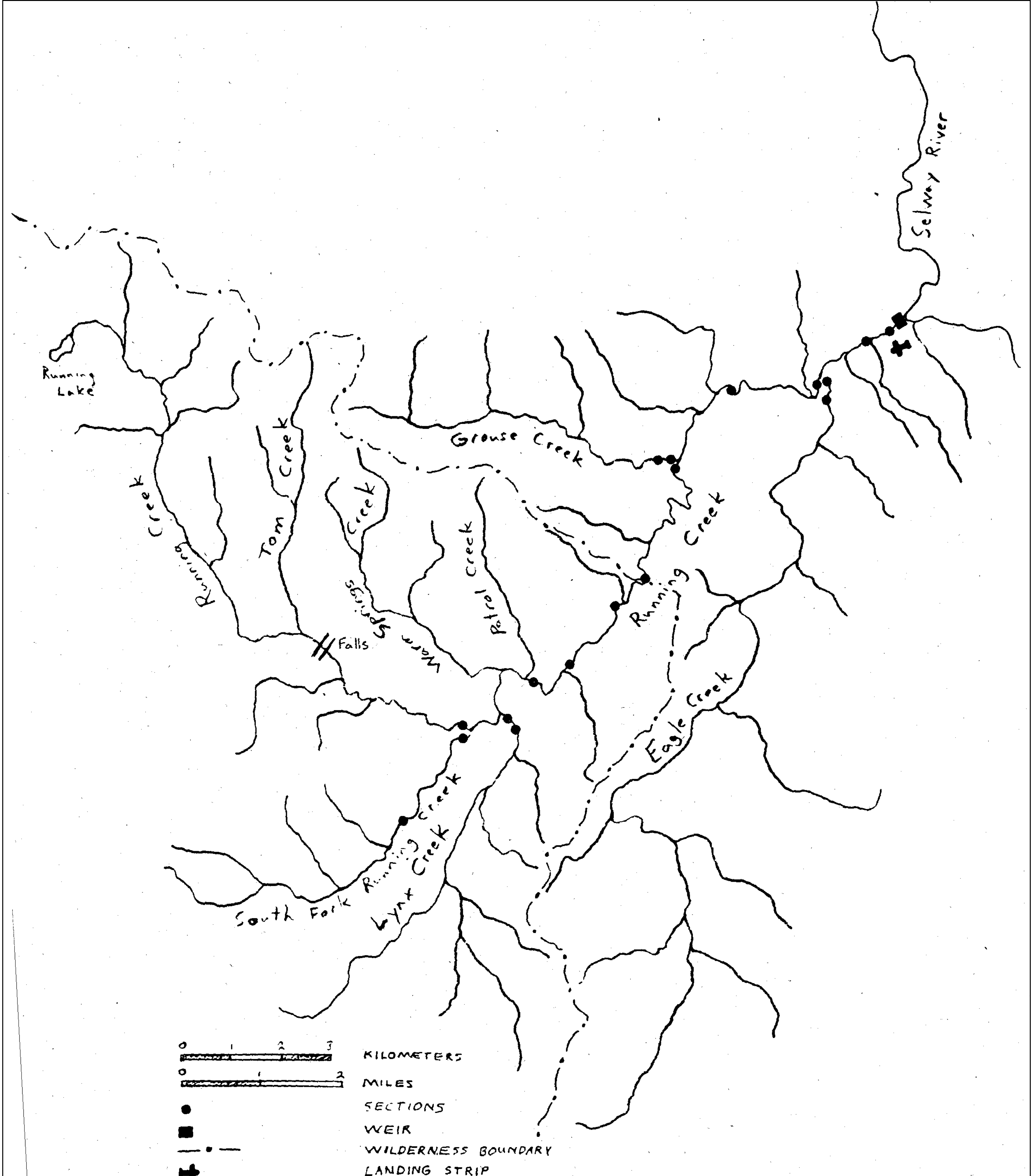

Figure 6. Location of proposed weir and sections sampled in the Running Creek drainage 1992.

Table 19. Physical characteristics of parr density sections snorkeled in the Running Creek drainage during July 1992. All sections were in B-type channels (Rosgen 1985). Sections are ordered going upstream.

Section	Length (m)	Mean width (m)	Water (°)	Conductivity (Us)	Gradient (%)
Mainstem					
RUN-1[c]	88.0	11.25	16	20	0.7
Cabin[b]	46.6	14.75	14	20	0.8
RUN-2[c]	42.2	12.18	14	20	0.8
Dry Wash	35.2	9.40	13	20	1.7
Grouse Mouth[a]	55.2	8.42	11	20	1.9
Wilderness Boundary[b]	62.4	10.40	13	20	1.4
Trail Culvert[b]	68.0	12.75	9	--	1.2
Road Bridge[a]	32.1	11.73	10	20	0.5
Yorks Camp[a]	94.5	10.95	10	--	1.8
South Fork Mouth[a]	33.3	7.77	10	20	3.4
Mean:	55.8	10.96	12	20	1.4
Sample size (n):	10	10	10	8	10
Tributaries					
Eagle Creek					
Trail Crossing[a]	41.0	7.92	13	--	3.2
Diversion	36.4	5.38	11	30	1.6
Grouse Creek					
Mouth	52.8	3.62	10	20	7.0
Trail Crossing[a]	37.0	5.48	10	20	5.4
Lynx Creek					
Mouth[b]	31.2	4.88	10	--	2.3
Culvert	55.5	3.85	8	30	1.6
South Fork					
Mouth[a]	27.2	4.85	10	20	2.3
Culvert[b]	67.1	3.70	9	--	4.6
Mean:	43.5	4.96	10	24	3.5
Samples size (n):	8	8	8	5	8
Grand mean:	50.3	8.29	11	22	2.3
Sample size (n):	18	18	18	13	18

[a] Renamed in 1992.
[b] New section in 1992.
[c] Monitoring section.

Table 20. Steelhead trout and chinook salmon parr densities for sections snorkeled in the Running Creek drainage during July 1992. STH = steelhead trout, WCT = westslope cutthroat trout, CHN = chinook salmon. Sections are ordered going upstream.

Section	STH/WCT 0	STH 1	STH 2	STH 1&2	CHN 0	CHN 1
			Mainstem			
RUN-1[c]	0.1	0.8	0.5	1.3	0.0	0.
Cabin[b]	0.3	3.2	1.3	4.5	0.3	0.
RUN-2[c]	2.5	2.9	0.0	2.9	0.0	0.
Dry Wash	5.1	14.2	2.4	16.6	0.0	0.
Grouse Mouth[a]	0.4	13.1	2.4	15.5	0.0	0.
Wilderness Boundary[b]	4.9	6.2	0.9	7.1	0.0	0.
Trail Culvert[b]	0.5	0.9	0.4	1.3	0.0	0.
Road Bridge[a]	0.0	0.5	0.0	0.5	0.0	0.
Yorks Camp[a]	1.1	0.7	1.3	1.9	0.0	0.
South Fork Mouth[a]	0.8	3.1	1.2	4.3	0.0	0.
Mean (n = 10):	1.6	4.6	1.0	5.6	<0.1	0.
CV (%):	124	112	83	105	316	
Eagle Creek						
Trail Crossing[a]	0.0	0.3	0.0	0.3	0.0	0.
Diversion	2.6	0.5	0.5	1.0	0.0	0.
Grouse Creek						
Mouth	0.0	2.6	1.1	3.7	0.0	0.
Trail Crossing[a]	0.5	1.0	0.0	1.0	0.0	0.
Lynx Creek						
Mouth[b]	0.0	2.0	0.0	2.0	0.7	0.
Culvert	0.0	0.9	0.0	0.9	0.0	0.
South Fork						
Mouth[a]	3.8	3.0	0.8	3.8	0.0	0.
Culvert[b]	1.2	5.6	0.8	6.4	0.0	0.
Mean (n = 8):	1.0	2.0	0.4	2.4	0.1	0.
CV (%):	143	89	114	87	283	-
Grand mean (n = 18):	1.3	3.4	0.8	4.2	0.1	0.
CV (%):	130	120	102	114	316	
90% CI (t):	0.7	1.7	0.3	1.9	0.1	0.0

[a] Renamed in 1992.
[b] New section in 1992.
[c] Monitoring section.

Recommendations

1. In Rapid River, expand intensive parr sampling to include upper portions of the mainstem and Paradise Creek. Determine extent of parr distribution, and establish permanent sampling sections. Collect scales for age analysis.

2. Continue intensive parr sampling in Running Creek, Rush Creek, and upper Chamberlain Creek. Establish permanent sampling sections. Sample with hook-and-line, electrofishing, or seining to distinguish juvenile steelhead trout from cutthroat trout. Collect scales for age analysis.

Escapement Above Weirs

Rapid River Wild A-Run Steelhead Trout (BY 89-92)

From April 7 through May 19, 1989, 69 wild steelhead trout were trapped at the weir (Table 21). Twelve additional hatchery fish were trapped and returned to the Little Salmon River. Of the wild fish, 22 were males (32%) and 47 were females (68%).

From April 11 through June 10, 1990, 117 wild steelhead trout were trapped at the weir (Table 21). Eighteen hatchery fish were trapped and returned to the Little Salmon River. Of the wild fish, 43 were males (37%) and 74 were females (63%).

From April 25 through June 26, 1991, 46 wild steelhead trout were trapped at the Rapid River weir (Table 21). One hatchery fish was trapped and returned to the Little Salmon River. Of the wild fish, 7 were males (15%) and 39 were females (85%).

From March 19 through May 27, 1992, 82 wild steelhead trout were trapped at the Rapid River weir (Table 21). Thirty hatchery fish were trapped and returned to the Little Salmon River. Of the wild fish, 31 were males (58%) and 51 were females (62%).

Reproduction Curves General

In the future, reproduction curves could be developed using parr density and escapement information collected above Idaho weirs for up to 21 chinook salmon and 15 steelhead trout populations (Tables 3 to 7). Most existing weirs are in natural production areas with varying degrees of hatchery influence. Current data are very limited for wild populations with only one existing weir representing each wild class: 1) wild summer chinook salmon and A-run steelhead

Table 21. Rapid River wild A-run steelhead escapement and estimated egg deposition and density, parr density and abundance, egg-to-yearling survival, and yearling-to-age 2 survival. One ocean fish are males 567 cm FL, females <-65 cm FL3. Fecunditites are assumed.

Parameter	BY 89	BY 90	BY 91	BY 92
Escapement:				
Ocean 1-M	18	11	3	27
Ocean 2-M	4	32	4	4
Sum -	22	43	7	31
Ocean 1-F	8	8	5	29
Ocean 2-F	39	66	34	22
Sum	47	74	39	51
Total run	69	117	46	82
%Females	68	63	85	62
Fecundity:				
Ocean 1-F	4,344	4,344	4,344	4,344
Ocean 2-F	6,313	6,313	6,313	6,313
Egg deposition:				
Ocean 1-F	34,752	34,752	21,720	125,976
Ocean 2-F	246,207	416,658	214,642	138,886
Sum	280,959	451,410	236,362	264,862
Prod Area (m^2)[a]:	176,500	176,500	176,500	176,500
Eggs/100 m^2:	159.18	255.76	133.92	150.06
Average parr/100 m^2:				
(BY+1) Age 1	4.12	3.14	7.37	
N =	15	8	12	
(BY+2) Age 2	4.34	3.51		
N =	8	12		
Total parr;				
(BY+l) Age 1	7,272	5,542	13,008	
(BY+2) Age 2	7,660	6,195		
Egg-age 1 survival (%)[b]:				
Method 1	2.6	1.2	5.5	
Method 2	2.6	1.2	5.5	
Age 1-2 survival (%)[b]:				
Method 1	105.3	111.8		
Method 2	105.3	111.8		

/[a] Estimated for weir to Paradise Creek, plus West fork to barrier using subbasin planning stream lengths and average measured widths.

[b] Method l uses densities, method 2 uses total numbers.

trout at Rapid River; and 2) wild spring chinook salmon and B-run steelhead trout at Marsh Creek. With the current emphasis on wild populations of anadromous fish, documentation of their reproduction curves is important. Hence, we emphasize the need for the proposed weirs in wild production areas.

The 21 chinook salmon and 15 steelhead trout curves would represent most of Idaho's major production drainages (Table 8). For chinook salmon, they would include all drainages except the Lower Snake River and Yankee Fork Salmon River. For steelhead trout, they would include all drainages except the Lower Snake, Lower Salmon, Lower Clearwater, Yankee Fork Salmon, and Lochsa rivers.

It will be difficult to construct reproduction curves if wild spawning escapements and resulting parr densities remain at low levels. In the future, greater escapement will be necessary to provide the range of seeding levels to detect a density dependent relationship.

Rapid River Wild A-Run Steelhead Trout (BY 89-91)

We summarized data for age 1 and age 2 parr density and adult escapement for Rapid River wild A-run steelhead trout, BY 89-91 (Table 21). We consider the brood year analyses preliminary, pending a determination of parr length-at-age from scale samples.

Future application of the escapement and parr density data to other drainages may require different forms of reproduction curves depending on data availability. For demonstration, we plotted three forms of reproduction curves from the preliminary brood year analyses using age 1 and age 2 parr density versus total escapement (males and females; Figure 7), female escapement (Figure 8), and estimated egg density (Figure 9). The ordinate was scaled to reflect the rated parr carrying capacity in excellent habitat (20 parr/100 m^2). Abscissas were scaled to reflect escapement objectives based on subbasin planning procedures, as modified by our estimates of total production area. Based on Radko's (USFS unpublished data) observed parr distributions, our estimate for Rapid River production area is lower than that estimated for subbasin and IDFG anadromous planning (IDFG 1992).

The three forms of reproduction curve show similar plots for the three years (figures 7 to 9), and suggest to us a fairly high variation in brood year survival between years. Within a two-fold range of escapements, the preliminary data for BY 89-91 do little to define an underlying density dependent function. In addition to between-year variation in survival, these plots may contain the following sources of error:

1) Measurement error - we may not be accurately aging or identifying parr, or we may be counting different proportions of actual parr numbers in our sections between years. Some parr may be concealed, but we assume all parr are counted within a section. Age 1-to-age 2 survival rates >100% (see below) suggest we are making some error in aging, identifying, or counting.

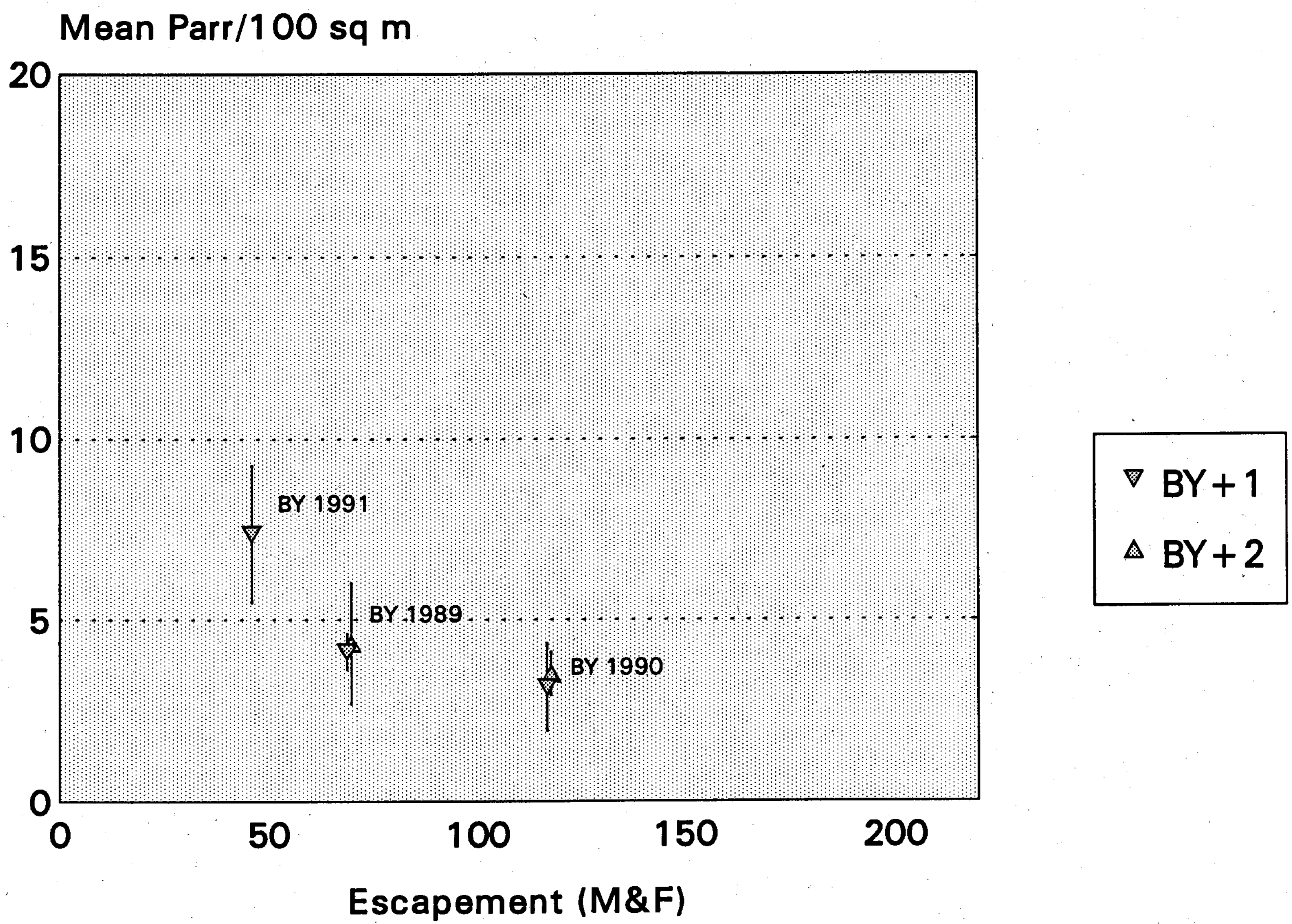

Figure 7. Plot of total escapement (males and females) with estimated mean parr densities. Data are for Rapid River wild A-run steelhead trout, BY 1989-91; bars are 90% confidence intervals.

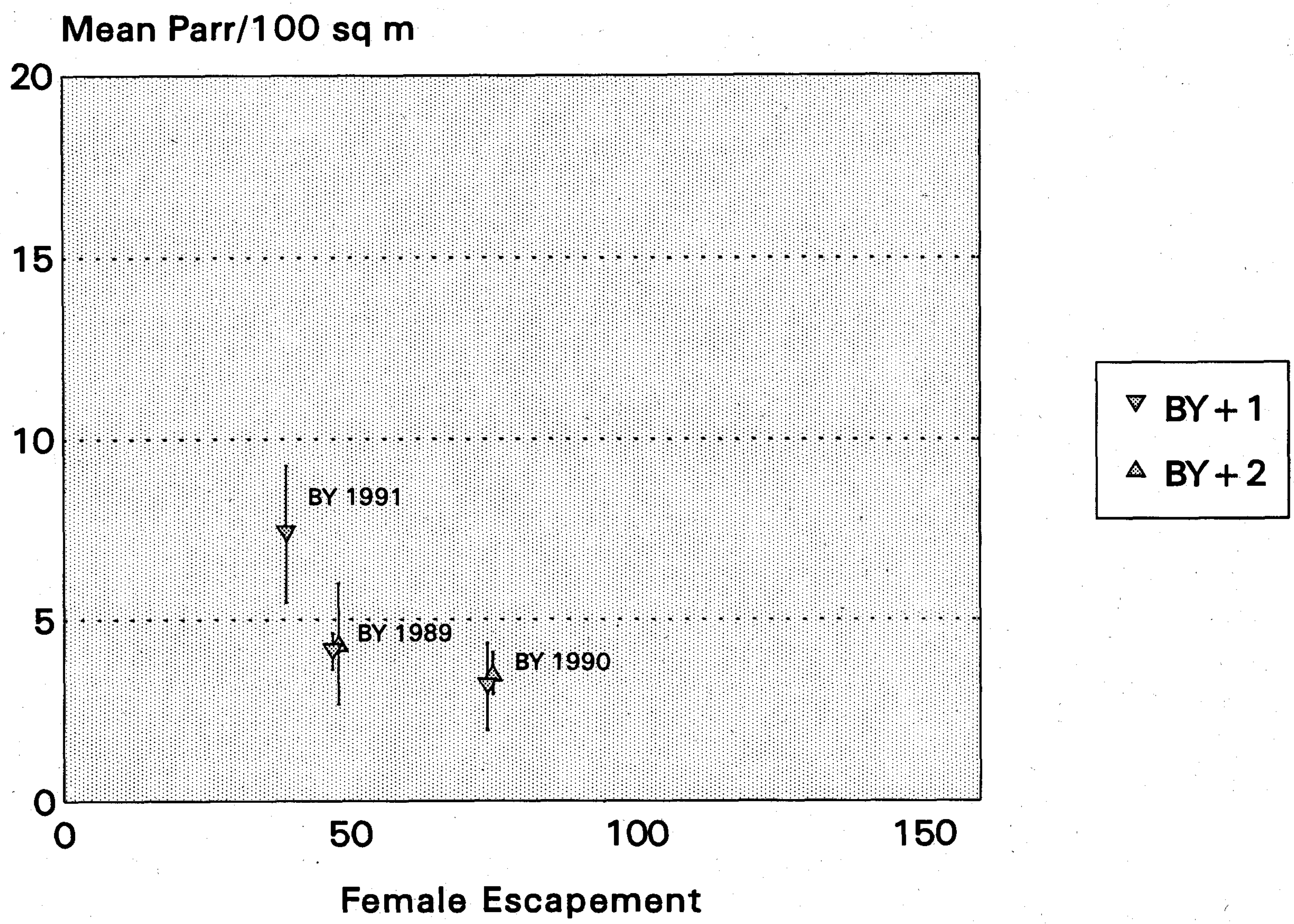

Figure 8. Plot of female escapement with estimated mean parr densities. Data are for Rapid River wild A-run s trout, BY 1989-91; bars are 90% confidence intervals.

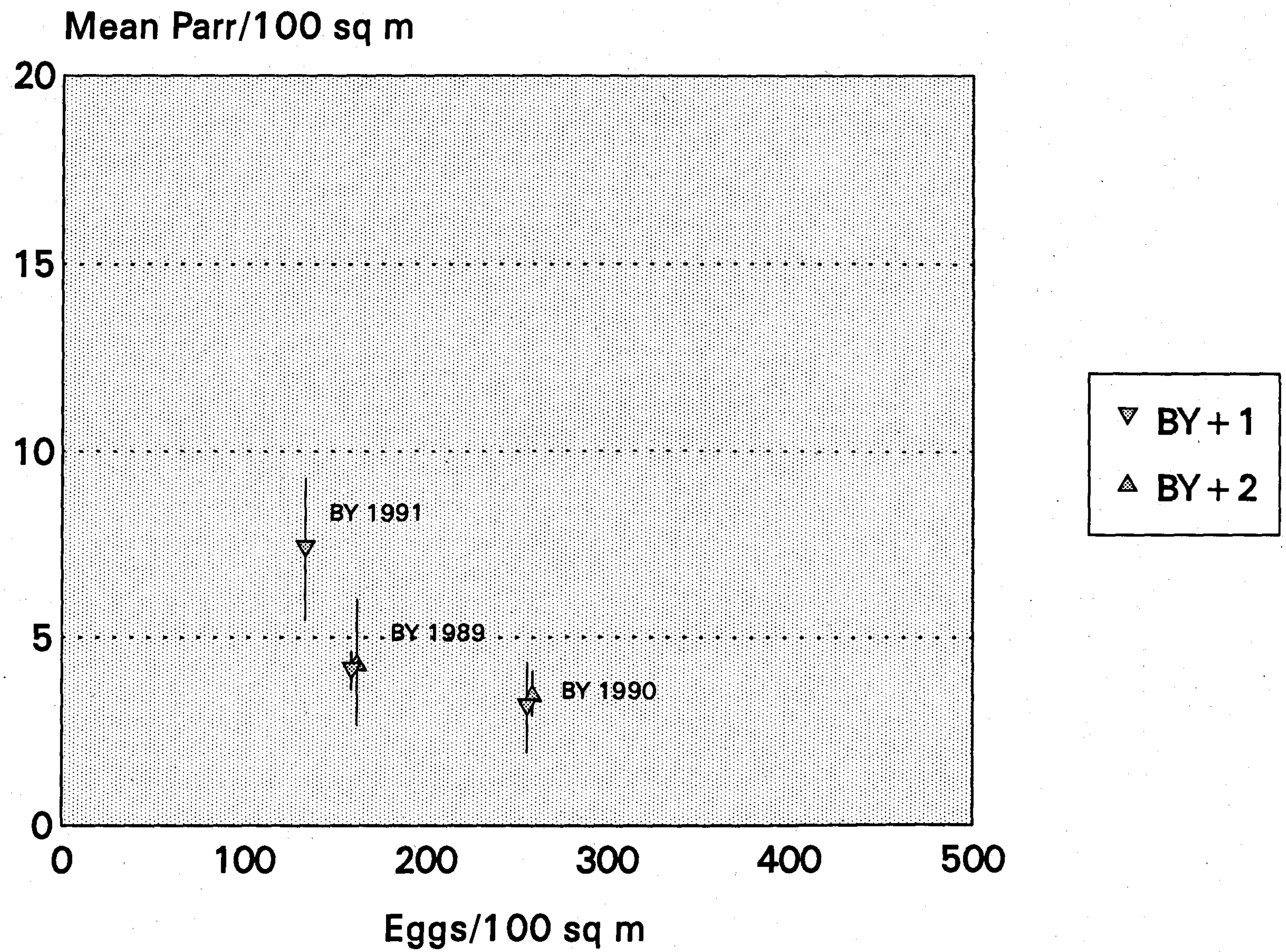

Figure 9. Plot of estimated egg densities with estimated mean parr densities. Data are for Rapid River wild A-run steelhead trout, BY 1989-91; bars are 90% confidence intervals.

We dismiss misidentification of parr as cutthroat trout and resident rainbow trout trout are rarely observed in the drainage.

2) Sampling error - we will quantify this in the future for average parr densities using ANOVA. Our CVs for age 1 and age 2 parr were less than 60% over all years (Table 22). Sampling was done at similar times of the year but not at identical locations.

3) Migration - parr may be moving out of the drainage before we count them. This would affect our results if different proportions moved between years. Downstream parr movement has been documented in the Upper Salmon River (Kiefer and Lockhart 1993). We may use downstream migrant traps to quantify parr movement in the future. We note parr cannot move up into the drainage due to the velocity barrier.

4) Measurement error - inaccurate counts of adults, mismeasurement of size, or misidentification of sex. We dismiss these sources of error.

5) Inaccurate assumptions - assumed adult ages-at-length, fecundities, prespawn mortality rates, and percent egg retention may be incorrect. However, despite the form of escapement data used, plots were similar in shape. This implies that these assumptions may not be too critical in developing reproduction curves.

We do not believe BY 89-91 escapements fully seeded Rapid River. PCC for combined age 1 and 2densities averaged less than 55% over all years. Further, assuming 1.0 redds/female and 10.3 mi of available spawning habitat, the 1989 escapement would have produced 4.6 redds/mi, the 1990 escapement 7.2, and the 1991 escapement 3.8; these are generally less than those observed in Joseph Creek, Oregon (range 7.1-22.0 redds/mi; Rich et al. 1992).

Egg-to-Parr Survival Rates

Rapid River Wild A-Run Steelhead Trout

From BY 89-91 steelhead trout females counted at the Rapid River weir and resulting 1990-92 average age 1 densities, egg-to-age 1 survival rates ranged from 1.2 to 5.5% (Table 21; Rich et al. 1993). Assuming no pre-spawn mortality and all females spawned completely, total egg deposition ranged from 236,362 to 451,410, resulting in egg densities ranging from 133.9 to 255.8 eggs/100 m^2.

This assumes a total production area of 176,500 m^2 and would include the mainstem above the weir to Paradise Creek and a small portion of the West Fork below the falls. Snorkeling by USFS personnel in mid-August 1991 revealed no steelhead trout in Paradise Creek or in the mainstem above the mouth of Fry Pan Creek, which is just upstream from Paradise Creek (Mike Radko, USFS, unpublished data). We feel the best estimate of production area will ultimately be derived from their extensive habitat mapping data set. Production area estimates will be revised as mapping data are finalized.

Table 22. Sample statistics for steelhead parr densities, 1990-92. Age 0 densities may include cutthroat trout. Age designations are based on size groups (0.0-2.9 in = Age 0; 3.0-5.9 in = Age 1; 6.0-8.9 in = Age 2).

Stream	STH/WCT 0			STH 1			STH 2			Age 1-Age 2
	x	CV (%)	n	x	CV (%)	n	x	CV (%)	n	Survival (%)
1990										
Rapid River	0.35	217	1	4.12	27	15	3.33	26	15	--
1991										
Rapid River	0.03	283	8	3.14	57	8	4.34	58	8	105
Rush Creek	1.93	147	1	1.34	79	14	0.96	62	14	--
Running Creek	2.67	188	2	1.96	117	23	0.84	134	23	--
1992										
Rapid River	2.02	130	1	7.37	50	12	3.51	32	12	112
Rush Creek	0.55	166	1	2.63	140	12	0.73	105	12	54
Running Creek	1.32	130	1	3.42	120	18	0.76	102	18	39
Chamberlain Creek	5.39	134	27	3.35	64	27	0.88	66	27	--

An unknown sampling error of parr density is indicated by the preliminary estimates of age 1-to-age 2 survival that exceeded 100% for the 2 years of data (Table 21). The most likely explanations include error in age assignment or counting. Presently, we have assigned parr to age groups based on length-frequency assumptions rather than scale analyses. Scale sample analysis is progressing to address this possible source of error. Snorkel counts possibly underestimate parr densities (Hillman et al. 1993). A consistent counting bias between age groups would not affect the age 1-to-age 2 survival estimate. However, a greater tendency to underestimate abundance of smaller parr would inflate this survival estimate.

Future Sampling Considerations

The number of years of time series data necessary to define reproduction curves will depend largely on the range of observed escapements, variation in brood year survival, as well as accuracy and precision of the escapement and parr density estimates. The range of observed escapements used to develop the curves can be broadened by aggregating data from several streams and thereby taking advantage of the between-stream variation in spawner density. However, escapements greater than recently observed will be necessary to define a density-dependent response for wild populations. Manipulation of escapement might be considered in the future.

The potential difficulty of operating the proposed weirs to obtain complete counts of steelhead trout spawners suggests the need to develop escapement estimation techniques (with associated variances) for this species in the event that total counts cannot be obtained. Large velocity barriers that would assure total count data are not appropriate at most sites due to their wilderness locations. Total counts for chinook salmon adults should be possible at these sites, however.

Snorkel counts are the most practical method of indexing juvenile chinook salmon and steelhead trout abundance, especially in backcountry areas, and are widely used throughout Idaho anadromous production areas (Rich et al. 1993). Snorkel counts potentially underestimate parr abundance, especially at lower temperatures during late summer and fall (Hillman et al. 1993). Other comparisons of snorkeling and electrofishing methods did not demonstrate this negative bias, however (Petrosky and Holubetz 1987; Hankin and Reeves 1988). Continued adherence to a July 1 to August 21 time window for parr sampling can reduce this potential bias. Field records of time and water temperature may also prove useful as covariates to adjust the snorkel counts.

Determination of steelhead trout parr length-at-age from scale analysis should be continued. Verification of ages using length-frequency distributions, marking known-age fish, or analyzing otoliths should also be attempted. It is reasonable to assume that there is some variation in growth rates throughout this species range in Idaho. Again, field records of time and water temperatures may prove useful as covariates.

Parr migration into and out of the study areas can be expected at all proposed study streams (Kiefer and Lockhart in press). Accounting for this factor will be especially important for weirs located higher in the drainages (e.g., Marsh, Chamberlain and West Fork Chamberlain creeks).

A primary objective of developing reproduction curves is to extrapolate results from the study streams to other drainages to refine escapement management objectives. Potential effects of sample bias and variance should be considered primarily in the context of the potential influence on the need to extrapolate results to other drainages. While a consistent bias may be very important to the absolute life stage survival estimates, it may be unimportant in a relative sense. For example, while the estimated egg-to-parr survival is highly sensitive to bias in parr abundance estimates, the estimated egg deposition required for a density-dependent response may be insensitive to that bias, if the magnitude of error is similar at all seeding levels. A focus on the intended use of the information gathered from the weir studies will be extremely important in future development of this project.

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