IDAHO HABITAT & NATURAL PRODUCTION MONITORING: PART I

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INTRODUCTION

The Idaho Department of Fish and Game (IDFG) has been monitoring and evaluating proposed and existing habitat improvement projects for rainbow-steelhead trout Oncorhynchus mykiss and chinook salmon O. tshawytscha in the Clearwater River and Salmon River drainages (Figure 1) on a large scale for the past 8 years (Table 2). Projects included in the evaluation are funded by, or proposed for funding by, the Bonneville Power Administration (BPA) under the Northwest Power Planning Act as off-site mitigation for downstream hydropower development on the Snake and Columbia rivers. This evaluation project is also funded under the same authority (Fish and Wildlife Program, Northwest Power Planning Council [NPPC]).

A mitigation record is being developed using increased carrying capacity and/or survival as the best measures of benefit from a habitat enhancement project. Determination of full benefit from a project depends on completion or maturation of the project and presence of adequate numbers of fish to document actual increases in fish production. The depressed status of upriver anadromous stocks has precluded measuring full benefits of any habitat project in Idaho. Partial benefit is credited to the mitigation record in the interim period of run restoration.

Agency and tribal roles for implementation, monitoring, and evaluation of Idaho habitat projects were established in the 1985 BPA Work Plan (BPA 1985). Project implementors have the major responsibility for measuring physical habitat and estimating habitat change. To date, Idaho habitat projects have been implemented primarily by the U.S. Forest Service (USFS); the Shoshone-Bannock Tribes (SBT) have sponsored three projects (Bear Valley Mine, Yankee Fork, and East Fork Salmon River projects). IDFG implemented two barrier removal projects (Johnson Creek and Boulder Creek) that the USFS was unable to sponsor at that time. The role of IDFG in physical habitat monitoring is primarily to link habitat quality or habitat change to changes in actual and potential fish production.

Estimation of anadromous fish response to BPA habitat projects in Idaho is generally the responsibility of IDFG (BPA 1985). However, the SBT have primary responsibility for developing the mitigation record for the three projects that they have sponsored.

Approaches to monitor habitat projects and document a record of credit were developed in 1984-1985 (Petrosky and Holubetz 1985, 1986). The IDFG evaluation approach consists of three basic integrated levels: parr density monitoring, parr standing stock evaluations, and estimation of survival rates between major freshwater life stages (egg, parr, smolt) of chinook salmon and steelhead trout. The latter is referred to as "intensive studies." Annual general monitoring of anadromous fish densities in a small number of sections for each project is being used to follow population trends and define seeding levels. For most projects, standing stock estimates of parr will be used to estimate smolt production based on survival rates from parr to smolt stages. Intensive studies (Kiefer and

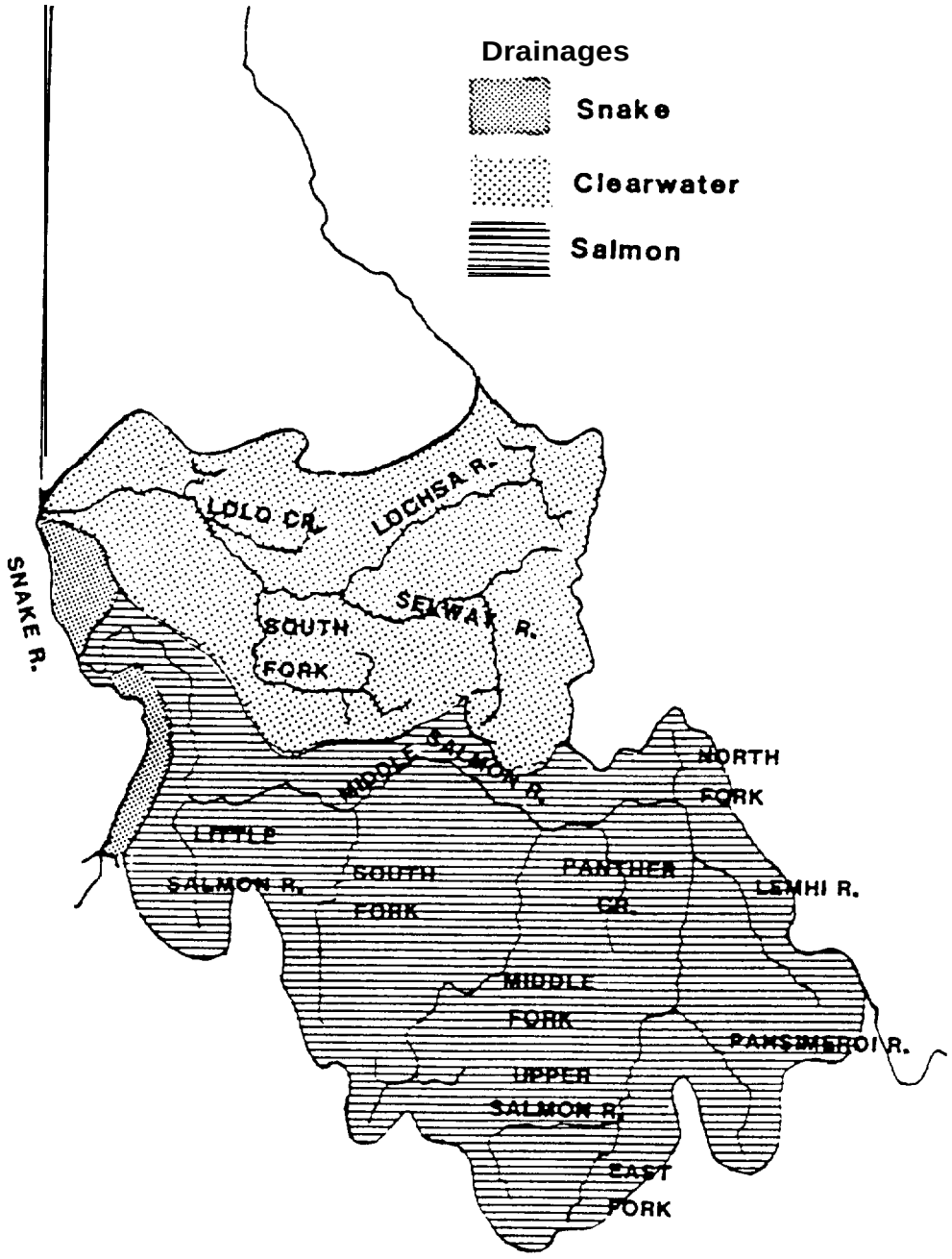

Figure 1. Idaho's remaining anadromous fish production waters showing major drainages of the Clearwater, Salmon, and Snake river subbassins.

Forster 1990) estimate survival rates from egg-to-Parr and parr-to-smolt and provide other basic biological information that is necessary to evaluate the Fish and Wildlife Program.

A physical habitat and parr density database has been developed for BPA habitat projects in Idaho. The data will be integrated among the three evaluation levels. The schedule of BPA habitat project implementation and IDFG general monitoring-evaluation activities from 1983-92 is presented in Table 1. A complete mitigation record can be made when three conditions are met: 1) the habitat project is completed or at full maturation; 2) the fish population affected is observed at full seeding, or a full seeding level has been determined for the affected habitat type; and 3) the appropriate survival rates from summer parr stage to smolt stage have been determined from the intensive studies. Although most fish populations have not approached full seeding, the general and intensive monitoring results provide inferences into effectiveness of habitat projects and the status of wild/natural anadromous fish in Idaho.

After a habitat enhancement project has been implemented and prior to the time that the aforementioned conditions have been met, IDFG has constructed a partial mitigation record based on estimated increases in parr and smolt production. Monitoring data are essential to establish trends and estimate partial benefits during the years that project evaluations are not conducted.

The long-term direction of this project, beginning in 1991, has been to monitor success of the Fish and Wildlife program in Idaho's Salmon River, Clearwater River, and Snake River subbasins at increasing production of wild and natural salmon and steelhead trout by improving flow/passage conditions and through other production enhancement activities. With this direction, habitat project benefits will continue to be monitored secondarily to overall production.

In 1992, the general monitoring and evaluation project focused on:

1) General density monitoring;
2) Estimates of BPA habitat project benefits;
3) Comparisons of densities and percent carrying capacities between wild and natural populations of both steelhead trout and chinook salmon;
4) Estimates of chinook salmon and steelhead trout total abundance and egg-to-parr survival in Rapid River based on known adult escapements;
5) Total abundance estimates of steelhead trout and chinook salmon in other candidate weir streams (Rush, Running, Chamberlain creeks);
6) Correlation of chinook salmon and steelhead trout redd densities with subsequent parr densities;
7) Comparisons of anadromous fish populations at different levels of sedimentation and riparian degradation; and
8) Comparisons of densities in sections treated and not treated with instream structures in Red River.

Results of 1992 monitoring in Rapid River (Task 4) and candidate weir streams (Task 5) are reported separately by Schrader and Petrosky (in press).

Table 1. Schedule of Bonneville Power Administration project implementation (I) and evaluation activities (P = pretreatment evaluation, M = monitoring, and E = post-treatment evaluation) in Idaho, 1983-92.

Drainage, Project	Project type[a]	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992
Clearwater River											
Colt Creek	PA				I	M	M	M	M	M	M
Crooked Fork Creek	PA		I,P	I,P	E	E	E	E	M	M	M
Crooked River	PA		I,P	M	E	M	M	E	E	M	M
	IS		I,P	I,P,M	E	M	M	M	E	M	M
	OC		I,M	I,M	I,E	I,M	I,E	E	E	M	M
Eldorado Creek	PA		I,P	I,M	E	M	M	M	M	M	M
Lochsa River (Upper)	IS	I	I,E	M	M	M	M	M	M	M	M
Lo10 Creek	IS	I	I,P,E	E	M	M	M	M	E	M	M
Meadow Creek	PA					I,M	M	M	M	M	M
Red River	BC	I	I,M	M	M	M	M	M	M	E	M
	IS	I,M	I,M	I,M	E	M	M	M	M	E	E
	RR										
Salmon River											
Alturas Lake Creek	IF		P	M	M	P	P	P	P	P	P
Boulder Creek	PA		P	I,P	E	M	E	M	M	M	M
Lemhi River	IF			P	M	M	M		M	M	M
Panther Creek	SP		P	M	M	M	M	M	M	M	M
Pine Creek	PA					I,M	M				
Pole Creek	PA	I	M	M	M	E	E	E	E	E	M
	RR		M	P	M	P	M	M	M	M	M
Salmon River (Upper)	IF		P	P	M	P	P	P	P	P,M	P,M
	RR		M	P	M	P	P	P	P	P,M	P,M
Valley Creek	RR			P	M	M	M	M	M	M	M
	PA			P	M	M	I,M	M	M	M	M
Salmon River, Middle Fork											
Bear Valley Creek	SP		I,P	I,P	1.M	M	M	M	M	M	M
	RR		M	P	P	M	I,M	I,M	M	M	M
Camas Creek	RR		M	M	M	M	1.M	M	E	M	M
	BC		M	M	M	M	M	E	E	M	M
Elk Creek	RR		M	P	P	M	I,M	I,M	M	M	M
Knapp Creek	PA		M	P	M	I,M	M	M	M	M	M
Loon Creek	co			M	H	M		M	M	M	M
Marsh Creek	RR		M	P	M	M	M	M	M	M	M
Sulphur Creek	co		M	M	P	M	M	E	M	M	M
Salmon River, South Fork											
Do1 lar Creek	PA				I,M	M	M	M	M	M	M
Johnson Creek	PA		I,P	I,E	I,E	E	E	M	E	M	M

[a] BC = bank-channel rehabilitation
co = control stream
IF = improved flows
IS = instream structure
OC = off-channel developments
PA = passage
RR = riparian revegetation
SP = sedimentation and pollution control

TABL92

METHODS

Project 91-73 (formerly 83-7) has been monitoring parr densities in stream sections within the Clearwater River and Salmon River drainages since 1984. Only data from 1985 on are reported in this publication because of the small number of stream sections sampled in 1984 (the initial year of the project). Additionally, the IDFG fisheries research section and regional fisheries programs have monitored parr densities in stream sections in coordination with this project, 50 that parr densities are being monitored in all major anadromous fish production areas of Idaho. Other current contributors to the monitoring data set include the U.S. Fish and Wildlife Service's Fishery Resource Office in Ahsahka and the Nez Perce Tribe. The number of sections monitored annually since 1984 is shown in Table 2.

Phvsical Habitat

Monitoring sections provide an annual index of anadromous fish abundance in different habitat types and drainages. Monitoring section5 average approximately 100 m in length with boundaries at defined breaks between habitat types; sections included at least one riffle-pool sequence. Streams, project strata, and sections were cross-referenced to the Environmental Protection Agency (EPA) reach numbering system (NPPC and BPA 1989). Sections monitored in 1992 are listed in Appendix A-l.

Physical habitat variables were standardized and measured at least once since 1984 in each established density monitoring section and in most other sections used in habitat project evaluations. The physical habitat variables other than width and length were not measured every year in each section due to time constraints (Parr densities in all sections need to be sampled within a 2-month period from late June to late August) and because the physical habitat was relatively stable from year to year. The same physical variables were measured in the parallel IDFG-funded monitoring program. IDFG has encouraged other agencies and tribes to incorporate this standardized variable list (Appendix D) into their monitoring programs. More intensive physical habitat monitoring for BPA habitat projects in Idaho is carried out by Project 84-24 which incorporates these standardized variables.

Physical habitat variables measured in each section were percent of pool, run, riffle, pocket water, and backwater; percent of substrate surface sand, gravel, rubble, boulder, and bedrock; section length, average width and depth, gradient, and channel type (Rosgen 1985). The techniques used to collect the physical habitat data are described in Petrosky and Holubets (1988) and Scully et al. (1990). Physical habitat data collected during 1984-92 were summarized by channel type. This variable simultaneously categorizes aeveralmorphological characteristics and was used as a primary classification to compare composition of habitat types and substrate within and between streams and to investigate chinook salmon and steelhead trout rearing potential and population response to sedimentation.

Table 2. Number of sections where steelhead trout and chinook salmon parr were monitored in Idaho by BPA project 91-73 and other management and research programs from 1984 through 1992.

Year	Number of steelhead trout sections	Number of chinook salmon sections[a]
1984	60	37
1985	184	139
1986	190	156
1987	225	178
1988	225	175
1989	268	216
1990	349	243
1991	315	241
1992	334	241

[a] Chinook salmon sections are a subset of the steelhead trout sections.

The physical habitat database is being used in conjunction with data collected by project implementors to develop the mitigation record for BPA habitat projects. Quantity and quality of habitat added and improved are estimated primarily by project implementors. Actual and potential production of steelhead trout and chinook salmon parr attributable to each project are estimated using relationships developed from this database.

We classified the monitoring sections according to two major channel types (Rosgen 1985) and compared parr density trends within these channel types. Scully and Petrosky (1991) demonstrated the effect of channel type on both steelhead trout and chinook salmon parr densities. A comparison of parr densities in B and C channels showed that chinook salmon densities were 3.5 times higher in C channels, while steelhead trout densities were 2-3 times higher in B channels. B channels are confined in valleys or canyons and have high enough gradient that most fine materials are flushed out. A significant part of the substrate composition may be comprised of boulders larger than 30 cm diameter. C channel streams, in contrast, meander through flat alluvial valleys and are characterized by deposition of fine materials and low velocities. Substrate composition in C channels has a high percentage of small materials (sand and gravel). In unstable watersheds, sand may be the predominant substrate type in C channels. In general, our C channel sections had gradients less than 1.5%, while B channel sections had gradients in excess of 1.5%.

Parr Density Monitoring

In 1984-92, the BPA general monitoring and intensive monitoring subprojects established a total of 166 monitoring sections to index the annual abundance of steelhead trout and chinook salmon parr in BPA habitat project streams. Steelhead trout parr are defined here as age 1+ and age 2+, with respective lengths of 8-15 cm (3.0-5.9 in) and 15-23 cm (6.0-8.9 in). The steelhead trout length-at-age intervals are similar to those defined by Thurow (1987). Chinook salmon parr are age 0+, with lengths less than 10 cm (4 in). These data, and data from the parallel IDFG-funded monitoring program, were used to index trends in annual abundance, estimate rearing potential in different habitats, and develop relationships between adult escapements and juvenile fish densities. Mitigation benefits are being determined in part from density trends and habitat-fish relationships developed from this database.

Most anadromous fish production streams in Idaho are clear and have low conductivity. In these streams, snorkel counts by trained observers are preferred for efficiency over estimates obtained from electrofishing. Comparisons of snorkel counts and electrofishing estimates in typical Idaho anadromous streams (Petrosky and Holubetz 1987) demonstrated that direct observation is an excellent method of surveying salmon and steelhead trout parr populations. Hankin and Reeves (1988) presented similar evidence for Western Oregon streams. We obtained density estimates by snorkeling in all sections, except those in the highly conductive and slightly turbid Lemhi River, which we electrofished. The field fish population data form we use for snorkeling surveys is presented in Appendix D; survey methods were presented in Petrosky and Holubetz (1986).

We snorkeled the monitoring sections with a team of divers working upstream. Crew size ranged from one for small streams to five or more for larger streams. The combined programs monitored sections in 105 streams, representing a variety of stocks, production types, and habitats. We compared parr densities among all major anadromous fish drainages in Idaho during 1985-92, and summarized steelhead trout and chinook salmon parr densities by year and production type (wild or natural). Because of the preference of steelhead trout for B channels and chinook salmon for C channels, parr density comparisons among drainages incorporated only the preferred channel type for each species. We analyzed A-run and B-run steelhead trout separately because of large differences in Columbia River harvest rates and escapements between the two runs (TAC 1991).

We also estimated parr density as a percent of carrying capacity (PCC) derived from standardized smolt capacity ratings developed for subbasin planning by the System Planning Group for the NPPC (1986). The parr density database was merged with the NPPC's species presence/absence database using the common variable EPA reach number. The NPPC file rates each EPA reach as being poor, fair, good, or excellent habitat for rearing chinook salmon and steelhead trout smolts. Respective NPPC smolt densities in number/100 m^2 are 10, 37, 64, and 90 for chinook salmon and 3, 5, 7, and 10 for steelhead trout. The NPPC smolt density ratings provide a consistent, though subjective, assessment of habitat quality and smolt carrying capacity within Idaho subbasins. Based on parr densities from this project and a planning value of 50% parr-to-smolt survival, or less (Kiefer and Forster 1991), the NPPC smolt densities appear to be good approximations for steelhead trout, but overestimate capacity for chinook salmon in Idaho streams. NPPC steelhead trout smolt capacity in excellent habitat (10/100 m^2) and 50% parr-to-smolt survival imply a parr density of 20/100 m^2, the same as defined by Petrosky and Holubetz (1988) based on empirical data. NPPC chinook salmon smolt carrying capacity in excellent habitat (90/100 m^2) and 50% parr-to-smolt survival imply a parr density of 180/100 m^2, which is 67% higher than defined by Petrosky and Holubetz (1988) based on empirical data and fry stocking experiments.

We adjusted the NPPC smolt density ratings to parr carrying capacity assuming that excellent steelhead trout habitat would support 20 parr/100 m^2 and excellent chinook salmon habitat would support 108 parr/100 m^2 (Petrosky and Holubetz 1988). We also assumed the same relative density proportions between the NPPC habitat classes of poor, fair, good, and excellent. Thus, respective parr carrying capacity ratings for the four habitat classes were: 6, 10, 14, and 20/100 m^2 for steelhead trout; and 12, 44, 77, and 108/100 m^2 for chinook salmon.

Excellent habitat for chinook salmon would be undisturbed C channel streams, and good habitat would be in undisturbed B channels with moderate gradients. High gradient undisturbed B channels would rate as fair or poor for chinook salmon (Petrosky and Holubetz 1988). For steelhead trout, excellent habitat would be in undisturbed B channels, and good habitat would be in undisturbed C channels. C channels in productive spring-fed streams could also be classified as excellent steelhead trout rearing habitat. Degraded streams received ratings of good, fair, or poor for both species depending on the degree of disturbance and channel type. Because the different habitat types and quality ratings are considered in the carrying capacity rating system, PCC data from both B and C

channel sections are analyzed for both species, unlike the analysis for the parr density statistic.

Parr Densitv Comparisons

We compared steelhead trout and chinook salmon parr densities and PCC among classes and years for 1985-92. Steelhead trout classes were wild A-run, wild B-run, natural A-run, and natural B-run. Chinook salmon classes were wild and natural.

Wild (indigenous) steelhead trout populations in Idaho presently occur in the lower tributaries (below the mouth of the North Fork Salmon River) and Selway River of the Clearwater River drainage; in most small Snake River tributaries and in most small mainstem Salmon River tributaries downstream from the mouth of the **Middle** Fork Salmon River, and in the entire Middle Fork Salmon and South Fork Salmon river5 and in Rapid River, tributary to the Little Salmon River (Figure 2). Areas not listed above were considered in this analysis to have natural (hatchery-influenced) populations.

Wild spring chinook salmon populations in Idaho presently occur throughout the Middle Fork Salmon River drainage and several Salmon River tributaries below the Middle Fork Salmon River. Wild summer chinook salmon occur in the Secesh River, South Fork Salmon River, Middle Fork Salmon River drainage, and Rapid River, as well as in the upper mainstem Salmon River and tributaries, lower Valley Creek, and the lower East Fork Salmon River (Figure 3). Chinook salmon parr rearing in the latter three areas comprise an unknown mix of natural springs and wild summers and were classified as natural populations for this analysis. The remainder of Idaho's chinook salmon waters were also classified here as natural populations. Because sample size was small for summer chinook salmon, we combined spring and summer chinook salmon and compared only wild and natural classes.

For steelhead trout, the statistic PCC used the density of age l+ and age 2+ steelhead trout parr relative to maximum density that could occur in the section. The PCC statistic may be most appropriate for comparing relative status of populations because it incorporates an estimate of the carrying capacity. Differences in channel type, gradient, stream size, and sediment level are accounted for, in part, by the rating. Because the PCC for steelhead trout includes both age l+ and age 2+ parr, it may mask annual differences resulting from adult escapement from two brood years.

The best **index of steelhead trout escapement is probably the age 1+ parr** density in B channels. In underseeded conditions as occur in most of Idaho's **anadromous fish** waters, **sufficient B channel habitat exists to support the age** l+ steelhead trout parr and few are forced into the less desirable C channel habitat. Also, unlike age 2+ parr, none of the age l+ cohort would have **previously smolted.**

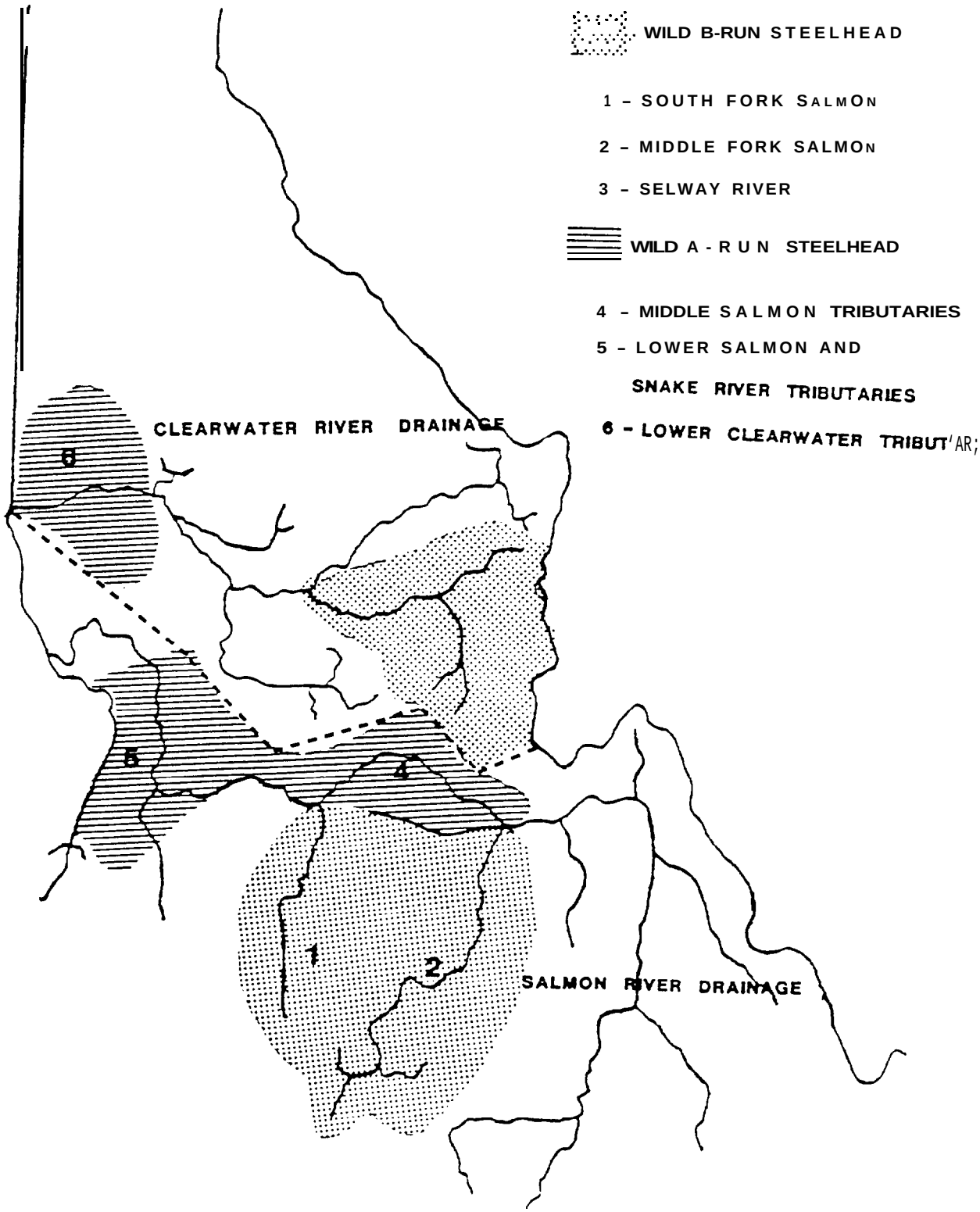

Figure 2. Present distribution of wild A-run and B-run steelhead trout production areas in Idaho.

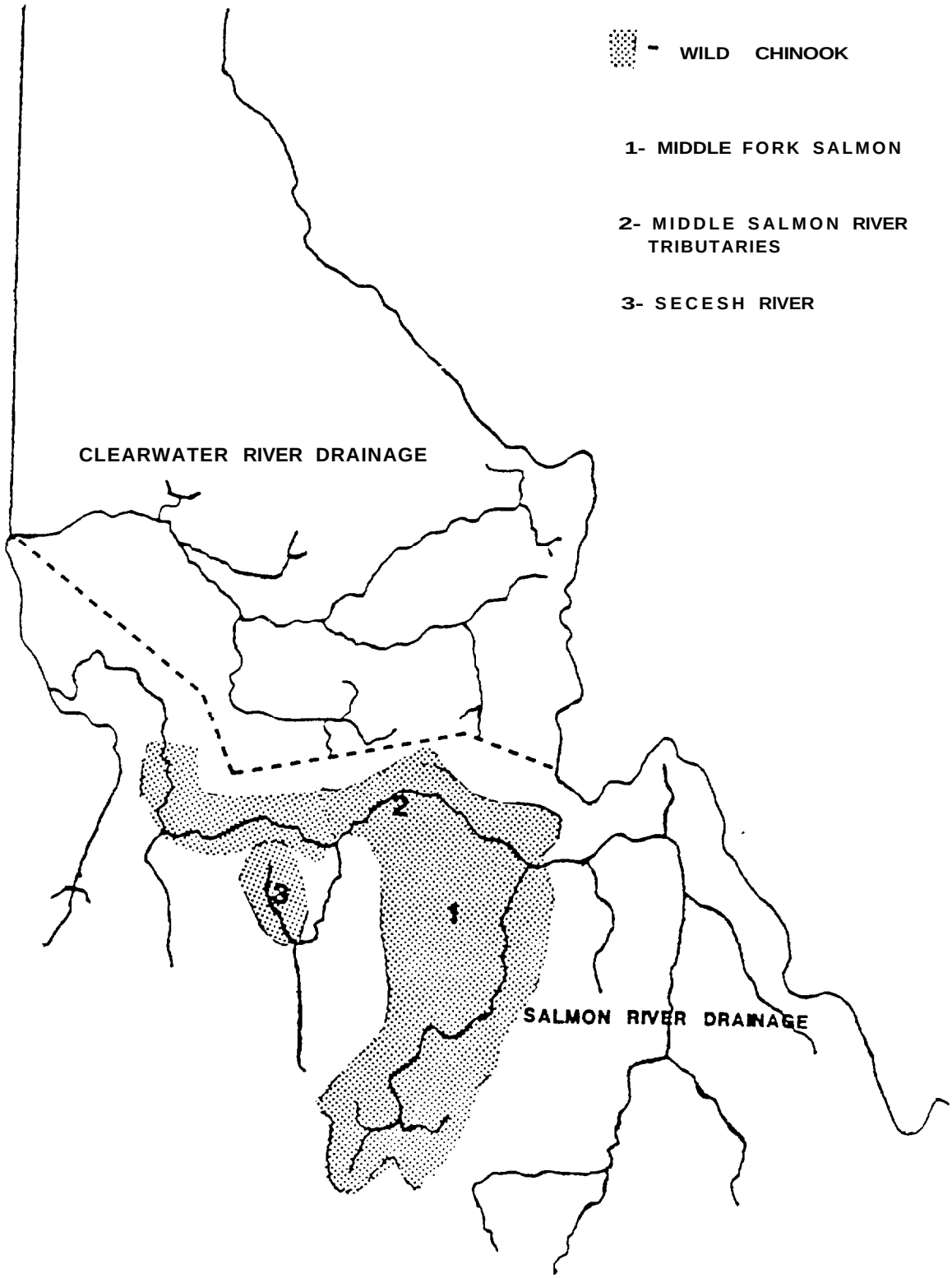

Figure 3. Present distribution of wild chinook salmon production areas in Idaho.

For chinook salmon, both parr density and PCC are for a single age class (age 0+) and brood year. Thus, the best overall index may be PCC rather than density in C channels because PCC has a larger sample size, incorporating both B and C channel sections. At extremely low escapements, relatively fewer chinook salmon parr and a smaller PCC would be expected in the less preferred B channel habitat.

The appropriate model to test for effects of class and year, for monitoring data in fixed sections, is a one-way analysis of variance with repeated measures on years. We have been unable to run the repeated measures to date because SYSTAT (Wilkinson 1988) deletes all data from observations from sections with missing values. Scully and Petrosky (1991) approximated the effects of class and year with a two-factor analysis of variance for 1985-89 parr density monitoring data. Future analyses will require development of a statistical method to approximate the missing values for use in the repeated measures model. If missing data are determined to be in patterns, stepdown procedures (variation of MANOVA) will be used. If missing data are random and not excessive, the EM algorithm (Expectation Maximization) will be used (K. Steinhorst, University of Idaho, personal communication).

Anadromous Fish Introductions

The 1984-89 chinook salmon and steelheadtrout releases into BPA project and monitoring streams are summarized in Scully and Petrosky (1991). Chinook salmon fry stockings by this project were discontinued in 1990 due to poor adult escapement in 1989. The new supplementation research project (89-098) will evaluate future hatchery chinook salmon introductions.

Reproduction Curves

Columbia River Basin system planning documents (NPPC 1986) assume smolt production in rearing habitat to have a density-dependent relationship with brood year (BY) adults in the form of a Beverton-Holt function (Ricker 1975). As redd or egg densities increase, smolt (or parr) densities increase to an asymptote (carrying capacity).

We have developed generalized reproduction curves (Ricker 1975) for chinook salmon using redd densities and parr densities (Scully and Petrosky 1991); we have also collected comparable data for steelhead on a feasibility basis. In 1991 and 1992, we scoped potential locations to build weirs to more accurately measure escapement and juvenile production of both species (Schrader and Petrosky, in press). Our goal is to represent a range of stocks and drainage types.

Chinook Salmon Redd Counts and Parr Densities

Scully and Petrosky (1991) compared 1985-89 densities of age-O+ chinook salmon from Salmon River streams to 1984-88 densities of redds in IDFG spawning ground survey reaches. The data set included only a few observations that approached carrying capacity. Because 1989-91 redd densities and resultant 1990-92 parr densities were low, these data contributed little to further development of this reproduction curve.

Steelhead Trout Redd Counts and Parr Densities

Development of steelhead trout reproduction curves comparable to those for chinook salmon has been impossible due to lack of established steelhead trout redd counts in Idaho. In 1990, Project 91-73 personnel began conducting single peak redd counts in several Clearwater River and Salmon River streams to relate subsequent yearling parr densities to indexed escapements. Primary objectives are to determine: 1) if redd counts correlate to known numbers of spawners; 2) if single peak counts are sufficient to index spawning escapement; 3) if parr densities correlate to redd densities; 4) if accurate redd counts could be made in most years; and 5) in how many years and under what conditions can we expect to miss counts.

We will begin evaluating these objectives next year, at which time we will have three seasons of redd count data (BY 1990-92) and two seasons of subsequent age 1 parr density data. Rich et al. (1992) found a significant relationship (ANOVA, $F = 29.391$, $p < 0.001$) between redd density (using ground counts) and yearling parr density (using electrofishing) in the Joseph Creek, OR, drainage.

Partial Project Benefits

Partial project benefits were estimated from 1985 through 1989 according to the project-specific approaches in Petrosky and Holubetz (1986) and reported by Scully and Petrosky (1991). Partial project benefits for 1985 through 1992 are reported in Appendix B.

Four general types of habitat improvement projects have been evaluated: barrier removals, off-channel developments, instream structures, riparian revegetation, and sediment reduction. Barrier removals and off-channel developments were evaluated by estimating the population of affected anadromous salmonids which reared upstream of the barrier removal site or within the off-channel developments. Total abundance was estimated by stratified random or systematic sampling (Cochran 1965). In years when total abundance was not estimated directly, densities in the affected areas were monitored at one or more snorkeling sections per project, and monitored densities were expanded to population estimates using procedures described in Scully and Petrosky (1991).

While long-term monitoring of habitat improvement projects will continue, intensive evaluations of habitat projects will be suspended as the project evolves to place more emphasis on natural production monitoring and less on habitat mitigation evaluation.

Barrier Removals

We did not intensively evaluate any of the barrier removal projects in 1992, however, historical monitoring data for mitigation accounting purposes are in Appendix B.

Instream Structures

During 1983 and 1984, Clearwater and Nez Perce National Forest personnel began placing structures in Crooked River, Red River, and Lolo Creek to improve habitat that was degraded from mining, logging, and grazing activities. During the 5 years following these structure placements, the IDFG monitored control and treated stream sections to evaluate project benefits in terms of increased parr densities.

In some years and streams, a larger number of replicate sections were sampled to analyze responses of parr densities to instream structures within a given year (Petrosky and Holubetz 1985, 1986, 1987). Scully and Petrosky (1991) analyzed, with repeated measures of analyses of variance, monitoring data replicated annually from 1985 through 1988 from control and treatment sections in two strata (stream reaches) each from Crooked River, Lolo Creek, and Red River.

In 1990, we compared densities in sections treated and not treated with instream structures in Lolo Creek and Crooked River. We selected treatment and control sections in close proximity and increased sample size (Lo10 Creek, 24 treatment and 8 control sections; Crooked River, 13 treatment-control pairs of sections) to reduce variance and increase the power of the tests to detect differences (Rich et al. 1992).

In 1991, we compared densities of several classes of both chinook salmon and steelheadtrout parr (as well as other fish species and select habitat variables) at various treatment/type sections and in paired adjacent control sections. Variance of historical treatment and control data from Red River was used to determine the sample size necessary to have a reasonable chance of detecting statistical differences in densities at treatment vs. control sites. We determined that given historical data, we would need 55 treatment/control (T/C) pairs in order to have an 80% chance of detecting a 30% or greater difference in fish density between the two stream section types. We snorkeled 55 T/C pairs (110 sections) and analyzed the data using paired **t** tests based on the following variable/transformation/model list:

log $\bar{y}_1$ - log $\bar{y}_2$ = difference and,

% difference = difference in logs / log lower y

Variables tested were:

BIOLOGICAL
- STHDlD - number of age l+ steelhead trout/100 m^2
- STHD2D - number of age 2+ steelhead trout/100 m^2
- STHDl2D - number of age l+ AND 2+ steelhead trout/100 m^2
- CHINOD - number of age 0+ chinook salmon/100 m^2
- CHINlD - number of age l+ chinook salmon/100 m^2
- CUTD - number of cutthroat trout (any age)/100 m^2
- BRTD - number of brook trout (any age)/100 m^2
- WHFD - number of mountain whitefish (any age)/100 m^2

PHYSICAL (HABITAT)
- DEPTH - mean depth (m) of section
- POOL - percentage of section classified as pool habitat
- RUN - percentage of section classified as run habitat
- POCW - percentage of section classified as pocket water habitat
- RIFFLE - percentage of section classified as riffle habitat
- BACW - percentage of section classified as backwater habitat
- SAND - percentage of substrate classified as sand
- GRAV - percentage of substrate classified as gravel
- RUBL - percentage of substrate classified as rubble
- BOLD - percentage of substrate classified as boulder
- BEDR - percentage of substrate classified as bedrock

In 1992, another intensive evaluation of instream structures was conducted at Red River with the same methodology but approximately half the effort (27 treatment and 29 control sections).

Riparian Revegetation and Sediment Reduction

In 1987, the Boise National Forest began a project (84-24) to reduce sediment recruitment and revegetate the riparian zone of Bear Valley/Elk Creek in conjunction with improved grazing management (Andrews and Everson 1988). Degradation from cattle grazing is the primary habitat problem in this drainage (OEA 1987). The restoration is expected to be slow and hinges on achievement of improved grazing management. We are evaluating the success of this work, in part, in terms of increased parr density in this drainage relative to densities in control drainages. Concurrently, Project 84-24 has monitored aquatic habitat and riparian conditions both pre- and post-implementation (Andrews, in press).

Benefits from sediment reduction/riparian revegetation projects will be analyzed after completed projects have matured and the physical habitat has responded to the changes. Pretreatment data document the low parr density and

low egg-to-parr survival in heavily sedimented streams when compared to undisturbed control streams in the same drainage. When parr density and egg-to-parr survival improve in response to the projects, comparisons will be made to determine if significant improvements have occurred in the ratio of parr density in sedimented streams to control streams and in the egg-to-parr survival of treated streams. Because of the time lag between treatment and habitat response, analyses to date are limited to comparisons between streams with different sediment levels and riparian conditions.

Database Management and Statistical Analvses

All biological and some physical habitat data from 1985 through 1992 were entered into dBase III+ files for easy access and arrangement for various analyses. These files are available for use by project implementors, tribes, and natural resource agencies upon request.

Summary statistics, analysis of variance, and regressions were done with the statistical software SYSTAT (Wilkinson 1988), LOTUS 123 v-3.0, or SAS (SAS Institute). Statistical differences were considered significant at probabilities less than 0.10.

RESULTS AND DISCUSSION

Substrate Sand and Wild Parr Densities

From 1985 through 1991, chinook salmon and steelhead trout parr densities were lower in the heavily sedimented Bear Valley/Elk Creek (BVC/EC) drainage of the Middle Fork Salmon River than in control stream sections of the Middle Fork Salmon River drainage. The controls were similar to the BVC/EC sections in terms of channel type (C) and wild fish management, but the control drainages were not grazed by cattle. Chinook salmon and steelhead trout parr densities averaged 10 and 20 times higher, respectively, in the control sections than in BVC/EC sections (Figure 4). The differences were significant ($p < 0.001$) for each species. Surface substrate sand in the BVC/EC and control sections averaged 46% and 20%, respectively (Appendix A-4).

Chinook salmon and steelhead trout parr densities declined in 1992 in the seven control sections as did chinook salmon parr densities in the BVC/EC sections. Steelhead trout parr density in the BVC/EC sections increased in 1990-92 (Figure 4).

According to the IDFG Five-Year Anadromous Fish Management Plan, 1992-96 (IDFG 1992) the priority for the habitat program is to obtain suitable mainstem Snake and Columbia River hydroelectric project velocity conditions for juvenile

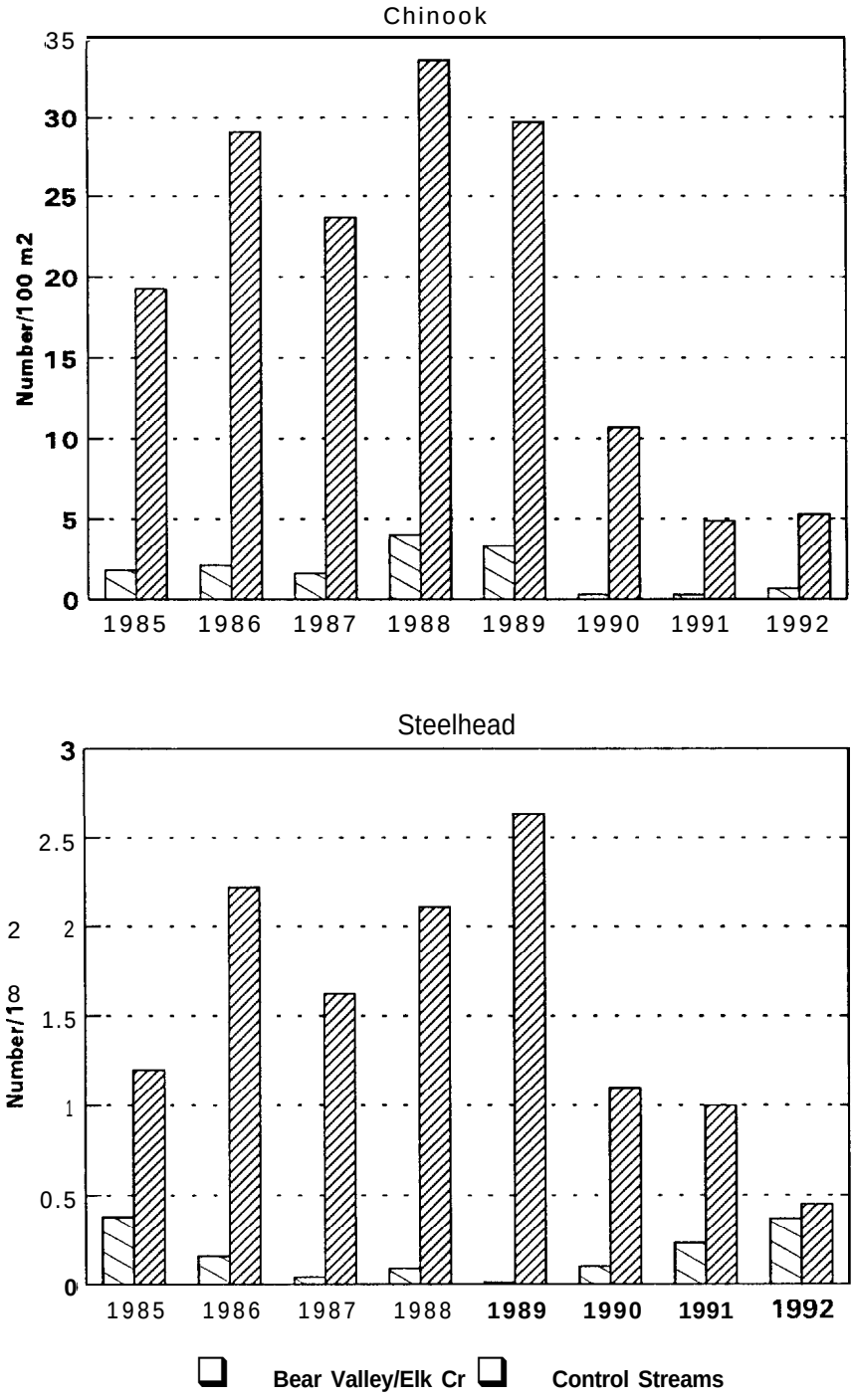

Figure 4. Average annual densities of chinook salmon and steelhead trout parr in the heavily-sedimented Bear Valley/Elk Creek drainage and Middle Fork Salmon River control streams.

salmon and steelhead trout migration. Improved migration velocities are a prerequisite for success of habitat restoration projects, because mainstem survival is the bottleneck for survival. Exceptions include areas where fine sediment also limits egg-to-smolt survival, such as the South Fork Salmon River and the BVC/EC drainage. In these areas, restoring critical habitat that limits early life history survival is also a priority.

Parr Density Monitoring

Steelhead Trout Parr

The lowest mean densities for age l+ steelhead trout parr in 1992 were for natural A-run in the Upper Salmon River (cell 8) at 0.2/100 m^2 and wild B-run production areas of the Middle Fork Salmon River (cell 2) at 0.7/100 m^2 (Table 3). The highest mean densities were for the lightly supplemented Snake River tributaries (natural A-run cell 10) at 9.7/100 m^2 followed by the Lochsa River (natural B-run cell 4) at 6.7/100 m^2, and wild A-run in the Snake River (cell 12) at 6.4/100 m^2. Statewide, age 1+ steelhead trout parr densities in 1992 were similar to those in 1991.

Percent Carrying Capacity-Parr monitoring in 1985-92 demonstrated depressed levels of some steelhead trout populations. Wild A-run steelhead trout density in 1992 averaged 37% of rated carrying capacity, and has declined since 1988. Wild B-run averaged 9% of rated carrying capacity (Figure 5, Table 4). Natural (hatchery-influenced) A-run and B-run steelhead trout PCC were intermediate to those of wild A and B-run8 during 1985-92.

Steelhead trout PCC in 1992 was similar to that in 1991 for all classes. Most classes have fluctuated in a similar manner annually and shown mild or no declines overall through the period, while the wild A runs have shown an overall decline with a sharp drop from 1990 through 1992, when PCC was at its lowest value for the period. The recent addition (1991) of monitoring sections in the lower Selway (wild B run) and lower Lochsa (natural B run) rivers influenced the means for those cells (1 and 4). Steelhead trout PCC in the recently added monitoring streams (Fire and Split creeks in the Lochsa River drainage, and Gedney Creek in the Selway River drainage) averaged higher than in established areas. Statistical comparisons of annual and run type differences in PCC will be made after we resolve the problem with missing observations in SYSTAT repeated measures models.

Age l+ Density in B Channels-Comparisons among run types and years of age l+ steelhead trout parr densities in preferred B channel habitats were similar to those reported for PCC. Wild A-run and wild B-run densities show the greatest separation, with mean annual densities of wild A-run steelheadtrout consistently three to eight times higher than densities of wild B's, even in 1991-92 after the sharp decline in wild A-run densities (Figure 6, Table 4).

Table 3. Average percent carrying capacity (PCC) for ages 1+ and 2+ steelhead trout in all monitoring sections and densities (number/100 m^2) of age 1+ steelhead trout parr in B channels, 1992.

Class, Cell	Average PCC	(n)	Average Age l+ density in B channels	In)
Wild B-run				
1. Selway River	19	(23)	2.1	(23)
2. Middle Fork Salmon River	6	(55)	0.7	(16)
3. South Fork Salmon River	9	(30)	1.6	(15)
Natural B-run				
4. Lochsa River	46	(22)	6.7	(21)
5. South Fork Clearwater River	48	(52)	6.2	(24)
6. Lolo Creek	16	(10)	2.8	(6)
Natural A-run				
7. Little Salmon River, Hazard Creek, Slate Creek and the East Fork Salmon River (A-run streams with B-run or A- and B-run supplementation histories)	36	(13)	5.7	(11)
8. Upper Salmon River	3	(83)	0.2	(51)
9. Eastern Salmon River tributaries (Pahsimeroi, Lemhi and North Fork Salmon rivers)	29	(18)	4.2	(9)
10. Snake River tributaries of Captain John and Granite creeks; and the Little Salmon River tributary of Boulder Creek	69	(6)	9.7	(6)
Wild A-run				
11. Middle Salmon River tributaries of Bargamin, Sheep, Chamberlain and Horse creeks	25	(12)	2.1	(10)
12. Snake River tributaries of Sheep and Wolf creeks; lower Clearwater River tributary of Big Canyon Creek lower Salmon River tributary of Whitebird Creek; and the Little Salmon River tributary, Rapid River	50	(10)	6.4	(10)

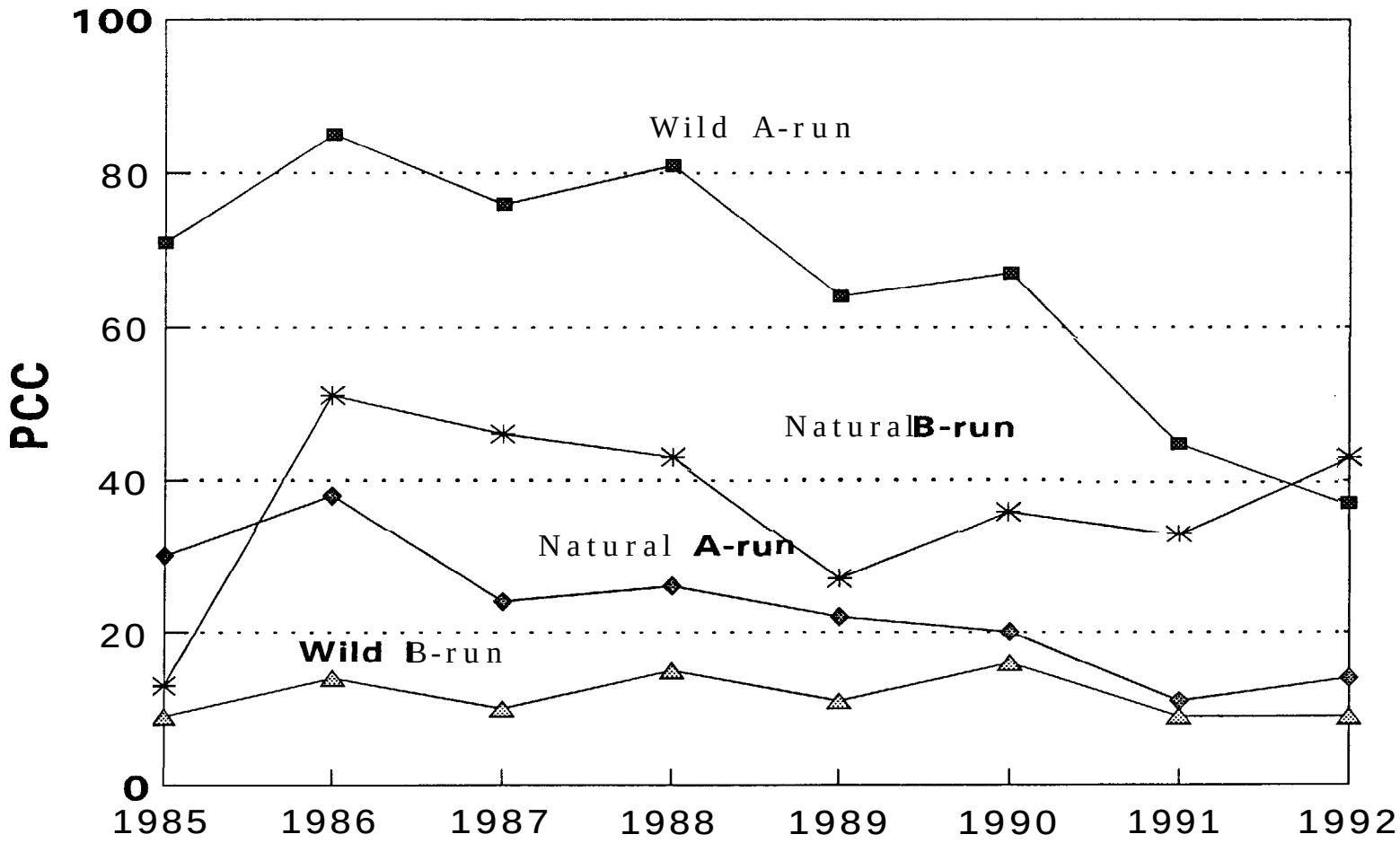

Figure 5. Mean annual percent of carrying capacity of four classes of steelhead trout parr (age 1 + and 2 +) in Idaho, 1985-92

Table 4. Mean percent of rated carrying capacity (PCC) of age 1+ and age 2+ steelhead trout parr, and density of age 1+ steelhead trout parr in B channels, by class and year, 1985-92.

Summary	Class[1]	1985	1986	1987	1988	1989	1990	1991	1992	Mean	SD
PCC	WA	71	85	76	81	64	67	45	37	65.8	15.8
	WB	9	14	10	15	11	16	9	9	11.6	2.7
	NA	30	38	24	26	22	20	11	14	23.1	8.1
	NB	13	51	46	43	27	36	33	43	36.5	11.4
B-channel Density	WA	5.9	9.7	7.9	10.3	8.4	8.8	4.7	4.2	7.5	2.1
	WB	1.7	2.1	1.2	2.2	1.7	1.9	1.3	1.5	1.7	0.3
	NA	4.6	7.2	2.7	4.8	3.2	3.3	1.7	2.2	3.7	1.7
	NB	0.9	5.7	4.6	6.1	3.3	6.2	3.3	6.0	4.5	1.8

[1] WA = wild A, WB = wild B, NA = natural A, NB = natural B.

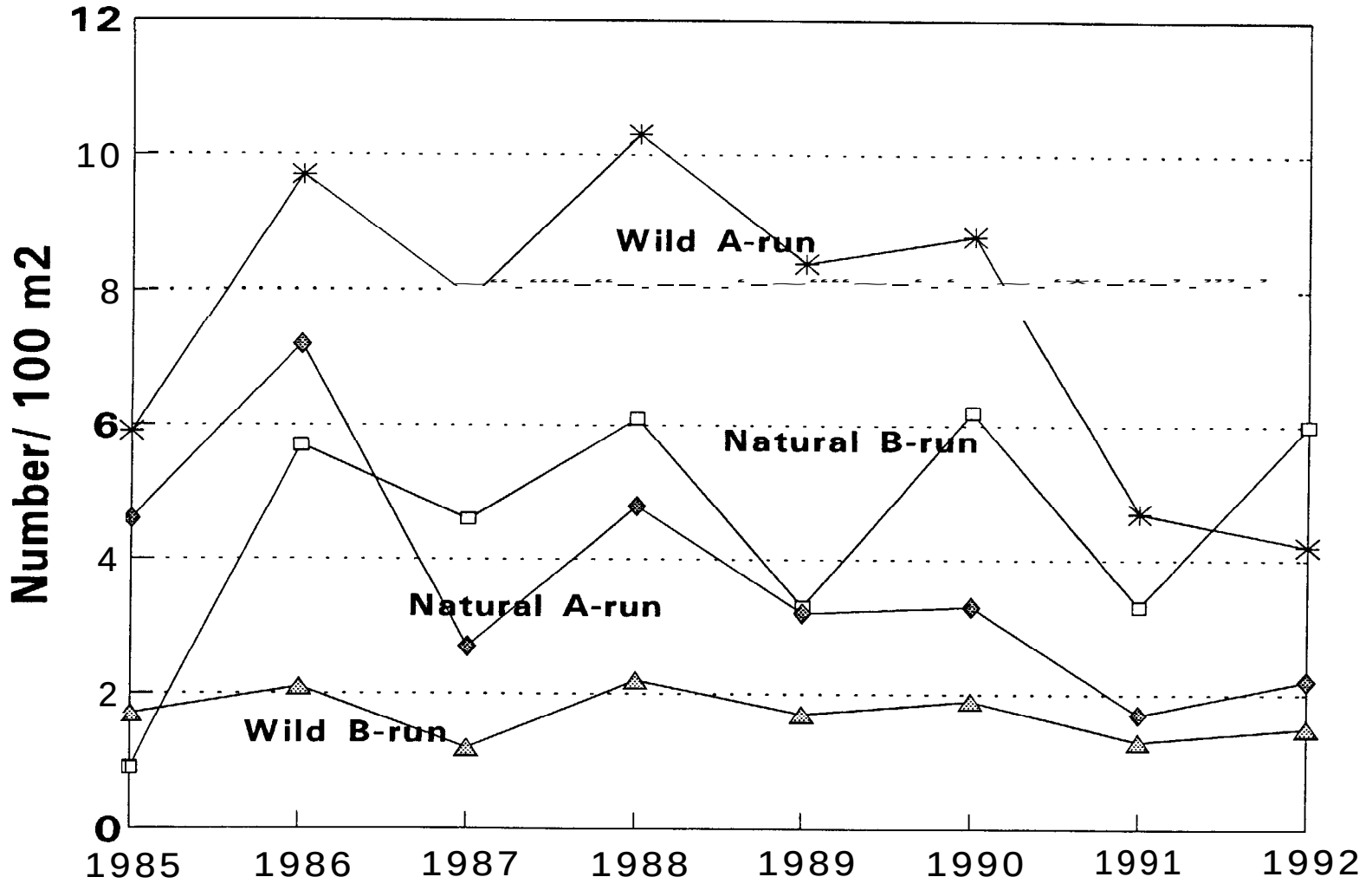

Figure 6. Mean annual density (number of age 1 + steelhead trout/l00m2) of four classes of steelhead trout parr in Idaho, 1985-92.

Chinook Salmon Parr

In 1992, wild and natural chinook salmon parr densities remained extremely low in all areas (Table 5). Statewide, chinook salmon parr densities in 1992 were similar to those in 1990, and only slightly higher than in 1991.

Percent Carrvinu Caoacity-Parr monitoring in 1985-92 demonstrated depressed levels of chinook salmon populations. In 1992, wild spring and summer chinook salmon density averaged only 6.0% of the rated carrying capacity (Table 6, Figure 7). Natural spring and summer chinook salmon PCC averaged 4%.

Chinook salmon PCC in 1990-92 was considerably lower than in 1985-89, reflecting poor escapements in 1989-91. Mean PCC was higher for natural chinook salmon than for wild chinook salmon in all years except 1992 (Figure 7).

As with steelhead trout, statistical comparisons of annual and production type differences in PCC will be made following resolution of the problem with missing observations in the repeated measures model. Again, some levels shown for natural production areas were artificially elevated by annual fry outplants prior to 1990.

Ase 0+ Densitv in C Channels-Chinook salmon parr densities in preferred habitat (C channels) have generally mirrored the PCC estimates for all monitoring sections (Table 6, Figures 7-8), although in 1992 wild chinook salmon densities exceeded those of natural runs for the third time during the 1985-92 monitoring period.

Chinook salmon parr density in C channels in 1992 averaged only 6/100 m^2, slightly higher than in 1991.

Reproduction Curves

Chinook Salmon Redd Counts and Parr Densities

None of the parr density data points in 1990-92 approached a fully-seeded condition, and they added little to the relationship developed by Scully and Petrosky (1991). The relationship has been well anchored at the origin.

Table 5. Percent carrying capacity (PCC) for chinook salmon parr in all monitoring sections and density (number of fish/100 m^2) of chinook salmon parr in C channels, 1992.

Class, Cell	Average PCC	(n)	Average Age 0 density in C channels	(n)
Wild (Spring)				
1. Middle Fork Salmon River (Without Bear Valley/Elk Creek)	9	(35)	10.2	(23)
2. Salmon River canyon tributaries (without Chamberlain Basin)	1	(12)	--	(0)
4. Chamberlain Basin	11	(6)	20.7	(2)
5. Rear Valley/Elk Creek	1	(16)	0.4	(15)
Wild (Summer)				
3. Middle Fork Salmon, Secesh and upper Salmon rivers	4	(7)	6.8	(3)
Natural (Soring)				
6. Upper Salmon River	5	(49)	5.4	(20)
7. Pahsimeroi, Lemhi, North Fork Salmon rivers and Panther Creek	10	(11)	21.9	(20)
9. Little Salmon River	4	(11)	--	(0)
10. Selway River	1	(21)	--	(0)
11. Lochsa River	0.3	(16)	1.5	(1)
12. South Fork Clearwater River	3	(32)	3.2	(14)
13. Lo10 Creek	4	(7)	9.0	(1)
Natural (Summer)				
8. South Fork Salmon River	5	(18)	5.6	(7)

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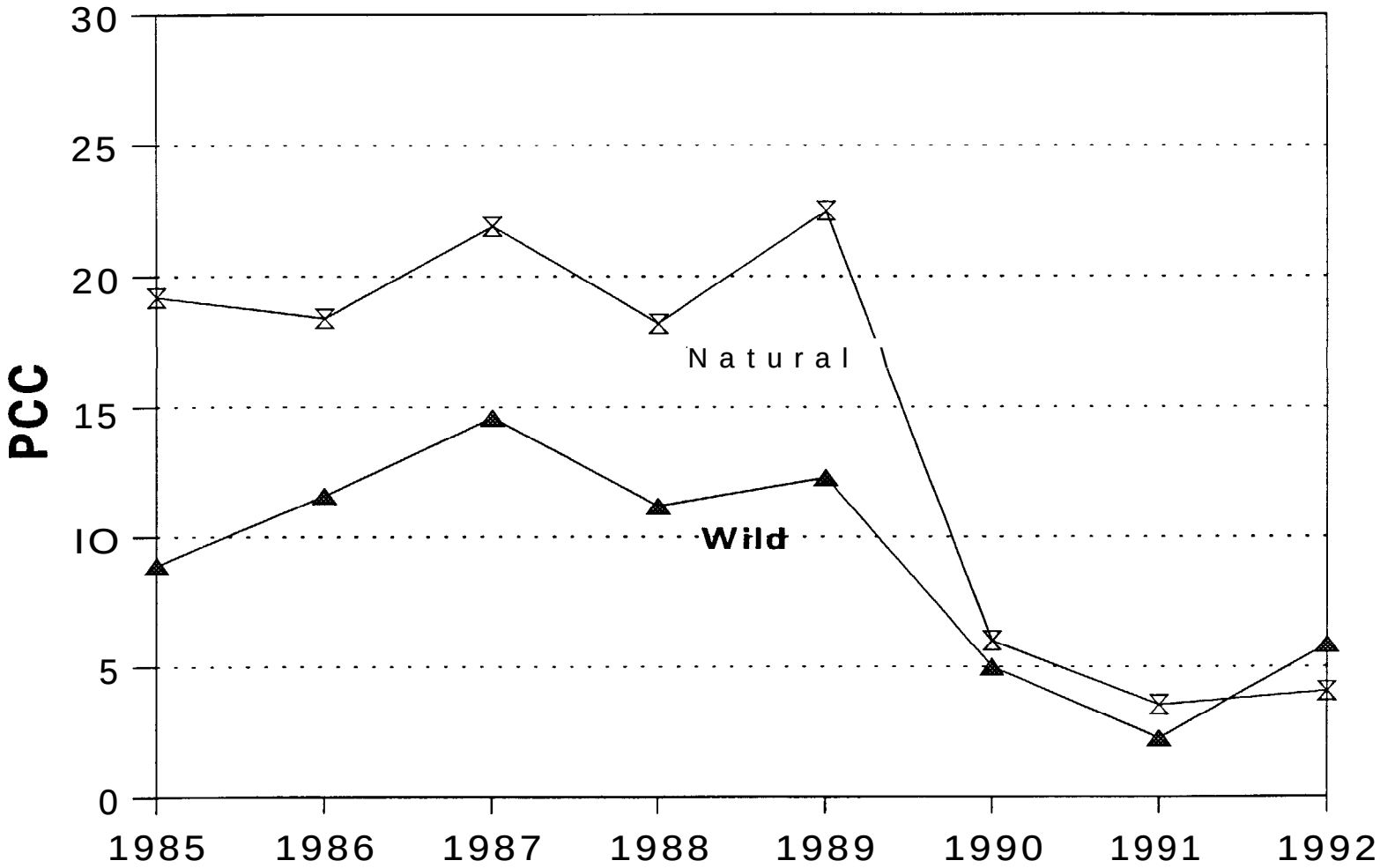

Figure 7. Mean annual percent of carrying capacity of two classes of chinook salmon parr (age 0 +) in Idaho, 1985-92.

Table 6. Mean percent of rated carrying capacity (PCC) of age 0+ chinook salmon parr, and density of age 0+ chinook salmon parr in C channels, by class and year, 1985-92.

Summary	Class'	1985	1986	1987	1988	1989	1990	1991	1992	Mean	SD
PCC	wsp/wsu	9	12	15	11	12	5	2	6	9.0	4.1
	NSp/NSu	19	18	22	17	23	6	3	4	14.0	7.7
C-channel Density	wsp/wsu	13.0	15.4	23.9	16.7	13.9	4.9	3.4	6.6	12.2	6.5
	NSp/NSu	16.2	18.7	21.8	18.5	32.5	6.3	2.7	5.0	15.2	9.4

[a] WSp = wild spring, WSu = wild summer, NSp = natural spring, NSu = natural summer.

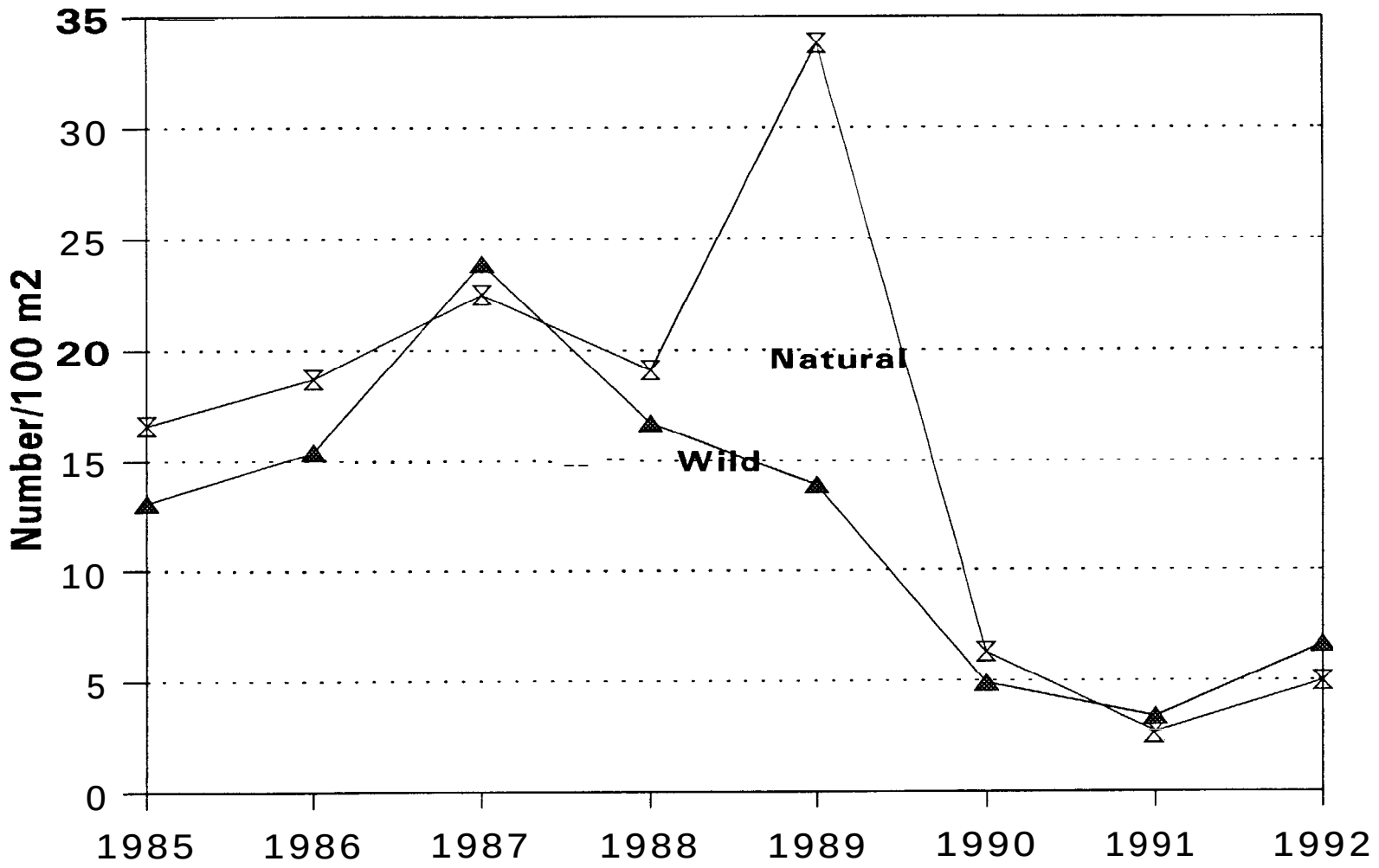

Figure 8. Mean annual density (number/l 00 m2) of two classes of chinook salmon parr (age 0+) in Idaho, 1985-92).

Steelhead Trout Redd Counts and Parr Densities

In 1992, we counted steelheadtrout redds by helicopter in 39 stream reaches (Table 7). All streams sampled except the upper Salmon River and Chamberlain Creek are classified as H-run. Redd densities were artificially high from dropout above and below the Sawtooth Fish Hatchery weir and in the Crooked River Meanders reach from adult outplants (Kiefer and Lockhart, in press). The South Fork Salmon River redd count reaches had the highest redd densities of any drainage (4 to 42/mi; 1 to S/hectare). Redd densities for redd count reaches in all other drainages ranged from 0 to 5/mi (0 to 6/hectare) in 1992 (excluding the Crooked River adult outplant reach) and below the Sawtooth weir.

1992 Habitat Project Evaluations

Barrier Removal

In 1992, no barrier removal projects were evaluated at an intensity level higher than for routine monitoring.

Instream Structures

We sampled 1992 parr densities in sections of Red River treated and not treated (control) with instream structures. We compared densities of several classes of both chinook salmon and steelhead trout parr in various treatment/type sections and in paired adjacent control sections. Variance of historical treatment and control data from Red River was used to determine that 55 pairs of treatment and control sites would be necessary to have an 80% chance of detecting a 30% difference in parr densities.

In 1992, sample sizes were reduced from 1991 levels (29 controls and 17 treatments) due to time constraints, other sampling priorities, and continued low densities of steelhead trout and chinook salmon parr. Densities of age 2+ and combined age 1 and age 2+ steelhead parr were significantly higher in treated sections than in untreated sections in 1992 ($t = 2.59$, $p < 0.05$, and $t = 2.76$, $p < 0.01$)(Figure 9). No differences were detected for chinook salmon parr, age 1+ steelhead trout parr or for resident species.

In 1991, we snorkeled 58 pairs of sections including four major treatment types: log structures (drop logs and K-dams), rock structures (rock weirs, upstream and downstreamV's), boulder placements, and current deflectors (log and rock). The 1991 results when all treatment types were lumped indicated that densities were not significantly different between treatments and controls for any class of steelhead trout or chinook salmon parr (Rich et al., 1993).

Table 7. Steelhead trout redds counted from helicopter in experimental index areas, 1992.

Date	Stream	Reach	Miles	Hectares	Redds	Redds/ mile	Redds/ hectare
South Fork Salmon River							
5/13/91	Salmon River, South Fork	Poverty Flat	1.2	5.62	31	25.8	5.5
	Salmon River, South Fork	Darling Cabin	0.4	1.81	17	42.5	9.4
	Salmon River, South Fork	Oxbow	2.6	14.22	27	10.4	1.9
	Salmon River, South Fork	Krassel	1.8	10.57	8	4.4	0.8
	Johnson Creek	Ice Hole to Clements	3.5	9.80	27	7.7	2.8
Middle Fork Salmon River							
5/14/91	Sulphur Creek	Slide to Ranch	1.6	2.30	4	2.5	1.7
	Sulphur Creek	Ranch to Trail	2.1	3.13	1	0.5	0.3
	Bear Valley Creek	Fir Creek bridge to Poker bridge	2.5	8.59	11	4.4	1.3
	Bear Valley Creek	Poker bridge to Elk Creek	3.1	11.03	15	4.8	1.4
	Marsh Creek	Capehorn bridge to Knapp Creek	2.1	3.02	10	4.8	3.3
	Loon Creek	Falconberry to Rock Creek	3.4	8.88	8	2.4	0.9
	Camas Creek, South Fork	Mouth to 1st Creek on W side	1.3	0.64	4	3.1	6.3
	Camas Creek	West Fork to Duck Creek	1.5	4.96	2	1.3	0.4
	Camas Creek	Duck Creek to Furnace Creek	5.8	19.17	1	0.2	0.1
5/15/91	Big Creek	Cougar Creek to Cave Creek	3.4	15.54	***	***	***
Upper Salmon River							
5/14/91	Valley Creek	Stanley Creek bridge to Mouth	5.6	13.97	26	4.6	1.9
	Upper Salmon River	Redfish Lake Creek to weir	1.7	7.00	26	15.3	3.7
	Upper Salmon River	Weir to Hell Roaring Creek	10.3	41.55	12	1.2	0.3
	Upper Salmon River	Hell Roaring Creek to Alturas Lake Creek	5.8	21.59	17	2.9	0.8
	Upper Salmon River	Alturas Lake Creek to Busterback diversion	4.6	6.28	0	0.0	0.0
	Upper Salmon River	Busterback diversion to Highway 93 bridge	7.7	7.47	0	0.0	0.0
	Salmon River, East Fork	Germania Creek to weir	5.3	10.52	0	0.0	0.0
	Salmon River, East Fork	Weir to Herd Creek	9.5	25.83	IO	1.1	0.4
Salmon Canyon							
5/15/91	Chamberlain Creek	Flossie Creek to West Fork	2.5	3.70	1	0.0	0.0
	Chamberlain Creek, West Fork	Mouth to Game Creek	2.6	1.98	3	1.2	0.2
South Fork Clearwater River							
5/15/91	Crooked River	Canyon to bridge	2.3	3.73	3	1.3	0.8
	Crooked River	Bridge to Orogrande	3.0	4.06	1	0.3	0.2
	Crooked River	Mouth to weir	0.1	0.16	2	20:o	12.3
	Crooked River	Weir to meanders	0.9	1.49	8	8.9	5.4
	Crooked River	Meanders	1.0	1.82	5	5.0	2.7
	Crooked River	Meanders to narrows	0.6	1.13	1	1.7	0.9
Selway River							
5/15/91	Running Creek	Mouth to Eagle Creek	2.1	4.00	0	0.0	0.0
	Bear Creek	Mouth to Cub Creek	5.5	19.16	0	0.0	0.0
	Bear Creek	Cub Creek to Squaw Creek	5.3	10.40	4	0.8	0.4
Lochsa River							
5/15/91	Crooked Fork Creek	Mouth to Highway 12 bridge	6.8	24.10	7	1.0	0.3
	Crooked Fork Creek	Highway 12 bridge to Shotgun Creek	5.0	13.58	3	0.6	0.2
	Whitesand Creek	Big Flat Creek to Heather Creek	3.8	6.18	20	5.3	3.2
	Storm Creek	0.5 mi below Maud Creek upstream to rock outcrop	5.1	2.51	3	0.6	1.2
	Fish Creek	Hungry Creek to Alder (Ash) Creek	9.1	14.79	3	0.3	0.2
	Hungry Creek	Mouth to Doubt Creek	1.4	1.73	0	0.0	0.0

*** Section not counted due to turbid water condition.

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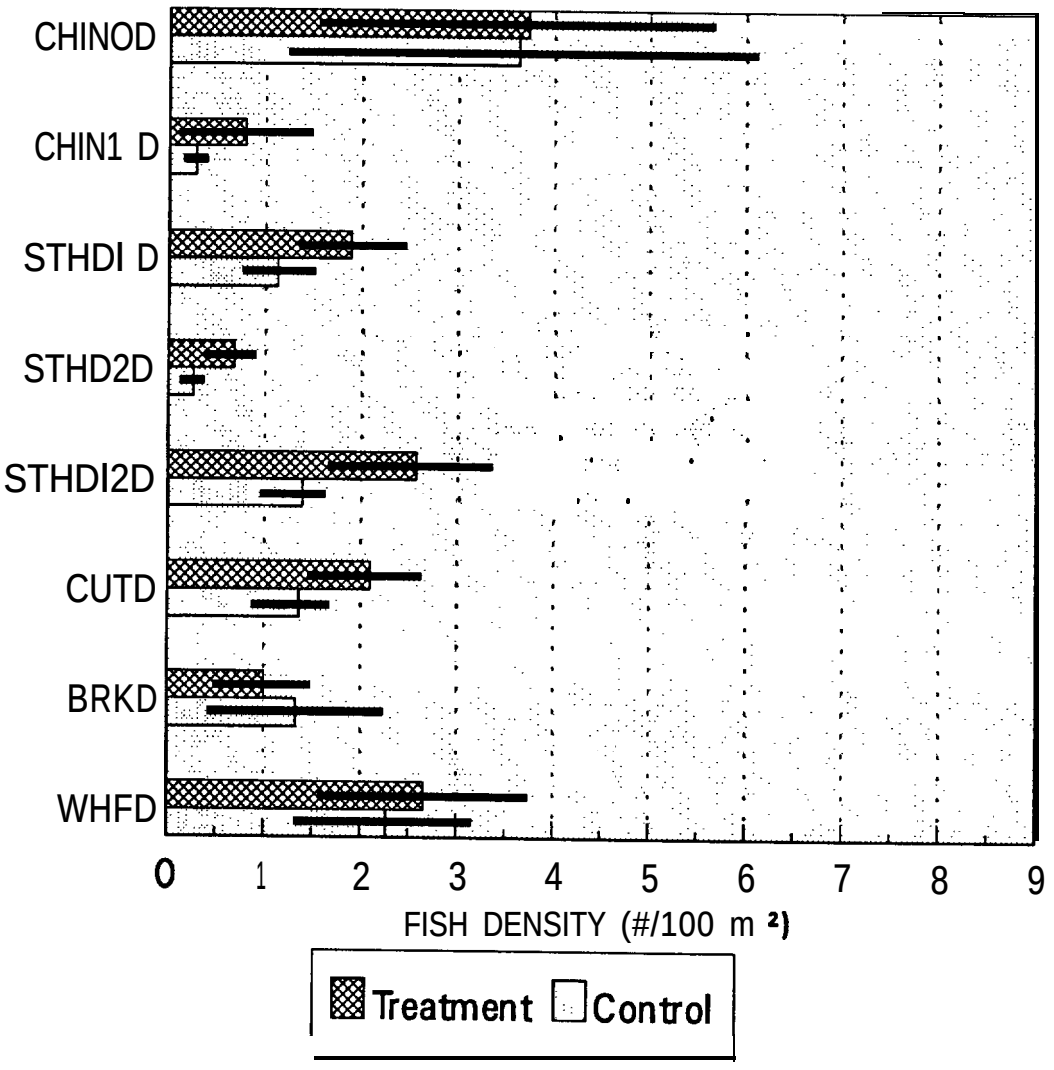

Figure 9. Mean fish class densities and ±2SE for instream structure treatment and control snorkel sections, Red River 1992 (CHINOD = age 0 chinook salmon density; CHIN1 D = age 1 + chinook salmon density; STHD1 D = age 1 + steelhead trout density; STHD2D = age 2 + steelhead trout density; STHD12D = age 1 + and 2+ steelhead trout density; CUTD = cutthroat trout density; BRKD = brook trout density; WHFD = mountain whitefish density).

Testing of chinook salmon deneities in **both 1991 and 1992 was generally difficult due to very low seeding levels and resultant absence of parr in many** treatment and control sectione. This sampling suggested modest benefits at best for **spring chinook salmon and steelhead trout parr due to instream structure projects. However, seeding rates were so low that we may only have observed attraction of parr to structures rather than an increase in production. Also, benefits of structures which create deeper pools with interrupted flow patterns may be more beneficial to parr during winter, for the fraction of the population that wintere in the summer rearing area. For mitigation accounting purposes, we** assumed mean density differences were real even when not statistically significant.

Riparian Revegetation/Sediment Reduction

No riparian revegetation/sediment **removal** projects were evaluated at an intensity level higher than for routine monitoring in 1992.

Partial Project Benefits

The Fish and Wildlife Program has funded habitat enhancement projects in Idaho to increase spawning and rearing potential for steelhead trout and chinook salmon. Projects include barrier removals, off-channel developments, instream structures, and sediment reduction. Although benefits to date are modest, 14 of the 16 projects evaluated had measurable production that was attributed to the enhancement projects through 1989 (Scully and Petrosky 1991). Estimates of Partial Project Benefits were updated through 1992 in this report.

Barrier removals, followed by instream structures, have had the largest **effect on increasing anadromous fish production. Off-channel developments in the form of connected ponds, have very high chinook salmon parr carrying capacity, with observed densities in supplemented ponds in excess of 200/100 m^2. However, the amount of surface area in off-channel developments, thus far created, has been small and total smolt production benefits slight.**

The sediment reduction project on the BVC/EC drainage depends on improved grazing management and will not produce full benefits in terms of reduced sediment and increased egg-to-parr survival for several years. **A slight improvement occurred in 1987-89 in the ratio of chinook salmon parr density for** BVC/EC:control streams; since 1990, however, the ratio declined. These ratios **undoubtedly reflect trends in addition to the habitat project. However, it is clear that production benefits to date have been small.**

Quantification of instream structure benefits has been the **most** difficult. Monitoring of parr densities **in treatment and control sections suggest some project benefits have occurred. More intensive evaluations by this project, especially in 1990 and 1991, have detected some parr densities significantly higher associated with structures than controls, but the majority of differences were not significant (Petrosky and Holubetz 1985, 1986, and 1987; Rich et al.**

1992). Clear-water Biostudies, Inc. (1988) found that age 0+ chinook salmon and age l+ and older steelhead trout parr were generally more abundant in enhanced than unenhanced habitat in Lolo Creek.

It appears that modest density increases have occurred due to the three instream structure project8 in Lo10 Creek, Crooked River, and Red River. The upper Lochsa River instream structure projects had no definable benefits, and its evaluation was ceased. However, it is important to note that it is extremely difficult to differentiate between an increase in actual densities (increased parr production) and mere attraction to instream structures (site specific increased parr concentration). For current mitigation accounting, we have assumed that the density differences are real. These estimates will be revised as necessary based on future evaluations with increased sample size. Scully and Petrosky (1991) estimated benefits as the mean difference in parr density each year between control and treatment sections. The mean differences in parr density were multiplied by the stream surface area in the affected reaches and factored by the estimated Parr-to-smolt survival. This approach probably overestimated instream structure benefits, since we have not yet determined the portion of the reaches that were not affected by the structures; i.e., sections we which would classify as control areas or sections which already had good habitat and were not considered for treatment. However, the amount of area not treated in the instream structure project reaches is very small relative to the area treated.

Kiefer and Forster (1990) determined average parr-to-smolt survival rates of 39% for chinook salmon and 44% for steelhead trout for 1988-90 from the upper Salmon River and Crooked River. During the period when most habitat enhancement projects were mature (1986-92), annual benefits averaged 4,200 steelhead trout smolts (9,600 parr) and 25,000 chinook salmon smolts (65,000 parr)(Appendix Cl and C2). The averages have declined since 1989 (Scully and Petrosky 1991) due to declining escapements.

Maximizing benefits from habitat improvement projects depends on adequate mainstem flows and velocities and good passage survival of smolts in the Snake and Columbia rivers. Determination of benefits in terms of adult returns and economic benefits is beyond the scope of Project 91-73, but will be possible based on these parr and smolt estimates and the future System Monitoring and Evaluation Program data on smolt-to-adult returns to the Columbia River and to Idaho.

The number of parr or smolts attributed to the habitat projects to date is small relative to their potential (Figure 10). This is due primarily to chronic poor passage survival and the resulting underescaped depressed populations. It is also important to note that the project benefits for chinook salmon (Figure 10) may be overestimated due to fry stocking in barrier removal project streams.

In BPA habitat improvement project areas, 1985-92 chinook salmon densities averaged 14% of the rated capacity; 4% of the PCC was attributed to the projects (Appendix Cl). Project benefits were artificially high for chinook salmon due to fry stocking in many streame; fry were stocked through 1989, either to

establish natural populations or to supplement natural production in the project areas. Chinook salmon densities and PCC have since declined (Figures 7 and 8).

Steelhead trout PCC averaged 13% in habitat improvement project streams in 1985-92; 4% of the PCC was attributed to the projects (Appendix C2). Most steelhead trout projects were in B-run production areas or in A-run areas of the upper Salmon River; both areas had extremely depressed populations.

Eighty-six percent of carrying capacity for chinook salmon and 87% of carrying capacity for steelhead trout remained unoccupied in the project streams for 1985-92. Stocking has artificially increased the PCC in some project streams in some years, but not to an extent that has overcome the escapement deficit from poor passage survival.

Compared to subbasin planning estimates of natural smolt potential in Idaho of 15.5 million spring/summer chinook salmon and 4.5 million steelhead trout, the increased production is extremely small. If all Idaho habitat improvement projects identified in subbasin planning were implemented, total smolt potential would increase only 17% for chinook salmon and 9% for steelhead trout because the productive capacity remains high for the majority of Idaho anadromous fish streams. However, for a limited number of degraded streams, habitat improvement could yield significant benefits if the passage survival problem is solved.

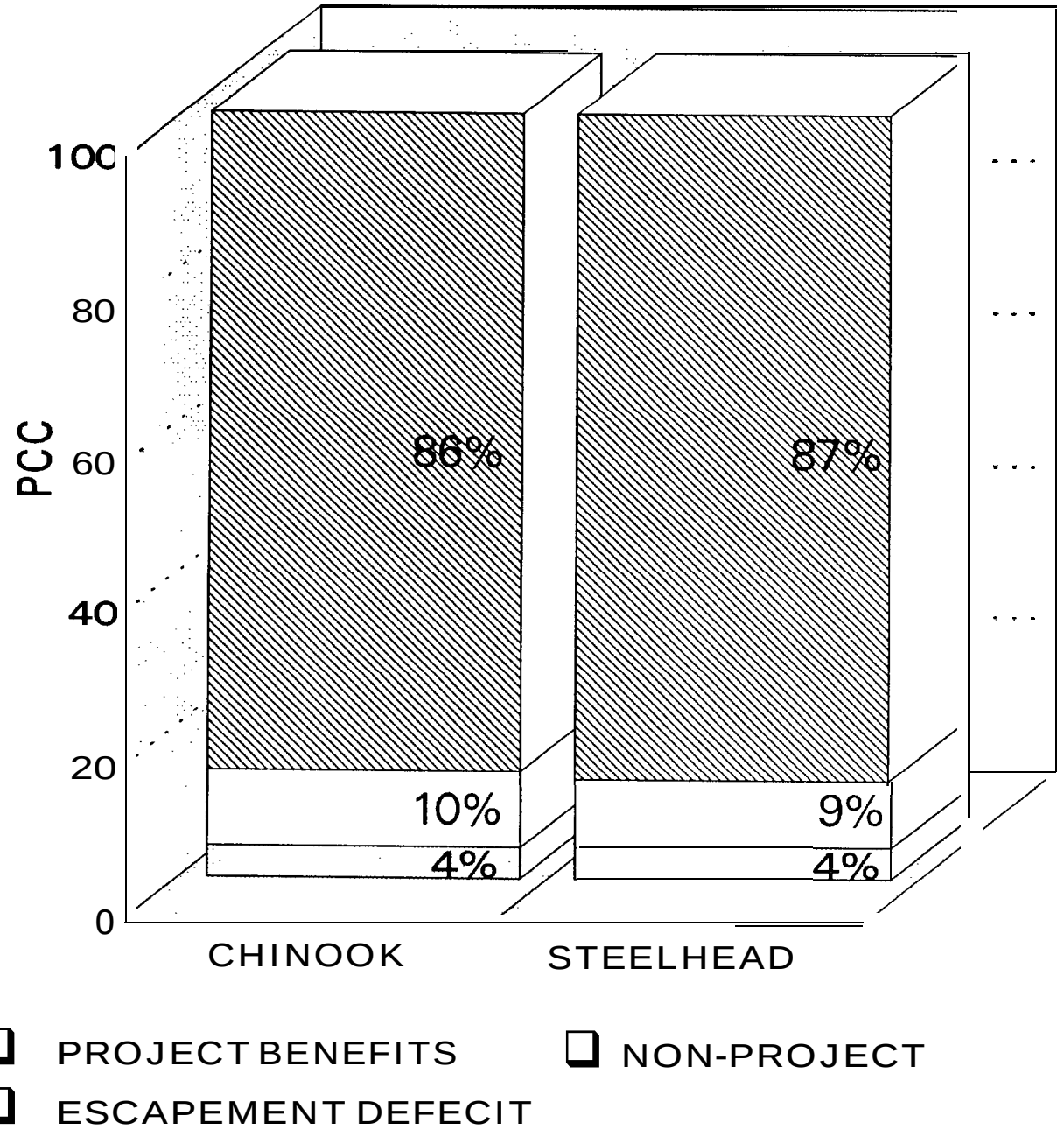

Figure 10. Mean percent of rated carrying capacitiy for chinook salmon and steelhead trout parr with proportion attributable and non-attributable to the projects and proportion not used due to escapement defecit in BPA habitat improvement areas, Idaho, 1985-92.

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A P P E N D I C E S

Appendix A.

Snorkel survey sections (monitoring and evaluation) for project 91-73.

Appendix A-l. Monitoring section names and EPA stream reach locations, channel types (B or C), steelhead trout classification (wild or natural, A or B-run), chinook salmon classification (wild or natural, spring or summer), and if chinook salmon are monitored.

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class U vs N Spr vs Sum
Snake River. above mouth Salmon River						
1706010101000.00	GRANITE CREEK	LOUER	1	B	NA	USPR
1706010101000.00	GRANITE CREEK	MIDDLE	2	B	NA	USPR
1706010101300.00	SHEEP CREEK		1	B	WA	WSPR
1706010101300.00	SHEEP CREEK		2	B	WA	WSPR
Upper Salmon River						
1706020100200.00	MORGAN CREEK	LOUER	FENCE	B	NA	NSPR
1706020100200.00	MORGAN CREEK	UPPER	ELM CAMP	C	NA	NSPR
1706020100900.00	UARH SPRINGS CREEK	LOUER	ABVCAB	B	NA	NSPR
1706020100900.00	WARM SPRINGS CREEK	LOVER	CABINS	B	NA	NSPR
1706020103500.00	THOMPSON CREEK	ABOVE	TWO-POLE	B	NA	NSPR
1706020103500.00	THOMPSON CREEK	BELOW	1	B	NA	NSPR
1706020103900.00	SALMONRIVER		RBNSN-BAR	B	NA	WSUM
1706020105200.00	VALLEY CREEK	1	B	C	NA	NSPR
1706020105300.00	VALLEY CREEK	3	A	C	NA	NSPR
1706020105300.00	VALLEY CREEK	VC6	BY-PASS CH	C	NA	NSPR
1706020105400.00	VALLEY CREEK	3	B	C	NA	NSPR
1706020105500.00	VALLEY CREEK	6	B	B	NA	NSPR
1706020106000.00	SALMON RIVER	2	B	B	NA	NSPR
1706020106100.00	REDFISH LAKE CREEK		LOWER	B	NA	NSPR
1706020106100.00	REDFISH LAKE CREEK	UEIR	DS	B	NA	NSPR
1706020106900.00	SALMON RIVER	3	A	B	NA	NSPR
1706020106900.00	SALMON RIVER	3	B	B	NA	NSPR
1706020106900.00	SALMON RIVER	3	BRA	C	NA	NSPR
1706020106900.00	SALMON RIVER	3	BRB	C	NA	NSPR
1706020106900.00	SALMON RIVER	III	3-SA	C	NA	NSPR
1706020106900.00	SALMON RIVER	III	3-SB	C	NA	NSPR
1706020107001.00	SALMON RIVER	4	A	C	NA	NSPR
1706020107001.00	SALMON RIVER	4	B	C	NA	NSPR
1706020107001.00	SALMON RIVER	4	BRA	C	NA	NSPR
1706020107001.00	SALMON RIVER	IV	4-BRB	B	NA	NSPR
1706020107001.00	SALMON RIVER	IV	4-SA	C	NA	NSPR
1706020107001.00	SALMON RIVER	IV	4-SB	B	NA	NSPR
1706020107200.00	SALMON RIVER	5	A	B	NA	NSPR
1706020107200.00	SALMON RIVER	5	B	B	NA	NSPR
1706020107501.00	SALMON RIVER	6	A	C	NA	NSPR
1706020107501.00	SALMON RIVER	6	B	B	NA	NSPR
1706020107501.00	SALMON RIVER	VI	6-SA	B	NA	NSPR
1706020107501.00	SALMON RIVER	VI	6-SB	B	NA	NSPR
1706020107600.00	PETTIT LAKE CREEK	1	IA	C	NA	NSPR
1706020107600.00	PETTIT LAKE CREEK	1	1B	C	NA	NSPR
1706020107600.00	YELLOWBELLY CREEK	1	1A	B	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	1	1A	B	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	1	IB	B	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	2	28	C	NA	NSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
Upper Salmon River (continued1						
1706020108100.00	ALTURAS LAKE CREEK	4	4A(2A)	C	NA	NSPR
1706020108100.00	ALTURAS LAKE CREEK	US DIV	4B(2B)	C	NA	NSPR
1706020108100.00	ALTURAS LAKE CREEK	US LAKE	5A(3A)	B	NA	NSPR
1706020108100.00	ALTURAS LAKE CREEK	US LAKE	5B(3B)	B	NA	NSPR
1706020108200.00	SALMON RIVER	7	A	C	NA	NSPR
1706020108200.00	SALMON RIVER	7	B	C	NA	NSPR
1706020108200.00	SALMON RIVER	8	A	C	NA	NSPR
1706020108200.00	SALMON RIVER	8	B	C	NA	NSPR
1706020108200.00	SALMON RIVER	VII	7-SA	C	NA	NSPR
1706020108200.00	SALMON RIVER	VIII	8-SA	C	NA	NSPR
1706020108200.00	SALMON RIVER	VIII	8-SB	C	NA	NSPR
1706020108300.00	SMILEY CREEK	1	1A	B	NA	NSPR
1706020108300.00	SMILEY CREEK	1	1B	B	NA	NSPR
1706020108300.00	SMILEY CREEK	1	1BB/S2	B	NA	NSPR
1706020108300.00	SHILEY CREEK	1	2A	B	WA	NSPR
1706020108300.00	SMILEY CREEK	2	2B	B	NA	NSPR
1706020108400.00	SALMON RIVER	10	A	B	NA	NSPR
1706020108400.00	SALMON RIVER	10	AB	B	NA	NSPR
1706020108400.00	SALMON RIVER	10	B	C	NA	NSPR
1706020108400.00	SALMON RIVER	9	A	C	NA	NSPR
1706020108400.00	SALMON RIVER	9	B	B	NA	NSPR
1706020108500.00	FOURTH OF JULY CREEK	1	A	B	NA	NSPR
1706020108500.00	FOURTH OF JULY CREEK	1	B	B	NA	NSPR
1706020108700.00	GOLD CREEK	1	1A	B	NA	NSPR
1706020108700.00	GOLD CREEK	1	B	B	NA	NSPR
1706020109800.00	SALMON RIVER, EAST FORK		ZEIGLER	B	NAB	NSPR
1706020109800.00	SALMON RIVER, EAST FORK		BELOW FOX	C	NAB	NSPR
1706020110700.00	SALMON RIVER, EAST FORK		ABOVE-WEIR 2	C	NAB	NSPR
1706020110700.00	SALMON RIVER, EAST FORK		ABOVE-WEIR 3	B	NAB	NSPR
1706020114600.00	CHAMPION CREEK	LOWER (II)	2-A	B	NA	NSPR
1706020114600.00	CHAMPION CREEK	UPPER (II)	2-B	B	NA	NSPR
1706020114700.00	BEAVER CREEK	1	1B	C	NA	NSPR
1706020114700.00	BEAVER CREEK	2	2A	C	NA	NSPR
1706020114700.00	BEAVER CREEK	2	2B	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	2	2A/2s4	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	2	2B/2S6	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	l	IA	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	l	lB/Sl	B	NA	NSPR
1706020114900.00	POLE CREEK	2	2B/2S4	B	NA	NSPR
1706020114900.00	POLE CREEK	3	3A/3S4	B	NA	NSPR
1706020114900.00	POLE CREEK	3	3B/3S4	B	NA	NSPR
1706020114900.00	POLE CREEK	I	1A	C	NA	NSPR
1706020114900.00	POLE CREEK	I	1B	C	NA	NSPR
1706020114900.00	POLE CREEK	II	2A	C	NA	NSPR
1706020114900.00	POLE CREEK	II	2B	B	NA	NSPR
1706020114900.00	POLE CREEK	III	3A	B	NA	NSPR
1706020114900.00	POLE CREEK	III	38	B	NA	NSPR
1706020115400.00	HUCKLEBERRY CREEK	1	1A	B	NA	NSPR
1706020115400.00	HUCKLEBERRY CREEK	1	IB	B	NA	NSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
Pahsimeroi River						
1706020200100.00	PAHSIHEROI RIVER	LOWER	DWTN LANE	C	NA	NSUM
1706020200100.00	PAHSIMEROI RIVER	UPPER	DWTN LANE	C	NA	NSUM
Salmon River						
1706020300600.00	PANTHER CREEK	DS-CLEAR	PC1	B	NA	NSPR
1706020301000.00	PANTHER CREEK	DS BIG-D	PC4	B	NA	NSPR
1706020301400.00	PANTHER CREEK	DS BLACK B	PC6	C	NA	NSPR
1706020302000.00	PANTHER CREEK	ABOVE	PC9	C	NA	NSPR
1706020302200.00	PANTHER CREEK	ABOVE	PC10	C	NA	NSPR
1706020302300.00	MOYER CREEK	ABOVE	MO1	C	NA	NSPR
1706020302300.00	MOYER CREEK	ABOVE	NEW SEC	B	NA	NSPR
1706020303400.00	PINE CREEK	ABOVE	BRIDGE	B	NA	NSPR
1706020303400.00	PINE CREEK	ABOVE	SAWMILL CREEK	B	NA	NSPR
1706020307500.00	SALMON RIVER, NORTH FORK		HUGHES	C	NA	NSPR
1706020307700.00	SALMON RIVER, NORTH FORK		DAHLONEGA	B	NA	NSPR
Lemhi River						
1706020402400.00	HAYDEN CREEK	HC3	B	B	NA	NSPR
1706020402600.00	BEAR VALLEY CREEK	HCl	B	C	NA	NSPR
1706020402600.00	BEAR VALLEY CREEK	HCI	CAMP	B	NA	NSPR
1706020402800.00	HAYDEN CREEK	HC2	B	B	NA	NSPR
1706020408300.00	BIG SPRINGS CREEK	LEM1	A	C	NA	NSPR
Upper Middle Fork. Salmon River						
1706020500300.00	MARBLE CREEK	ABOVE	PACKBRIDGE	B	WB	WSPR
1706020500501.00	MARBLE CREEK		MAR2	C	WB	WSPR
1706020500600.00	MARBLE CREEK	UPPER	MAR1	B	WB	WSPR
1706020500601.50	MARBLE CREEK		MAR1B	B	WB	WSPR
1706020500603.00	MARBLE CREEK	UPSTREAM	SUNNYSIDE	B	WB	WSPR
1706020502100.00	SULPHUR CREEK	3	A	B	WB	WSPR
1706020502100.00	SULPHUR CREEK	4	A	C	WB	WSPR
1706020502100.00	SULPHUR CREEK	4	B	B	WB	WSPR
1706020502300.00	BEAR VALLEY CREEK	1	A	B	WB	WSPR
1706020502500.00	BEAR VALLEY CREEK	2	A	C	WB	WSPR
1706020502500.00	BEAR VALLEY CREEK	2	B	C	WB	WSPR
1706020502600.00	ELK CREEK	1	A	C	WB	WSPR
1706020502600.00	ELK CREEK	1	B	C	WB	WSPR
1706020502600.00	ELK CREEK	2	A	C	WB	WSPR
1706020502600.00	ELK CREEK	2	B	C	WB	WSPR
1706020502700.00	BEAR VALLEY CREEK	3	A	C	WB	WSPR
1706020502800.00	BEAR VALLEY CREEK	5	A	C	WB	WSPR
1706020502800.00	BEAR VALLEY CREEK	7	BIG-MDW-L	C	WB	WSPR
1706020502800.00	BEAR VALLEY CREEK	9	8	C	WB	WSPR
1706020503200.00	MARSH CREEK	1	A	B	WB	WSPR
1706020503200.00	MARSH CREEK	1	B	B	WB	WSPR
1706020503400.00	CAPE HORN CREEK	1	A	C	WB	WSPR
1706020503400.00	CAPE HORN CREEK	2	B	C	WB	WSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
Upper Middle Fork, Salmon River (continued)						
1706020503500.00	MARSH CREEK	4	B	C	WB	WSPR
1706020503501.00	MARSH CREEK	5	A	C	WB	WSPR
1706020503503.00	KNAPP CREEK	1	A	C	WB	WSPR
1706020503503.00	KNAPP CREEK	1	DS DIV	C	WB	WSPR
1706020503503.00	KNAPP CREEK	2	B	C	WB	USPR
1706020503503.00	KNAPP CREEK	2	BIG BEVR DAM	C	WB	WSPR
1706020503503.00	KNAPP CREEK	2	CAMPSITE	C	WB	USPR
1706020503503.00	KNAPP CREEK	2	LCKD FENCE	C	WB	WSPR
1706020503600.00	BEAVER CREEK	3	B	C	WB	USPR
1706020505000.00	LOON CREEK		L1-BRIDGE	B	WB	USPR
1706020505000.00	LOON CREEK		L2-RUN	B	WB	WSPR
1706020505000.00	LOON CREEK	LNM1	3	B	WB	USPR
1706020505000.00	LOON CREEK	PACK BR	1	C	WB	USPR
1706020506300.00	MARSH CREEK	6	A	C	WB	WSPR
1706020508400.00	BEARSKIN CREEK		OXBOW	C	WB	WSPR
1706020508400.00	BEARSKIN CREEK	1	A	C	WB	WSPR
1706020508400.00	BEARSKIN CREEK	2	A	C	WB	WSPR
1706020508400.00	BEARSKIN CREEK	3	A	C	WB	USPR
1706020508400.00	BEARSKIN CREEK	3	B	C	WB	WSPR
Lower Middle Fork Salmon River						
1706020600700.00	BIG CREEK	LOWER	1	B	WB	USPR
1706020600700.00	BIG CREEK	MIDDLE	TAYLOR 1	C	WB	WSPR
1706020603200.00	BIG CREEK		LOGAN CREEK	C	WB	WSPR
1706020603200.00	BIG CREEK		NEAR FORD	C	WB	USPR
1706020603600.00	MONUMENTAL CREEK	DS HOLYTER	MONS	C	WB	WSPR
1706020603700.00	MONUMENTAL CREEK, WEST FORK		MON4	C	WB	USPR
1706020603800.00	MONUMENTAL CREEK		MON2	C	WB	WSPR
1706020603800.00	MONUMENTAL CREEK		MON3	C	WB	WSPR
1706020603800.00	MONUMENTAL CREEK	DS LOON CR	MON1	B	WB	WSPR
1706020605100.00	CAMAS CREEK		L1-MOUTH	B	WB	WSPR
1706020605200.00	CAMAS CREEK		1	C	WB	WSPR
1706020605200.00	CAMAS CREEK		2	C	WB	WSPR
1706020605200.00	CAMAS CREEK		CAM1	B	WB	WSPR
Upper Salmon River Canyon						
1706020703800.00	CHAMBERLAIN CREEK		MOUTH(L1)	B	WA	WSPR
1706020703800.00	CHAMBERLAIN CREEK		RUN(L2)	B	WA	USPR
1706020704200.00	CHAMBERLAIN CREEK		CHA1	B	WA	USPR
1706020704301.00	CHAMBERLAIN CREEK, WEST FORK		CHA2	C	WA	WSPR
1706020704301.00	CHAMBERLAIN CREEK, WEST FORK		CHA3	B	WA	WSPR
1706020704400.00	CHAMBERLAIN CREEK		CHA4	C	WA	WSPR
1706020707000.00	HORSE CREEK	BRIDGE	L2	B	WA	WSPR
1706020707000.00	HORSE CREEK	UPPER	L1	B	WA	WSPR
1706020708000.00	BARGAMIN CREEK	LOWER	1	B	WA	WSPR
1706020708000.00	BARGAMIN CREEK	UPPER	2	B	WA	WSPR
1706020709300.00	SHEEP CREEK		L1	B	WA	USPR
1706020709300.00	SHEEP CREEK		L2	B	WA	WSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channe 1 type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
South Fork Salmon River						
1706020801601.00	SECESH RIVER		GRWSE	C	WB	WSUM
1706020801601.00	SECESH RIVER		LONG-GULCH	C	WB	WSUM
1706020801601.00	SECESH RIVER		U-SCSH-MOW	C	WB	WSUM
1706020801700.00	LAKE CREEK		BURGDORF	C	WB	WSUM
1706020801700.00	LAKE CREEK		WILLOW CREEK	C	WB	WSUM
1706020802000.00	LICK CREEK		L1	B	WB	WSUM
1706020802000.00	LICK CREEK		L3	B	WB	WSUM
1706020802001.00	LICK CREEK	L	POOL	B	WB	WSUM
1706020802200.00	SALMON RIVER, SOUTH FORK		16	B	WB	NSUM
1706020802400.00	SALMON RIVER, SOUTH FORK		14	B	WB	NSUM
1706020802900.00	SALMON RIVER, SOUTH FORK		11	B	WB	NSUM
1706020802900.00	SALMON RIVER, SOUTH FORK		POVERTY	C	WB	NSUM
1706020803200.00	DOLLAR CREEK		1	C	WB	NSUM
1706020803200.00	DOLLAR CREEK		MOUTH	B	WB	NSUM
1706020803300.00	SALMON RIVER, SOUTH FORK		7	B	WB	NSUM
1706020803400.00	SALMON RIVER, SOUTH FORK		5	C	WB	NSUM
1706020803600.00	SALMON RIVER, SOUTH FORK		STOLLE1	C	WB	NSUM
1706020803600.00	SALMON RIVER, SOUTH FORK		STOLLEZ	C	WB	NSUM
1706020804200.00	SALMON RIVER, SOUTH FK, EAST FK		7	B	WB	NSUM
1706020804300.00	SALMON RIVER, SOUTH FK, EAST FK		6	B	WB	NSUM
1706020804400.00	JOHNSON CREEK	LOWER	L2	B	UB	NSUM
1706020804400.00	JOHNSON CREEK	LOWER	L3	B	UB	NSUM
1706020804700.00	JOHNSON CREEK	BELOW	PW3B	B	WB	NSUM
1706020804701.00	JOHNSON CREEK		PWIA	B	WB	NSUM
1706020804701.00	JOHNSON CREEK	ABOVE	M3	C	WB	NSUM
1706020804702.00	JOHNSON CREEK	ABOVE	M2	C	WB	NSUM
1706020804703.00	JOHNSON CREEK	ABOVE	M1	C	WB	NSUM
1706020805100.00	SALMON RIVER, SWTH FK, EAST FK		3	B	WB	NSUM
1706020807400.00	SAND CREEK	ABOVE	M2	C	WB	NSUM
1706020809800.00	ROCK CREEK	ABOVE	M1	C	WB	NSUM
Lower Salmon River Canyon						
1706020902501.00	SLATE CREEK		6	B	NAB	WSPR
1706020902513.00	SLATE CREEK		2	B	NAB	WSPR
1706020902513.00	SLATE CREEK		3	B	NAB	WSPR
1706020902513.00	SLATE CREEK		4	B	NAB	WSPR
1706020902900.00	WHITEBIRD CREEK		1	B	WA	WSPR
1706020903000.00	WHITEBIRD CREEK, SOUTH FORK		2	B	WA	WSPR
Little Salmon River						
1706021000200.00	RAPID RIVER		RAP2	B	WA	NSPR
1706021000300.00	RAPID RIVER, WEST FORK		RAP1	B	WA	NSUM
1706021000700.00	LITTLE SALMON RIVER		2	B	NAB	NSPR
1706021000900.00	BOULDER CREEK	ABOVE	1	B	NA	NSPR
1706021000900.00	BOULDER CREEK	ABOVE	2	B	NA	NSPR
1706021000900.00	BOULDER CREEK	BELOW	3	B	NA	NSPR
1706021000900.00	BOULDER CREEK	BELOW	5	B	NA	NSPR

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Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
Little Salmon River (continued1						
1706021001000.00	LITTLE SALMON RIVER		1	B	NAB	NSPR
1706021002000.00	LITTLE SALMON RIVER		1.5	B	NAB	NSPR
1706021002600.00	HAZARD CREEK		HAZ1	B	NAB	NSPR
1706021003000.00	HAZARD CREEK		HAZ2	B	NAB	NSPR
Upper Selway River						
1706030100800.00	RUNNING CREEK		PACK BR	B	WB	NSPR
1706030100801.00	RUNNING CREEK		EAGLE MOUTH	8	UB	NSPR
1706030101300.00	SELWAY RIVER		LITTLE-CW	B	WB	NSPR
1706030101300.00	SELWAY RIVER	ABOVE	BEAVER PT	B	WB	NSPR
1706030101400.00	SELUAY RIVER		HELLS HALF	B	WB	NSPR
1706030101900.00	DEEP CREEK		CACTUS	B	WB	NSPR
1706030101900.00	DEEP CREEK		SCIMITAR	B	WB	NSPR
1706030102100.00	WHITE CAP CREEK		UPPER	B	WB	NSPR
1706030102400.00	BEAR CREEK	LOWER	1	B	WB	NSPR
1706030102400.00	BEAR CREEK	UPPER	2	B	WB	NSPR
Lower Selway River						
1706030200500.00	MEADOW CREEK	LOWER	SLIMS CAMP	B	WB	NSPR
1706030200500.00	MEADOW CREEK	UPPER	ABOVE 2	B	WB	NSPR
1706030201400.00	MOOSE CREEK		1	B	WB	NSPR
1706030201500.00	MOOSE CREEK, EAST FORK			B	WB	NSPR
1706030201500.00	MOOSE CREEK, EAST FORK		3	B	WB	NSPR
1706030203000.00	MOOSE CREEK, NORTH FORK		4	B	WB	NSPR
1706030203000.00	MOOSE CREEK, NORTH FORK		5	B	WB	NSPR
1706030203900.00	THREE LINKS CREEK	PACK BRIDGE	2	B	WB	NSPR
1706030203900.00	THREE LINKS CREEK	TRAD SITE	#I	B	WB	NSPR
1706030204000.00	GEDNEY CREEK	LOWER	1	B	UB	NSPR
1706030204000.00	GEDNEY CREEK	LOWER	2	B	UB	NSPR
1706030206100.00	OTTER CREEK	#2 NEW	MOUTH	B	WB	NSPR
1706030206100.00	OTTER CREEK	#2 TRADI		B	UB	NSPR
Lochsa River						
1706030300400.00	FIRE CREEK	LOWER	1	B	NB	NSPR
1706030300400.00	FIRE CREEK	UPPER	2	B	NB	NSPR
1706030300600.00	OLD MAN CREEK			B	NB	NSPR
1706030300800.00	LOCHSA RIVER	@FISH CREEK	L1	B	NB	NSPR
1706030300800.00	LOCHSA RIVER	@PAPOOSE	CREEK L4	B	NB	NSPR
1706030301900.00	WARM SPRINGS CREEK	LOWER		B	NB	NSPR
1706030303000.00	COLT CREEK		BRIDGE	B	NB	NSPR
1706030304200.00	CROOKED FORK CREEK	BELOW	2B	B	NB	NSPR
1706030304200.00	CROOKED FORK CREEK	LOWER		B	NB	NSPR
1706030304200.00	CROOKED FORK CREEK	UPPER	3	C	NB	NSPR
1706030304300.00	BRUSHY FORK CREEK	LOWER	1	B	NB	NSPR
1706030304300.00	BRUSHY FORK CREEK	UPPER	2	B	NB	NSPR
1706030304600.00	CROOKED FORK CREEK	ABOVE	3A	B	NB	NSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steethead class W vs N A vs B	Chinook class W vs N Spr vs Sum
Lochsa River (continued1						
1706030304600.00	CROOKED FORK CREEK	ABOVE	4A	B	NB	NSPR
1706030304600.00	CROOKED FORK CREEK	BELOW	1B	B	NB	NSPR
1706030304701.00	HOPEFUL CREEK		US BOOGDWN1	B	NB	NSPR
1706030305400.00	FISH CREEK		1	B	NB	NSPR
1706030305400.00	FISH CREEK		2	B	NB	NSPR
1706030306600.00	SPLIT CREEK	LOWER	1	B	NB	NSPR
1706030306600.00	SPLIT CREEK	UPPER	2	B	NB	NSPR
1706030307000.00	CROOKED FORK CREEK	ABOVE	2A	B	NB	NSPR
1706030308000.00	POST OFFICE CREEK	LOWER	1	B	NB	NSPR
1706030308000.00	POST OFFICE CREEK	UPPER	2	B	NB	NSPR
South Fork Clearwater River						
1706030501600.00	JOHNS CREEK	1	2	B	NB	NSPR
1706030502000.00	JOHNS CREEK	2	3	B	NB	NSPR
1706030502000.00	JOHNS CREEK	2	4	B	NB	NSPR
1706030503000.00	TEN MILE CREEK	#1	2	B	NB	NSPR
1706030503000.00	TEN MILE CREEK	#2	2	B	NB	NSPR
1706030503300.00	CROOKED RIVER	C	CAN1	B	NB	NSPR
1706030503300.00	CROOKED RIVER	C	CAN2	B	NB	NSPR
1706030503300.00	CROOKED RIVER	C	CAN3	B	NB	NSPR
1706030503300.00	CROOKED RIVER	II	CONTROL 1	B	NB	NSPR
1706030503300.00	CROOKED RIVER	II	CONTROL 2	B	NB	NSPR
1706030503300.00	CROOKED RIVER	II	POND U	C	NB	NSPR
1706030503300.00	CROOKED RIVER	II	POND 11	C	NB	NSPR
1706030503300.00	CROOKED RIVER	II	TREAT 1	B	NB	NSPR
1706030503300.00	CROOKED RIVER	II	TREAT 2	B	NB	NSPR
1706030503300.00	CROOKED RIVER	III	NATURAL 1	C	NB	NSPR
1706030503300.00	CROOKED RIVER	III	NATURAL 2	C	NB	NSPR
1706030503300.00	CROOKED RIVER	III	NATURAL 3	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	MEANDER 1	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	MEANDER 2	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	MEANDER 3	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	POND S1	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	POND S2	C	NB	NSPR
1706030503300.00	CROOKED RIVER	IV	POND S3	C	NB	NSPR
1706030503301.00	CROOKED RIVER	H	OROGRANDE 1	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	BOULDER-A	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	BOULDER-B	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	CONTROL 1	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	CONTROL 2	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	POND-A	C	NB	NSPR
1706030503301.00	CROOKED RIVER	I	SILL-LOG-A	B	NB	NSPR
1706030503301.00	CROOKED RIVER	I	SILL-LOG-B	B	NB	NSPR
1706030503600.00	RED RIVER	IV	CONTROL 2	C	NB	NSPR
1706030503600.00	RED RIVER	IV	TREAT 2	C	NB	NSPR
1706030503600.00	RED RIVER	V	CONTROL 2	C	NB	NSPR
1706030503600.00	RED RIVER	V	TREAT 2	C	NB	NSPR
1706030503800.00	RED RIVER	I	CONTROL 1	C	NB	NSPR
1706030503800.00	RED RIVER	I	CONTROL 2	C	NB	NSPR

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Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
South Fork CLearwater River (continued)						
1706030503800.00	RED RIVER	II	CNTL VIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XIV	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XIX	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XVII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XVIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XX	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XXI	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XXII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XXIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CNTL XXIV	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTL XVI	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL 2	B	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL A	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL I	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL IV	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL IX	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL V	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL VI	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL X	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL XI	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL XV	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROL111	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROLVII	C	NB	NSPR
1706030503800.00	RED RIVER	II	CONTROLXII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT 2	B	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT A	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT I	C	NB	NSPR
1706030503200.00	RED RIVER	II	TREAT III	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT IV	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT IX	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT V	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT VI	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT VII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT VIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT X	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XI	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XIV	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XIX	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XV	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XVI	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XVII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XX	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XXI	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XXII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREAT XXIV	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREATXVIII	C	NB	NSPR
1706030503800.00	RED RIVER	II	TREATXXIII	C	NB	NSPR

Appendix A-l. (continued)

EAP stream reach	Stream name	Stratum	Section	Channel type	Steelhead class W vs N A vs B	Chinook class W vs N Spr vs Sum
South Fork Clearwater River (continued1						
1706030504100.00	AMERICAN RIVER		1	C	NB	NSPR
1706030504100.00	AMERICAN RIVER		2	C	NB	NSPR
1706030504300.00	NEWSDME CREEK			C	NB	NSPR
1706030504300.00	NEWSOME CREEK		4MI	C	NB	NSPR
1706030504300.00	NEWSOME CREEK		NEW SIDE	C	NB	NSPR
1706030504300.00	NEWSOME CREEK		OLD SIDE	C	NB	NSPR
1706030504800.00	MEADOW CREEK	CANYON	MP2	B	NB	NSPR
1706030504800.00	MEADOW CREEK	MEADOW	GRAZED	C	NB	NSPR
1706030507100.00	RELIEF CREEK	II	I-A	B	NB	NSPR
1706030507100.00	RELIEF CREEK	II	1-B	B	NB	NSPR
1706030507100.00	RELIEF CREEK	II	2-A	C	NB	NSPR
1706030507100.00	RELIEF CREEK	II	2-B	C	NB	NSPR
1706030507800.00	MOOSE BUTTE CREEK		BRIDGE	C	NB	NSPR
Lower Clearwater River						
1706030602200.00	BIG CANYON CREEK		BRIDGE	B	WA	NSPR
1706030602300.00	BIG CANYON CREEK		DIRT PILE	B	WA	NSPR
1706030603600.00	LOLO CREEK		DOWNSTREAMDS6	B	NB	NSPR
1706030603600.00	LOLO CREEK		DOWNSTREAMRUN	B	NB	NSPR
1706030603700.00	ELDORADO CREEK	ABOVE	IHG	C	NB	NSPR
1706030603700.00	ELDORADO CREEK	ABOVE	2LG	C	NB	NSPR
1706030603700.00	ELDORADO CREEK	ABOVE	2M	C	NB	NSPR
1706030603700.00	ELDORADO CREEK	BELOW	1B	B	NB	NSPR
1706030603800.00	LOLO CREEK	UPSTREAM	8360	B	NB	NSPR
1706030603900.00	LOLO CREEK	UPSTREAM	8303	C	NB	NSPR
1706030603900.00	LOLO CREEK	UPSTREAM	RUN1	B	NB	NSPR
1706030603900.00	LOLO CREEK	UPSTREAM	RUN7	B	NB	NSPR
1706030608400.00	MISSION CREEK	QUARRY	1	B	WA	NSPR
1706030608400.00	MISSION CREEK	QUARRY	2	B	WA	NSPR

Appendix A-2. Evaluation section names (1991) and EPA stream reach locations, channel types (B or CO, steelhead trout classification (wild or natural, A- or B-run), chinook salmon classification (wild or natural, spring or summer), and if chinook salmon are monitored.

EPA stream reach	Stream name	Stratwn	Section	Channel type	Steelhead Class W vs W A vs B	Chinook Class U vs N spr vs sum
User Salmon River						
1706020106900.00	SALMON RIVER	3	HANSON	C	NA	NSPR
1706020106900.00	SALMON RIVER	ACCESS US	SAWTOOTH	C	NA	NSPR
1706020107200.00	SALMON RIVER	4	ANDY2	B	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	1	1C	C	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	2	2A	B	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	3	3c	C	NA	NSPR
1706020107700.00	ALTURAS LAKE CREEK	US DIV	2	C	NA	NSPR
1706020108100.00	ALTURAS LAKE CREEK	3	3A	C	NA	NSPR
1706020108100.00	ALTURAS LAKE CREEK	3	3B	C	NA	NSPR
1706020108200.00	SALMON RIVER	7	ANDY1	C	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	II	s2	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	II	s3	B	NA	NSPR
1706020114800.00	FRENCHMAN CREEK	II	s5	B	NA	NSPR
1706020114900.00	POLE CREEK	IV	4A	C	NA	NSPR
1706020114900.00	POLE CREEK	IV	4B	B	NA	NSPR
1706020114900.00	POLE CREEK	V	5A	C	NA	NSPR
1706020114900.00	POLE CREEK	V	58	C	NA	NSPR
Upper Middle Fork Salmon River						
1706020500200.00	SALMON RIVER, MIDDLE FORK		ROCK IS		WB	WSPR
1706020500200.00	SALMON RIVER, MIDDLE FORK	II	COUGAR	B	WB	WSPR
1706020500200.00	SALMON RIVER, MIDDLE FORK	II	L JACKASS	B	WB	WSPR
1706020500200.00	SALMON RIVER, MIDDLE FORK	II	MARBLPL	B	WB	WSPR
1706020500200.00	SALMON RIVER, MIDDLE FORK	II	SKI JUMP	B	WB	WSPR
1706020500200.00	SALMON RIVER, MIDDLE FORK	II	WHITEYCX	B	WB	WSPR
1706020500800.00	SALMON RIVER, MIDDLE FORK	I	INDIAN	B	WB	WSPR
1706020500800.00	SALMON RIVER, MIDDLE FORK	II	PUNGO	B	WB	WSPR
1706020502603.00	ELK CREEK	US PORTER	C	C	WB	WSPR
Lower Middle Fork Salmon River						
1706020600301.50	SALMON RIVER, MIDDLE FORK	IV	SHIP ISLAND	B	WB	WSPR
1706020600600.00	SALMON RIVER, MIDDLE FORK	IV	BIG-CR-BR	B	WB	WSPR
1706020600600.00	SALMON RIVER, MIDDLE FORK	IV	LOVEBAR	B	WB	WSPR
1706020601500.00	BIG CREEK	MOUTH	CABIN CREEK	C	WB	WSPR
1706020604100.00	RUSH CREEK	LOWER	11/DIVERSI	B	WB	USPR
1706020604100.00	RUSH CREEK	LOWER	12/MOUTH	B	WB	USPR
1706020604100.00	RUSH CREEK	LOWER	ABOVE XING	B	WB	WSPR
1706020604100.00	RUSH CREEK	LOWER	ISLAND	B	WB	WSPR
1706020604100.00	RUSH CREEK	MIDDLE	CLIFF HANG	B	WB	WSPR
1706020604100.00	RUSH CREEK	MIDDLE	LOG JAM BAR	B	WB	USPR
1706020604100.00	RUSH CREEK	UPPER	3/SFK MOUTH	B	WB	WSPR
1706020604100.00	RUSH CREEK	UPPER	4/WFK MOUTH	B	WB	WSPR
1706020604100.00	RUSH CREEK	UPPER	RANGE CREEK MO	B	WB	WSPR
1706020604200.00	RUSH CREEK	UPPER-SEC2	PHONE MOUTH	B	WB	WSPR

Appendix A-2. (continued)

EPA stream reach	Stream name	Stratum	Section	Channel type	Steelhead Class W vs W A vs B	Chinook Class W vs N sor vs sum
Lower Middle Fork Salmon River (continued)						
1706020604200.00	RUSH CREEK, SOUTH FORK		MOUTH	B	WB	WSPR
1706020604200.00	RUSH CREEK, SWTH FORK		UPPER	B	WB	WSPR
1706020604500.00	SALMON RIVER, MIDDLE FORK	III	SURVEY	B	WB	WSPR
1706020604700.00	SALMON RIVER, MIDDLE FORK	III	AIRSTRIP	B	WB	WSPR
1706020604900.00	SALMON RIVER, MIDDLE FORK	III	FLYING-B	B	WB	WSPR
1706020605000.00	SALMON RIVER, MIDDLE FORK	II	HOSPPL	B	WB	WSPR
1706020605000.00	SALMON RIVER, MIDDLE FORK	II	HOSPRUN	B	WB	WSPR
1706020605000.00	SALMON RIVER, MIDDLE FORK	II	TAPPAN POOL	B	WB	WSPR
Chamberlain Creek						
1706020704200.00	CHAMBERLAIN CREEK		DRY MOUTH	B	WA	WSPR
1706020704300.00	CHAMBERLAIN CREEK, WEST FORK	BEAL	MEADOW	C	WA	WSPR
1706020704300.00	CHAMBERLAIN CREEK, WEST FORK		MOUTH	B	WA	WSPR
1706020704300.00	CHAMBERLAIN CREEK, WEST FORK		SAGE FENCE	C	WA	WSPR
1706020704301.00	CHAMBERLAIN CREEK, WEST FORK		IST XING	B	WA	WSPR
1706020704301.00	CHAMBERLAIN CREEK, WEST FORK		SPRING	B	WA	WSPR
1706020704301.00	CHAMBERLAIN CREEK, WEST FORK		TUMBLE DUN	B	WA	WSPR
1706020704400.00	CHAMBERLAIN CREEK		HOTZEL	C	WA	WSPR
1706020704400.00	CHAMBERLAIN CREEK		WFK MOUTH	C	WA	WSPR
1706020704401.00	CHAMBERLAIN CREEK	MOUTH	NO NAME	B	WA	WSPR
1706020704500.00	CHAMBERLAIN CREEK		FISH MOUTH	C	WA	WAPR
1706020704500.00	CHAMBERLAIN CREEK		FORKS	B	WA	WSPR
1706020704500.00	CHAMBERLAIN CREEK		SMOKE HOUSE	B	WA	WSPR
1706020704500.00	CHAMBERLAIN CREEK	LOWER	RED TOP	C	WA	WSPR
1706020704500.00	CHAMBERLAIN CREEK	UPPER	RED TOP	C	WA	WSPR
1706020704500.00	FISH CREEK		TRAIL XING	B	WA	WSPR
1706020704501.00	RIM CREEK		MOUTH	B	WA	WSPR
1706020704600.00	MOOSE CREEK		MOUTH	B	WA	WSPR
1706020704600.00	MOOSE CREEK		UPPER	B	WA	WSPR
1706020704600.00	MOOSE CREEK	LOWER	MOOSE JAW	C	WA	WSPR
1706020710300.00	FLOSSIE CREEK		TRAIL XING	B	WA	WSPR
1706020710500.00	GAME CREEK		TRAIL XING	B	WA	WSPR
1706020711100.00	CHAMBERLAIN CREEK, SOUTH FORK		MOUTH	B	WA	WSPR
Secesh River						
1706020801600.00	SECESH RIVER		1	C	WB	WSUM
1706020801600.00	SECESH RIVER		2	C	WB	WSUM
1706020801600.00	SECESH RIVER		3	C	WB	WSUM
1706020801600.00	SECESH RIVER		4	C	WB	WSUM
1706020801600.00	SECESH RIVER		5	C	WB	WSUM
1706020801601.00	SECESH RIVER		6	B	WB	WSUM
1706020801601.00	SECESH RIVER		7	B	WB	WSUM
1706020801602.00	SECESH RIVER		8	B	WB	WSUM
1706020801700.00	LAKE CREEK		1	C	WB	WSUM
1706020801701.00	LAKE CREEK		4	C	WB	WSUM
1706020801702.00	LAKE CREEK		5	C	WB	WSUM
1706020807100.00	LAKE CREEK		3	C	WB	WSUM
1706020807102.00	LAKE CREEK		6	C	WB	WSUM

A2.SDF

Appendix A-2. (continued)

EPA stream reach	Stream name	Stratum	Section	Channel type	Steelhead Class W vs W A vs B	Chinook Class W vs N spr vs sum
Lower Salmon River						
170602090.00	RACE CREEK	FIRST	CATTLE GRD		WA	WSPR
1706020902400.00	JOHN DAY CREEK		1		WA	WSPR
1706020902400.00	JOHN DAY CREEK		2		WA	WSPR
1706020902800.00	SKDOKUMCHUCK CREEK		1		WA	WSPR
1706020902800.00	SKDOKUMCHUCK CREEK		2		WA	WSPR
Little Salmon River						
1706021000200.00	RAPID RIVER		CLIFF HANG	B	WA	NSPR
1706021000200.00	RAPID RIVER	1	5	B	WA	NSUM
1706021000200.00	RAPID RIVER	1	6	B	WA	NSUM
1706021000200.00	RAPID RIVER	1	7	B	WA	NSUM
1706021000300.00	RAPID RIVER, WEST FORK		US FALLS	B	WA	NSPR
1706021000400.00	RAPID RIVER		1	B	WA	NSUM
1706021000400.00	RAPID RIVER		2	B	WA	NSUM
1706021000400.00	RAPID RIVER		4	B	WA	NSUM
1706021000400.00	RAPID RIVER	CABIN	PARADISE	B	WA	NSPR
1706021000400.00	RAPID RIVER	PACK BR	CASTLE CREEK	B	WA	NSPR
1706021000400.00	RAPID RIVER	PACK BR	COPPER CREEK	B	WA	NSPR
Upper Selway River						
1706030100800.00	RUNNING CREEK		CABIN	B	WB	NSPR
1706030100801.00	GROUSE CREEK		DS FALLS	B	WB	NSPR
1706030100801.00	GROUSE CREEK		MOUTH	B	WB	NSPR
1706030100801.00	RUNNING CREEK		DRY WASH	B	WB	NSPR
1706030100801.00	RUNNING CREEK		RD BRIDGE	B	WB	NSPR
1706030100801.00	RUNNING CREEK		TRAIL CULV	B	WB	NSPR
1706030100801.00	RUNNING CREEK		YORKS CAMP	B	WB	NSPR
1706030100801.00	RUNNING CREEK	BWNDRY	WILDERNESS	B	WB	NSPR
1706030100801.00	RUNNING CREEK	MOUTH	GROUSE CREEK	B	WB	NSPR
1706030100803.00	RUNNING CREEK		MWTH S FK	B	WB	NSPR
1706030104000.00	RUNNING CREEK, SOUTH FORK		CULVERT	B	NB	NSPR
1706030104000.00	RUNNING CREEK, SOUTH FORK		MWTH	B	NB	NSPR
1706030104100.00	LYNX CREEK		CULVERT	B	WB	NSPR
1706030104100.00	LYNX CREEK		MOUTH	B	WB	NSPR
1706030104200.00	EAGLE CREEK		2ND XING	B	WB	NSPR
1706030104200.00	EAGLE CREEK		DIVERSION	B	WB	NSPR
Lower Selway River						
1706030201200.00	MARTEN CREEK	NONE	NONE	B	WB	NSPR
Lochsa River						
1706030300100.00	LDCHSA RIVER		@PETE KING	B	NB	NSPR
1706030301301.00	LDCHSA RIVER		SADDLE CAMP3	B	NB	NSPR
1706030304900.00	SQUAW CREEK		1	B	NB	NSPR
1706030304900.00	SQUAW CREEK		10	B	NB	NSPR
1706030304900.00	SQUAW CREEK		11	B	NB	NSPR

Appendix A-2. (continued)

EPA stream reach	Stream name	Stratum	Section	Channel type	Steelhead Class W vs W A vs B	Chinook Class W vs N spr vs sum
Lochsa River (continued)						
1706030304900.00	SQUAW CREEK		2	B	NB	NSPR
1706030304900.00	SQUAW CREEK		3	B	NB	NSPR
1706030304900.00	SQUAW CREEK		4	C	NB	NSPR
1706030304900.00	SQUAW CREEK		5	C	NB	NSPR
1706030304900.00	SQUAW CREEK		6	B	NB	NSPR
1706030304900.00	SQUAW CREEK		7	B	NB	NSPR
1706030304900.00	SQUAW CREEK		8	B	NB	NSPR
1706030304900.00	SQUAW CREEK		9	B	NB	NSPR
1706030305800.00	PETE KING CREEK	.5 MIUSM	OUT		NB	NSPR
1706030305800.00	PETE KING CREEK	ABOVE	Z HOLE		NB	NSPR
1706030305800.00	PETE KING CREEK		BIG BOULDER		NB	NSPR
1706030305800.00	PETE KING CREEK		CULVERT		NB	NSPR
1706030305800.00	PETE KING CREEK		FALL		NB	NSPR
1706030305800.00	PETE KING CREEK		JUNGLE		NB	NSPR
1706030305800.00	PETE KING CREEK		LAST SLIDE		NB	NSPR
1706030305800.00	PETE KING CREEK		NUT		NB	NSPR
1706030305800.00	PETE KING CREEK		ROAD END		NB	NSPR
1706030305800.00	PETE KING CREEK		SLIDE		NB	NSPR
1706030307100.00	PAPOOSE CREEK		1	B	NB	NSPR
1706030307100.00	PAPOOSE CREEK		2	B	NB	NSPR
1706030307100.00	PAPOOSE CREEK		4	C	NB	NSPR
1706030307100.00	PAPOOSE CREEK		5	C	NB	NSPR
1706030307100.00	PAPOOSE CREEK		6	B	NB	NSPR
1706030307100.00	PAPOOSE CREEK		7	C	NB	NSPR
1706030307100.00	PAPOOSE CREEK		8	B	NB	NSPR
South Fork Clearwater River						
1706030501601.00	JOHNS CREEK	MWTH	GOSPEL	B	NB	NSPR
1706030501700.00	MOORES CREEK		1	B	NB	NSPR
1706030501700.00	MOORES CREEK		2	C	NB	NSPR
1706030502000.00	JOHNS CREEK	MOUTH	FRANK BROWN	B	NB	NSPR
1706030502100.00	JOHNS CREEK	MOUTH	TWIN LAKES	B	NB	NSPR
1706030502100.00	TWIN LAKES CREEK		CAMPSITE	C	NB	NSPR
1706030502100.00	TWIN LAKES CREEK		LOWER MDW	C	NB	NSPR
1706030503301.00	FIVE MILE CREEK	I	I	A	NB	NSPR
1706030503301.00	FIVE MILE CREEK	I	I	B	NB	NSPR
1706030503302.00	CROOKED RIVER, WEST FORK	H	WF1	B	NB	NSPR
1706030503302.00	CROOKED RIVER, WEST FORK	H	WF2	B	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	0.25U	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	0.5u	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	0.75u	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	1	l.OU	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	1.25U	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	1.75u	C	NB	NSPR
1706030504100.00	AMERICAN RIVER	I	2.0u	C	NB	NSPR
1706030504300.00	NEWSOME CREEK	1	BEAR CREEK	C	NB	NSPR
1706030504300.00	NEWSOME CREEK	1	BEAR CREEK RD	C	NB	NSPR
1706030504300.00	NEWSOME CREEK	1	BEAVER CREEK	C	NB	NSPR
1706030504300.00	NEWSOME CREEK	1	CATTLE GRD	B	NB	NSPR

A2. **SDF**

Appendix A-2. (continued)

EPA stream reach	Stream name	Stratum	Section	Channel type	Steelhead Class W vs W A vs B	Chinook Class W vs N spr vs sun
South Fork Clearwater River (continued)						
1706030504300.00	NEWSOME CREEK	1	SNGLSCMPG	C	NB	NSPR
1706030504300.00	NEWSOME CREEK	1 UPPER	SETL POND	C	NB	NSPR
1706030507200.00	CROOKED RIVER, EAST FORK	H	EF1	B	NB	NSPR
1706030507200.00	CROOKED RIVER, EAST FORK	H	EF2	B	NB	NSPR
1706030508100.00	GOSPEL CREEL		MOUTH	B	NB	NSPR
Lower Clearwater River						
1706030605000.00	POTLATCH RIVER		1	B	WA	NSPR
1706030605000.00	POTLATCH RIVER		1	B	WA	NSPR
1706030605000.00	POTLATCH RIVER		2		WA	NSPR
1706030605700.00	POTLATCH RIVER, EAST FORK		2		WA	NSPR
1706030605700.00	POTLATCH RIVER, EAST FORK		3		WA	NSPR
1706030605700.00	POTLATCH RIVER, EAST FORK		MIDDLE	C	WA	NSPR
1706030605700.00	POTLATCH RIVER, EAST FORK		MOUTH	B	WA	NSPR
1706030605700.00	POTLATCH RIVER, EAST FORK		UP CORRALS	C	WA	NSPR

Appendix B.

Mitigation benefits from habitat enhancement project.

The following sections describe habitat enhancement projects, surface areas affected, and parr production from each project. Project benefits are described in terms of parr production in the appendix tables. These benefits are converted to expected smolt production in text tables 15 and 16, based on parr-to-smolt survival rates determined by the Intensive Evaluation and Monitoring section of Project 91-73.

Appendix B-l. Proposed definition of mitigation benefits for implemented projects on Lo10 Creek.

Project Type: Instream Structures

Year Implemented: 1983-84

Soonsor: Clearwater National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares enhanced	22.5	22.5

Production Constraints: High sediment levels

Definition of Benefits: Statistical comparison of steelhead trout and chinook salmon parr densities in treated and untreated sections were scheduled at 3- to S-year intervals to determine the difference in densities. Parr density benefits were determined by subtracting control density from treatment density.

Evaluations were conducted in 1984 and 1985 at relatively low parr abundance. The 1985 evaluation determined that sections with structures supported higher rainbow-steelhead trout parr density (1.8/100 m^2 or 66%) than untreated sections. No difference was noted for chinook salmon.

A randomized block analysis of variance was done for the 1988 report using one treatment and control section in one stratum and two treatment and control sections from a second stratum, repeated annually from 1985 through 1988. Average densities of chinook salmon and steelhead trout parr were 19% and 46% higher in treatment than control sections, respectively. Statistically, treatment densities were significantly higher ($p = 0.03$) for chinook salmon, but the steelhead trout densities did not differ ($p = 0.42$).

An increased amount of sampling (24 treatment and 8 control sections) was conducted in 1990. ANOVA results indicated that treatment densities of Age l+ steelhead trout were significantly higher for K-dam and rock-weir sections than for controls, and for age 0 chinook salmon in rock weir sections only; modest benefit was suggested but all densities were quite low (Rich et al. 1992).

In 1992, normal monitoring levels of sampling revealed mixed benefits of instream structures for age 0 chinook salmon and a moderate positive benefit for steelhead trout.

Appendix Table B1-CH

LOCATION OF AFFECTED REACH: From Yoosa Creek to Brown's Creek in 1984 and from Yoosa Creek to the Forest Boundary from 1985 onward.

DRAINAGE: Clearwater River STREAM: Lolo Creek

SPECIES: Spring Chinook, Natural PROJECT TYPE: Instream Structures

YEAR INITIATED: 1983-84 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Density #/100m2	Parr potential	
Eldorado/Brown's Creek 1706030603800	1.77	10.7	100	1.77	18939	3	44	8333	
Brown's/Yoosa Creek 1706030603900	14.159	10.7	100	14.16	151512	2	77	116664	
Yakus/Eldorado Creek 1706030603600	5.632	17.1	100	3.17	54207	3	44	23851	
				19.1	224658			148848	Totals

Year	Sample size: Treat	Control	Densities(parr/100m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benfit	
1992	3	3	3.5	3.8	3.11	0.69	18	1550	
1991	3	3	11.6	10.1	13.15	-3.05	-30	-6852	
1990	24	8	2.5	2.85	1.49	1.36	48	3055	
1989	3	3	9.9	14.1	5.6	8.5	60	19096	
1988	3	3	31.2	33.2	29.2	4	12	8986	
1987	3	3	19.1	25.7	12.4	13.3	52	29880	
1986	3	3	18.6	13.3	23.9	-10.6	-80	-23814	
1985	26	16	7.6	9.4	4.6	4.8	51	10784	
1984	12	6	3.4	4.7	0.8	3.9	83	2060	a

a. In 1984 only 12.87/14.16 km of the Yoosa Creek to Brown's Creek reach was treated, and an estimated 50% of this reach contained instream structures. Thus, benefits in 1984 were applied to 116,225 m2 x (12.87/14.16) x 0.5 =52,818 m2.

Appendix Table Bl-SH

LOCATION OF AFFECTED REACH: From Yoosa Creek to Brown's Creek in 1984 and from Yoosa Creek to the Forest Boundary from 1985 onward.

DRAINAGE:Clearwater River STREAM: Lolo Creek

SPECIES: Sum. Steelhead, Nat. B's PROJECT TYPE: Instream Structures

YEAR INITIATED: 1983-84 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-Reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Density #/100m2	Parr potential	
Eldorado Brown's Creek 170603066 3800	1.77	10.7	100	1.77	18939	2	14	2651	
Brown's/Yoosa Creek 1706030603900	14.159	10.7	100	14.16	151512	2	14	21212	
Yakus/Eldorado Creek 170603 0603600	5.632	17.1	100	3.17	54207	2	14	7589	
				19.1	224658			31452	Totals

Year	Sample size: Treat	Control	Densities(parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to parr benefit	Total parr from benefit	
1992	3	3	3.2	4.15	2.28	1.87	45	4201	
1991	3	3	4.0	4.81	3.27	1.54	32	3460	
1990	24	8	2.5	2.85	1.49	1.36	48	3055	
1989	3	3	1.9	2.9	0.9	2	69	4493	
1988	3	3	4.5	4.9	4.1	0.8	16	1797	
1987	3	3	6.2	7.2	5.2	2	28	4493	
1986	3	3	5.4	6.7	4	2.7	40	6066	
1985	26	16	5.5	6.4	4.1	2.3	36	5167	
1984	12	6	11.4	12.1	10	2.1	17	1109	a

a. In 1984, only 12.87/14.16 km of the Yoosa Creek to Brown's Creek reach was treated, and an estimated 50% of this reach contained instream structures. Thus, benefits in 1984 were applied to 116,225 m2 x (12.87/14.16) x 0.5 =52,818 m2.

Appendix B-2. Proposed definition of mitigation benefits for implemented project in Eldorado Creek.

Project Type: Passage barriers

Year Implemented: 1984-85

Sponsor: Clearwater National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares added	14.3	14.3

Production Constraints: High sediment levels

Definition of Benefits: Complete passage barriers to adults of both species were removed. Benefits were scheduled to be determined from estimated numbers of parr reared above the project at 3- to S-year intervals.

Total abundance of steelhead trout parr above the project was estimated in August 1986 following an outplant of 1,150 Dworshak National Fish Hatchery adult steelhead trout in 1985. An estimated 7,310 yearling steelhead trout were present above the project in 1986, and additional parr were produced downstream of the project.

Total abundance of chinook salmon parr above the project was estimated in August 1986 following an outplant of 270,000 Rapid River Hatchery chinook salmon fry in April-May. August 1986 abundance totaled 30,203 (11.2% survival). Most of the area was underseeded as evidenced by decreases in abundance away from stocking sites.

Total abundance of chinook salmon and steelhead trout was estimated in 1986 using stratified sampling. Steelhead trout population abundance **estimates** for other years are the product of mean density in monitoring sections and total production area added. Chinook salmon population abundance for 1987 through 1989 were based on 1986 **estimates** of fry-to-parr survival (11.2%) multiplied by the number of fry introduced.

1990-92 parr population sizes were determined by multiplying mean densities **x area** of reach affected. Moderate benefits for steelhead trout were indicated while marginal to no benefit for chinook salmon was noted. The steelhead trout benefit was due to **some** combination of the barrier removal and continued outplants of Dworshak Hatchery steelhead trout fry.

Appendix Table B2-CH

LOCATION OF AFFECTED REACH: The entire upper Eldorado Creek, beginning at the barrier removal site (1 mile above mouth).

DRAINAGE: Clearwater R., Lolo Cr. STREAM: Eldorado Creek

SPECIES: Spring Chinook, Natural PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS): 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percnet of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/l00m2	Parr potential	
Entire stream length 1706030603700	28.96	6.1	86	27.35	166835	2	77	128462.9	
				27.4	166835			128463	Totals

Year	Samples size: Treat	Control	Densities(parr/l00m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit	
1992	3	1	0.0	0	0	0		0	
1991	3	1	0.0	0	0	0		0	
1990	3	1	0.7	0.73	0.46	0.27	37	450	
1989	3			73.4		73.4	100	20460	b
1988	3			26.9		26.9	100	5936	b
1987	3			58.1		58.1	100	13328	b
1986	17			29.9		29.9	100	30206	a
1985		6			0				
1984		4			0				

a. Population estimate derived from stratified sampling in August 1986. Summer parr were survivors from 270,000 fry stocked in April and May 1986. Fry to parr survival was 11.2%.

b. Based on numbers of fry stocked multiplied by the fry to parr survival rate estimated in 1986.

Appendix Table B2-SH

LOCATION OF AFFECTED REACH: The entire upper Eldorado Creek, beginning at barrier removal site, 1.6 km up from the mouth.

DRAINAGE: Clearwater R, Lolo Cr STREAM: Eldorado Creek

SPECIES: Sum. Stelhead, Nat. B's PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS): 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Entire stream length 1706030603700	28.96	6.1	86	27.35	166835	3	10	16684	
				27.4	166835			16684	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean Treat	Control	Benefit	%Density due to parr benefit	Total parr from benefit	
1992	3		0.21		0.21	100	350	
1991	3		7.03		7.03	100	11729	
1990	3		7.08		7.08	100	11812	
1989	3		1		1	100	1435	b
1988	3		0.91		0.91	100	1306	b
1987	3		3.7		3.7	100	5309	b
1986	17		3.9		3.9	100	7310	a
1985		6		0				
1984		4		0				

a. Population estimate derived from stratified sampling in August 1986. Summer parr were survivors from 270,000 fry stocked in April and May 1986. Fry to parr survival was 11.2%.

b. Based on parr density x surface area/100.

Appendix B-3. Proposed definition of mitigation benefits for implemented projects on the upper Lochsa River.

Project Type: Instream structures (lower White Sand and Crooked Fork Creeks)

Year Implemented: 1983-84

Sponsor: Clearwater National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares added	16.7	16.7

Production Constraints:

Definition of Benefits: An evaluation was conducted in 1984 at low parr abundance for both species. Little habitat change was observed, and no difference in densities for either species was detected between treated and untreated sections. A high rate of structure failure occurred the first year after implementation. No definable benefits are anticipated from this project and its evaluation has been discontinued.

Appendix B-4. Proposed definition of mitigation benefits for implemented projects on Crooked Fork Creek.

Project Type: Passage barriers

Year Imolemented: 1984-85

Sponsor: Clearwater National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares added	10.7	10.5

Production Constraints:

Definition of Benefits: Passage barriers to adults of both species were removed. Benefits were scheduled to be determined from estimated numbers of parr reared above the project at 3- to S-year intervals.

Total abundance of chinook salmon parr above the project was estimated in August of 1986, 1987, 1988 and 1989 following May fry plants of 156,200, 164,400, 102,800 and 93,400, respectively. Estimated parr abundance was 17,600, 32,600, 17,700 and 10,630, respectively. Average survival rate for these four years was 16.1%, and ranged from 11.3 to 19.8%. Most of the area was underseeded in both years as evidenced by decreases in abundance away from stocking sites.

The barrier had been a complete block to adult chinook salmon passage and a partial block to steelhead trout. We assumed 90% of adult steelhead trout were blocked based on occasional observations of steelhead trout parr above and prior to the project (Al Espinosa, personal communication). Hence, steelhead trout parr abundance was multiplied by 0.90 to estimate project benefits.

No steelhead trout supplementation has occurred above the project. Pioneering by wild/natural adults will be the source of population rebuilding.

Sampling was not conducted in 1990, and 1991-92 sampling indicated marginal benefit for chinook salmon and steelhead trout.

Appendix Table B4-CH

LOCATION OF AFFECTED REACH: From Barrier Removal project (1.21 km above mouth of Boulder to headwaters of Crooked Fork and Hopeful creeks.

DRAINAGE: Clearwater R, Lochsa R STREAM: Crooked Fork Creek

SPECIES: Spring Chinook, Natural PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS)50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
170603030470O	8.85	8.5	100	7.64	64940	3	44	28574	
All Hopeful Creek 170603030470l	6.28	4.9	64	6.28	19694	2	77	15164	
Above Hopeful Creek 17060303 O	6.44	3.7	75	6.44	17871	2	77	13761	
				20.4	102505			57499	Totals

Year	Sample size: Treat	Control	Densities (parr/l00m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit	
1992	3			0		0	100	0	
1991	2			0.43		0.43	100	441	
1990	0						100		
1989	18			10.34a			100	10600	a
1988	18			17.26a			100	17700	a
1987	22			31.80a			100	32600	a
1986	13			17.17a		0	100	17600	a
1985		4			0				
1984		4			0				

a. Parr numbers estimated by stratified sampling annually, from 1986-89.

Appendix Table B4-SH.

LOCATION OF AFFECTED REACH: From Barrier Removal project (1.21 km above mouth of up to headwaters of Crooked Fork and Hopeful creeks.

DRAINAGE: Clearwater R, Lochsa R STREAM: Crooked Fork Creek

SPECIES: sum. Steelhead, Nat B's. PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS): 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Boulder to Hopeful creek									
170603030447 00	8.85	8.5	100	7.64	64940	3	10	6494	
All Hopeful creek									
170603 0 304701	6.28	4.9	77	6.28	23694	2	14	3317	
Above Hopeful creek									
17060303 0	6.44	3.7	75	6.44	17871	2	14	2502	
				20.4	106505			12313	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	%Density due to parr from Benefit	Total benefit
1992	2			0.04		0.04	43
1991	2			0		0	0
1990	0						
1989	18			0		0	90 0 a
1988	18			0		0	90 0
1987	22			0.09		0.09	90 85
1986	13			0.29		0.29	90 277
1985		4			0		
1984		4			0.03		

a. Parr numbers estimated by stratified sampling.

Appendix B-5. Proposed definition of mitigation benefits for implemented project on Colt Creek.

Project Type: Passage barriers

Year Implemented: 1986

Sponsor: Clearwater National Forest

Enhancement	Species benefitted: B-Run steelhead trout	Species benefitted: Spring chinook salmon
Production type	natural	natural
Hectares added	6.1	0

Production Constraints: Gradient judged too steep to achieve chinook salmon passage.

Definition of Benefits: Passage barriers to adult steelhead trout were removed. Benefits were scheduled to be determined from estimated numbers of steelhead trout parr reared above the barriers at 3- to S-year intervals (after or a pioneering population is established).

No rainbow-steelhead trout parr were observed in the monitoring section from 1987 to 1989.

Colt Creek was not sampled in 1990 but the one section which was snorkeled in 1991 had a density of 1.12 steelhead trout parr/100 m2, indicating some pioneering is occurring by steelhead trout.

Appendix Table B5-SH

LOCATION OF AFFECTED REACH: Upper Colt Creek, beginning at barrier removal site, approximately 0.8 km above mouth.

DRAINAGE: Clearwater R, Lochsa R, White Sand Cr STREAM: Colt Creek

SPECIES: Sum. Steelhead, Nat. B's PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1986 EXPECTED PROJECT LIFE (YRS)50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706030303800	20.92	3	100	20.11	60330	2	14	8446	
				20.11	60330			8446	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2 Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	1			0		0		0
1991	1			1.12		1.12	100	676
1990	0							
1989	1			0		0	0	0
1988	1			0		0	0	0
1987		1			0			
1986								
1985								
1984								

Appendix B-6a. Proposed definition of mitigation benefits for implemented projects on Crooked River.

Project Passage barrier (culvert)

Year Implemented: 1984

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Sprina chinook salmon
Production type	natural	natural
Hectares added	12.7	8.4

Production Constraints: Channelized (treated with structures in 1985), lack of riparian vegetation for 6.1 km upstream of barrier culvert.

Definition of Benefits: A partial barrier to adult steelhead trout and chinook salmon was removed by replacement of a culvert with a bridge. Benefits will be determined annually from estimated numbers of parr reared above the project. Fifty percent of this production is assumed to be the mitigation benefit.

Total abundance was estimated in Crooked River between the project and the confluence of its East and West forks in 1986 and 1987. Beginning in 1988, the usable area in the East and West forks have been included in the total abundance **estimates.**

Appendix Table B6a-CH

LOCATION OF AFFECTED REACH: Beginning 13.0 km above the mouth (1.0 km above the mouth of Relief Creek) and continued to the confluence of the east and west forks in 1986 and 1987 and included these two forks in 1988.

DRAINAGE: Clearwater River STREAM: Crooked River

SPECIES: Spring Chinook, Natural PROJECT TYPE: Barrier (partial) Removal

YEAR INITIATED: 1984 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Crooked River 1706030503301	7.241	10.1	100	6.33	63933	2	44	28131	
Crooked River, East Fork 1706030507200	10.14	3.7	24	10.14	37518	2	44	16508	
Crooked River, West Fork 1706030503302	7.56	4.9	32	7.56	37044	2	44	16299	
				24.0	138495			60938	Totals

Year	Sample size: Treat	Control	Densities (parr #/100m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit	
1992	4			0		0		0	
1991	14			0		0		0	
1990	14			0.12		0.06	50	83	
1989	12			21.8		10.9	50	7061	c
1988	11			10.2			50	7061	b
1987	3			1.07			50	742	b
1986	16			5.35			50	3707	b
1985	4			16.82		16.82	50	5351	a
1984		11			0.23				

a. Estimate is (surface area/100*average density) times 50% as the barrier benefit.

b. Estimates are 50% of that obtained from stratified sampling, assuming barrier removal benefit from barrier removal is 50% of adult passage.

c. Estimate is surface area /100*50% of weighted average density, relative to surface area in each EPA reach.

Appendix Table B6a-SH

LOCATION OF AFFECTED REACH: Beginning 13.0 km above the mouth (1.0 km above the mouth of Relief Creek) and continued to the confluence of the East and West forks in 1986 and 1987 and included these two forks in 1988.

DRAINAGE: Clearwater River STREAM: Crooked River

SPECIES: Sum. Steelhead, Nat. B's PROJECT TYPE: Barrier (partial) Removal

YEAR INITIATED: 1984 EXPECTED PROJECT LIFE (YRS) 5ot

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Crooked River 1706030503301	7.241	10.1	100	6.33	63933	2	14	8950.62	
Crooked River, East Fork 1706030507200	10.14	3.7	71	10.14	37518	1	20	7503.6	
Crooked River, West Fork 1706030503302	7.56	4.9	100	7.56	37044	1	20	7408.8	
				24.0	138495			23863	Totals

Year	Sample size: Treat	Control	Densities (parr #/lOOm2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit		Pre-treat Numbers
1991	4			0.15		0.075	50	104		
1991	14			0.77		0.385	50	533		
1990	14			1.52		0.76	50	1053		
1989	12			1.48		0.74	50	942	b	
1988	11						50	1958	a	
1987	3						50	1174	a	
1986	16						50	1375	a	
1985		4	1.0		0.97	-0.97	50	0		618
1984		11	0.3		0.28	-0.28	ERR	ERR		178

a. Estimate is (surface area/lOO*average density) times 50% as the barrier benefit.

b. Estimates are 50% of that obtained from stratified sampling, assuming barrier removal benifit from barrier removal is 50% of adult passage.

Appendix B-6b. (Crooked R., continued).

Project Type: Instream structures, riparian revegetation

Year Implemented: 1984-85

Soonsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares enhanced	7.2	7.2

Production Constraints: Channelized, lack of riparian vegetation.

Definition of Benefits: Statistical comparisons of steelhead trout and chinook salmon parr densities in treated and untreated sections were scheduled at 3- to 5-year intervals to determine the differences in densities.

An evaluation was conducted in July and August 1986 at a fully seeded condition for yearling steelhead trout, and moderate seeding levels for chinook salmon. Alteration of habitat by the structures had occurred; riparian conditions had not yet improved. No difference in densities could be attributed to the instream structure project.

A randomized block analysis of variance was done for the 1988 report using one treatment and one control section in each of two strata, repeated annually from 1985 through 1988 to compare parr densities for both chinook salmon and steelhead trout. Average densities of chinook salmon and steelhead trout parr were 3.8% and 42.1% higher, respectively, in treatment than control sections. Statistically, the comparisons of treatment and control densities were not significant for either species ($p = 0.97$ and $p = 0.44$, respectively).

An increased amount of sampling (15 treatment and 13 control sections) was conducted in 1990. ANOVA results indicated significantly higher treatment densities for steelhead trout parr but not for chinook salmon (Rich et al. 1992). Normal monitoring level sampling in 1991-92 revealed no benefit for chinook salmon and a modest benefit for steelhead trout.

Appendix B6b-CH

LOCATION OF AFFECTED REACH: Beginning 14.1 km upstream from the mouth, at the culvert removal site and continuing upstream 7.24 km.

DRAINAGE: **Clearwater River** STREAM: Crooked River

SPECIES: Spring Chinook, Natural PROJECT TYPE: Instream Structures

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706030503301	7.241	10.1	100	2.735	27623.5	3	44	12154	
1706030503300	12.55	10.1	100	4.505	45500.5	2	77	35035	
				7.2	73124			47190	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit
1992	6	4	0.3	0.26	0.24	0.02		15
1991	6	4	0.0	0	0	0		0
1990	15	13	0.9	0.54	1.38	-0.84	-156	-614
1989	2	2	22.2	24.8	19.5	5.3	21	3876
1988	2	2	21.7	26.4	16.9	9.5	36	6947
1987	2	2	2.1	3.5	0.6	2.9	83	2121
1986	2	2	20.4	19.8	21	-1.2	-6	-877
1985	2	2	46.0	42.1	49.9	-7.8	-19	-5704
1984								

Appendix B6b-SH

LOCATION OF AFFECTED REACH: Beginning 14.1 km upstream from the mouth, at the culvert removal site and continuing upstream 7.24 km.

DRAINAGE: Clearwater River STREAM: Crooked River

SPECIES: Sum. Steelhead, Nat B's, PROJECT TYPE: Instream Structures

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KM.5 of reach affected	M2 of reach affected	Habitat rating	Rated density #/lOOm2	Parr potential	
1706030503301	7.241	10.1	100	2.735	27623.5	2	14	3867	
1706030503300	12.55	10.1	100	4.505	45500.5	2	14	6370	
				7.2	73124			10237	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	6	4	7.8	9.19	5.68	3.51	38	2567
1991	6	4	3.4	4.51	1.76	2.75	61	2011
1990	15	13	2.2	2.51	1.89	0.62	25	453
1989	2	2	4.2	5.4	3	2.4	44	1755
1988	2	2	9.9	11.8	7.9	3.9	33	2852
1987	2	2	9.8	13.2	6.3	6.9	52	5046
1986	2	2	9.8	9.8	9.8	0	0	0
1985	2	2	1.5	1.4	1.5	-0.1	-7	-73
1984								

Appendix B-6c. (Crooked R., Continued).

Project Type: Off-channel developments

Year Implemented: 1984-87

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares added	1.26	1.26

Definition of Benefits: The total abundance of steelhead trout and chinook salmon parr in connected ponds and side channels will be considered mitigation benefits.

Surface area of connected ponds increased from 0.65 hectares to 1.26 hectares beginning in 1989.

Connected ponds comprise all of the credited side channel habitat enhancements in Crooked River. benefits to steelhead trout have been modest, benefit for chinook salmon was significant (due to fry plants) in 1988 and 1989 but trivial to nonexistent in 1990-92.

Appendix B6c-CH

LOCATION OF AFFECTED REACH: Ponds connected to Crooked River in study strata I and II.

DRAINAGE: Clearwater River STREAM: Crooked River

SPECIES: Spring Chinook, Natural PROJECT TYPE: Off-Channel Developments (Connected Ponds)

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706030503301					12631	1	108	13641	
					12631			13641	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit
1992	6		0.2	0.15	0	0.15		19
1991	6		0.0	0	0	0	-	0
1990	1		0.1	0.08	0	0.08	100	10
1989	5			255		255	100	32209
1988	2			90.9		90.9	100	11482
1987	1			3.2		3.2	100	404
1986	5			63.2		63.2	100	7983

Appendix B6c-SH

LOCATION OF AFFECTED REACH: Ponds connected to crooked River in study strata I and II.

DRAINAGE: Clearwater River STREAM: Crooked River

SPECIES: Sum. Steelhead, Nat B's. PROJECT TYPE: Off-Channel Developments (Connected Ponds)

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706030503301					12631	2	14	1768	
					12631			1768	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit
1992	6			6.88		6.88	100	869
1991	6			5.69		5.69	100	719
1990	1			1.2		1.2	100	152
1989	5			11.45		11.45	100	1446
1988	2			17		17	100	2147
1987	1			47.2		47.2	100	5962
1986	5			5		5	100	632

Appendix B-7a. Proposed definition of mitigation benefits for implemented projects in Red River.

Project Type: Instream structures

year Implemented: 1984-85

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Soring chinook salmon
Production type	natural	natural
Hectares enhanced	11.8	11.8

Definition of Benefits: Statistical comparisons of steelhead trout and chinook salmon parr densities in treated and untreated sections were scheduled at 3- to 5-year intervals to determine the difference in densities.

An evaluation was conducted in July and August 1986 at moderately low steelhead trout and chinook salmon parr abundance. No difference in densities could be attributed to the instream structure project.

A randomized block analysis of variance was done for the 1988 report using one treatment and one control section in each of two strata, repeated annually from 1985 through 1988 to compare parr densities for both chinook salmon and steelhead trout in treatment and control sections. Average densities of chinook salmon parr were 34.7% higher in treatment than control sections, while densities of steelhead trout parr were 9.2% lower in treatment than control sections. Statistically, there were no differences in mean densities for either species, in control and treatment sections.

In 1990, monitoring level sampling indicated little benefit for steelhead trout and a negative benefit for chinook salmon. An intensive sampling effort in 1991 revealed almost no benefit for steelhead trout and a marginal benefit for chinook salmon.

Appendix B7a-CH

LOCATION OF AFFECTED REACH: Within two non-adjacent reaches, Siegel Creek to Moose Creek and South Fork Red River to Soda Creek.

DRAINAGE: Clearwater River STREAM: Red River

SPECIES: Spring Chinook, Natural PROJECT TYPE: Instream Structures

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential
Siegel to Moose Creek 1706030503600	8.689	13.4	100	2.73	36582	2	77	28168
South Fork to Soda Creek 1706030503800	9.493	10.1	100	8.05	81305	3	44	35774
				10.8	117887			63942

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit
1992	27	29	3.7	3.73	3.63	0.1	3	118
1991	60	58	6.4	7.48	5.25	2.23	30	2629
1990	3	5	15.7	12.11	17.8	-5.69	-47	-6708
1989	2	2	17.2	20.4	13.9	6.5	32	7663
1988	2	2	34.4	43.7	25.1	18.6	43	21927
1987	2	2	39.7	47.8	31.6	16.2	34	19098
1986	2	2	27.6	31.6	23.5	8.1	26	9549
1985	2	2	62.8	66.7	58.8	7.9	12	9313
1984								

Appendix B7a-SH

LOCATION OF AFFECTED REACH: Within two non-adjacent reaches, Siegel Creek to Moose Creek and South Fork Red River to Soda Creek.

DRAINAGE: Clearwater River STREAM: Red River

SPECIES: Sum. Steelhead, Nat. B's. PROJECT TYPE: Instream Structures

YEAR INITIATED: 1984-85 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Siegel to Moose creek 17060305003600	8.689	13.4	100	2.73	36582	3	10	3658	
South Fork to Soda Creek 17060305003800	9.493	10.1	100	8.05	81305	2	14	11383	
				10.8	117887			15041	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	27	29	2.0	2.57	1.39	1.18	46	1391
1991	60	58	1.1	1.12	1.1	0.02	2	24
1990	3	5	0.8	1.32	0.53	0.79	60	931
1989	2	2	1.5	1.2	1.8	-0.6	-50	-707
1988	2	2	1.5	1	1.9	-0.9	-90	-1061
1987	2	2	3.1	3.1	3	0.1	3	118
1986	2	2	2.4	2.3	2.5	-0.2	-9	-236
1985	2	2	1.2	1.5	0.9	0.6	40	707
1984								

Appendix B-7b. (Red River, Continued).

Project Type: Off-channel developments

Year Implemented: 1985

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Sprino chinook salmon
Production type	natural	natural
Hectares added	0.02	0.02

Production Constraints: Limited opportunity for side-channel/pond development.

Definition of Benefits: The total abundance of steelhead trout and chinook salmon parr in off-channel production areas are considered mitigation benefits.

In 1986, the numbers of steelhead trout and chinook salmon parr estimated in the 0.02 hectares added totaled 1 and 215, respectively. No sampling has been done in the ponds from 1987 through 1991.

Off channel developments in Red River have suffered from sediment deposition in low water years and their sampling was discontinued.

Appendix B-8. Proposed definition of mitigation benefits for implemented project in Pine Creek.

Project Type: Passage barrier

year Implemented: 1987

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted A-Run steelhead trout	Spring chinook salmon
Production type	natural	
Hectares added	6.9	

Production Constraints:

Definition of Benefits: A barrier to adult steelhead trout was removed by this project. However, we believe the barrier removal did allow adult steelhead trout to ascend Pine Creek. Even with additional barrier removals, the gradient appears too steep to ensure passage. Parr density monitoring has been discontinued in Pine Creek.

Appendix B-9. Proposed definition of mitigation benefits for implemented project in Pole Creek.

Project Type: Diversion screen

Year Implemented: 1983-84

Sponsor: Sawtooth National Forest

Enhancement	Species benefitted	
	A-Run steelhead trout	Spring chinook salmon
Production type	natural	natural
Hectares added	3.9	3.9

Production Constraints: Juvenile steelhead trout upstream passage is impeded.

Definition of Benefits: An unscreened irrigation diversion was screened. The proportion of steelhead trout and chinook salmon parr reared upstream of the diversion that are screened from the ditch and returned to Pole Creek will be considered as mitigation benefits. The proportion was assumed to be 50% for these estimates. The upper Salmon River intensive study will determine this proportion during PIT tag operations and will directly estimate parr-to-smolt survival.

Chinook salmon were stocked upstream of the diversion in 1989.

No parr of either species were observed above the diversion in 1990-92.

Appendix B9-CH

LOCATION OF AFFECTED REACH: From the irrigation diversion upstream 7.94 km.

DRAINAGE: Salmon River STREAM: Pole Creek

SPECIES: Spring Chinook, Natural PROJECT TYPE: Barrier (partial) Removal

YEAR INITIATED: 1984 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706020114900	14.48	4.9	100	7.94	38862	2	77	29924	
				7.9	38862			29924	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	2	4	0.0	0	0	0		0
1991	4	3	0.0	0	0	0		0
1990	4	3	0.1	0	0.19	0		0
1989	6			0.12		0.06	50	23
1988	6			0.04		0.02	50	8
1987	6			0				
1986	2			0				
1985	6			0				
1984		6			0			

Appendix B9-SH

LOCATION OF AFFECTED REACH: From the irrigation diversion upstream 7.94 km.

DRAINAGE: Salmon River STREAM: Pole Creek

SPECIES: Sum. Steelhead, Nat. A's. PROJECT TYPE: Barrier (partial) Removal

YEAR INITIATED: 1984 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach lenght (km)	Width (m)	Percent of reach utilized	KMS of reach affected	t42 of reach affected	Habitat rating	Rated density #/lOOm2	Parr potential	
1706020114900	14.48	4.9	100	7.94	38862	3	10	3886	
				7.9	38862			3886	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit	
1992	2	4	0.3	0	0.38	0		0	
1991	4	3	0.1	0	0.3	0		0	
1990	4	3	0.1	0	0.31	0		0	
1989	4			0.68		0.34	50	132	
1988	6			1.96		0.98	50	381	
1987	6			0		0	50	32	a
1986	2			0.11		0.055	50	23	
1985	6			1		0.5	50	210	a
1984		6			0				

a. Total parr from benefits is calculated from stratified sampling and multiplying the estimate by 0.5 to account for an assumed 50% benefit from the diversion screen.

Appendix B-10. Proposed definition of mitigation benefits for implemented project, Bear Valley and Elk Creeks.

Project Type: Sediment reduction, riparian revegetation

Year Implemented: 1987 - ongoing

Sponsor: Boise National Forest

	Species benefitted	
Enhancement	Middle Fork Salmon River B-Run steelhead trout	Spring chinook salmon
Production type	Wild	Wild
Hectares to be improved	77	76

Production Constraints: High sediment levels, streambank degradation.

Definition of Benefits: The Bear Valley and Elk Creek project will attempt to significantly reduce sediment from point and nonpoint sources in the drainage and complement anticipated grazing management improvements. Benefits will be estimated based on: a) measured changes in sediment (Project 84-24) and fish-sediment relationships, b) improvements in survival from egg deposition to parr, and c) an increase in the ratio of parr density in the Bear Valley/Elk Creek drainage to parr density in control streams throughout the upper Middle Fork Salmon River drainage.

The ratio of parr/100 m^2 to redds/hectare in the Bear Valley - Elk Creek spawning areas has shown no indication of increased parr survival from brood year 1983 to 1988. The ratios were 5.5, 2.5, 1.8, 0.8, 1.3 and 0.4 respectively (mean = 2.5). The average value for this ratio among other Middle Fork and upper Salmon River sections was 17.5. Data used for these ratios were those used for the Middle Fork and upper Salmon River redd to parr analysis with additional observations removed when redd/hectare or parr/100 m^2 = 0.0. The average treatment/control density ratio for chinook salmon averaged 0.05 in the pretreatment years of 1985 through 1987. The ratios in 1988 and 1989, after some sediment reduction work, which began in 1987, were 0.12 and 0.11, respectively. This small difference may not be a result of the project, but it demonstrates how the ratio might be used to determine benefits.

Evaluation of this sediment reduction project will be carried out when the project is complete (1991) and sufficient time has passed to allow bank stabilization and flushing of the accumulated sediment in the spawning areas of Bear Valley and Elk Creeks (at least 5 years). Recovery of the aquatic habitat is expected to be a slow process and hinges on improved grazing management by the USFS.

Despite an increased level of sampling intensity in 1991-92, parr benefit was negative or non-existent in the Bear Valley Complex compared to the Middle Fork control streams based on comparison of ratios. Extremely poor adult escapements, especially of chinook salmon, have confounded the problems in Bear Valley.

Appendix BlO-CH

LOCATION OF AFFECTED REACH: All of Bear Valley Creek and its tributarie
Elk Creek and Bearskin Creek.

DRAINAGE: Salmon R, M Fk Salmon R STREAM: Bear Valley Creek

SPECIES: Spring Chinook, Wild PROJECT TYPE: Sediment Reduction and Riparian Revegetation

YEAR INITIATED: 1987-91 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat Rating	Rated density #/lOOm2	Parr potential	
See below (a)	73.85	7.2	95.7	71.87	757085	2-3	70	529960	
				71.9	757085			529960	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Treat: control ratio	Mean T/C ratio '85-'87	Benefit density OBS-EXP	Total parr from benefit
1992	16	15	5.3	0.66	10.23	0.06	.05	-9.57	-72453
1991	18	20	2.3	0.17	4.14	0.04	.05	-3.97	-30056
1990	10	9	4.6	0.34	9.24	0.04	.05	-8.9	-67381
1989	10	9	16.3	3.3	30.7	0.11	.05	3.3	24984
1988	10	7	16.2	4	33.7	0.12	.05	4	30283
1987	pt=10 (b)	9	30.0	1.6	30	0.05	.05		
1986	pt=9 (b)	9	24.5	1.4	24.5	0.06	.05		
1985	pt=10 (b)	9	17.4	0.6	17.4	0.03	.05		
1984	pt=7 (b)	1	9.2	2.8	9.2	(d)			

a. EPA reaches, all be 8innin 2600, with 170602050 are: 2300, 2400, 2401, 2402, 2500, 2501, 270 2800, 2801, 2802, 2 03, 2601, 2602, 2603, 2604, 2605, 8400, and 8401.

b. pt=pretreatment. Although some improvements began in 1987, no significant reduction in sediment and fish density response was expected until after 1991.

c. control sections are in the Middle Fork Salmon River tributaries of Xnapp, Beaver, Cape Horn, Sulphur, and Loon creeks.

d. Insufficient control sections with which to make a treatment/control ratio in 1984.

Appendix B10-SH

LOCATION OF AFFECTED REACH: All of Bear Valley Creek and its tributarie Elk Creek and Bearskin Creek.

DRAINAGE: Salmon R, M Fk Salmon R STREAM: Bear Valley Creek

SPECIES: Sum. steelhead, Wild B's. PROJECT TYPE: Sediment Reduction and Riparian Revegetation

YEAR INITIATED: 1987-91 EXPECTED PROJECT LIFE (YRS):

Affected EPA-reach	EPA-reach lenght (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
See below (a)	73.85	7.2	95.7	71.87	757085	2-3	14	103721	
				71.9	757085			103721	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Treat: control 'ratio	Mean 85-87 T/C ratio	Benefit density OBS-EXP	Total parr from benefit
1992	16	15	0.7	0.37	1.04	0.36	0.16	-0.67	-5072
1991	18	20	0.5	0.09	0.93	0.10	0.16	-0.84	-6360
1990	10	9	0.9	0.04	1.92	0.02	0.16	-1.88	-14233
1989	10	9	0.7	0.02	1.53	0.01	0.16	0.02	151
1988	10	7	1.2	0.12	2.7	0.04	0.16	0.12	909
1987	pt=10 (b)	9	1.5	0.01	1.5	0.01			
1986	pt=9 (b)	9	1.4	0.2	1.4	0.14			
1985	pt=10 (b)	9	0.9	0.3	0.9	0.33			
1984	pt=7 (b)	1	0.0	0.06	0	(d)			

a. EPA reaches, all beginning with 170602050 are: 2300, 2400, 2401, 2402, 2500, 2501, 270 2800, 2801, 2802, 2803, 2600, 2601, 2602, 2603, 2604, 2605, 8400, and 8401.

b. pt=pretreatment. Although some improvements began in 1987, no significant reduction in sediment and fish density response is expected until approximately 1991.

c. Control sections are in the Middle Fork Salmon River tributaries of Knapp, Beaver, Cape Horn, Sulphur, and Loon creeks.

d. Insufficient control sections with which to make a treatment/control ratio in 1984.

Appendix B-11. Proposed definition of mitigation benefits for implemented project, Knapp Creek.

Project type: Passage barrier (diversion structure bypassed)

year implemented: 1987

Sponsor: Challis National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type		wild
Hectares added		7.8

Production constraints:

Definition of benefits: An irrigation diversion that partially blocked adult chinook salmon passage was modified. Benefits will be estimated as 50% of total abundance of chinook salmon parr reared above the barrier. Seeding of the area will be from pioneering by wild fish. Parr density estimates in 1987 and 1988 were based on one sample each year. Once density increases appear, benefits can be evaluated based on multiple samples and stratified sampling.

The barrier was removed during the summer of 1987 and could have provided adult chinook salmon passage that year and parr density benefits in 1988. Although the percent of parr carrying capacity above the barrier has remained below 1%, percent chinook salmon carrying capacity below the barrier has ranged from 7-21% and pioneering above the barrier is likely.

Pioneering above the barrier has probably been hindered by extremely low adult chinook salmon escapements and possibly by low flow.

Appendix Bll-CH

LOCATION OF AFFECTED REACH: All of of Upper Knapp Creek, beginning 3.5 km above the mouth.

DRAINAGE: Salmon R, M Fk Salmon R, Marsh Cr STREAM: Knapp Creek

SPECIES: Spring Chinook, Wild PROJECT TYPE: Barrier (partial) removal

YEAR INITIATED: 1987 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706020503503	**23.23**	**4.57**	**86**	**12.3**	56211	1	**108**	**60708**	
				12.3	56211			60708	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	**4**			2.31		**1.155**	**50**	649
1991	**4**			**5.12**		**2.56**	**50**	1439
1990	**5**			**0.11**		**0.055**	**50**	**31**
1989	1			**0.42**		**0.21**	**50**	118
1988	1			**0.16**		**0.08**	**50**	**45**
1987		1			0.15			
1986		1			0			
1985		**2**			0.29			
1984								

Appendix B-12. Proposed definition of mitigation benefits for implemented project, Johnson Creek.

Project Type: Passage barrier

Year Implemented: **1984-86**

Sponsor: Idaho Department of Fish and **Game**

Enhancement	Species benefitted	
	B-Run steelhead trout	Summer chinook salmon
Production type		natural
Hectares added		39.5

Production Constraints: High sediment levels in portions of the drainage.

Definition of Benefits: Natural rockbarriers that completely blocked adult chinook salmon passage were modified. Benefits are estimated from total abundance of chinook salmon parr reared above barriers.

Totals of 50,744, 177,606, 118,424, 366,800 and 200,000 summer chinook salmon fry were stocked into the upper Johnson Creek drainage in 1985, 1986, 1987, 1988 and 1989, respectively. Total abundance of parr from the 1986 and 1987 plants were estimated at 23,700 and 17,700, respectively. Average fry to parr survival was 14.2%. Fry stocking did not fully seed the drainage either year. For the monitoring years of 1985, 1988 and 1989, 14.2% fry-to-parr survival was assumed. In 1989, 15 chinook salmon redds were counted in Johnson Creek above the barrier **removal** project. These redds probably resulted from spawners returning from fry releases in 1985-87. Total parr abundance and egg-to-parr survival will be estimated in 1990.

An intensive evaluation in 1990 resulted in a total chinook salmon parr population size above the barrier removal of < or = 1225 fish. No sampling occurred in 1991, and no chinook salmon parr were observed in 1992.

Appendix BlZ-CH

LOCATION OF AFFECTED REACH: Upstream from the lower barrier removal site upstream to the headwaters including tributaries of Rock, Sand, Whiskey, and Boulder c

DRAINAGE: Salmon R, S Fk Salmon R, E Fk S Fk Salmon R STREAM: Johnson Creek

SPECIES: Summer Chinook, Natural PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1984 EXPECTED PROJECT LIFE (YRS): so+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
See below (a)	**64.68**	**8.04**	**85.9**	**49.14**	**395086**	**1-3**	**75**	**294734**	
				49.1	395086			294734	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit	
1992	**3**			**0**		**0**		**0**	
1991	**0**								
1990	**25**			**0.31**		**0.31**	**100**	**1225**	
1989	**7**			7.19	b	7.19		**28400**	**b**
1988	**7**			**13.17**	b	13.17		**52086**	b
1987	11			**4.48**	b	**4.48**		**17700**	b
1986	10			6	b	**6**		**23711**	b
1985	10			**1.82**	b	**1.82**		**7206**	b
1984		**23**			**0**				

a. EPA reaches affected all begin with 170602080 and end with: 4700, 4701, 4701.13, 4701.24, 4702, 4703, 4704, 9800, 7400, 960 , and 9700.

b. Populations above the barrier were estimated in 1986 and 1987 with stratified sampling. Average fry to parr survival was 14.2%. Population estimates in 1985 and 1988 are the product of number of fry planted and estimated fry to parr survival. Maximum summer parr population achieved (in 1988) equated to 18% of carrying capacity.

Appendix B-13. Proposed definition of mitigation benefits for implemented project in Dollar Creek.

Project Type: Passage barrier (partial)

Year Implemented: 1986

Sponsor: Boise National Forest

	Species benefitted	
Enhancement	South Fork Salmon River B-Run steelhead trout	Spring chinook salmon
Production type	wild	natural
Hectares added	6.8	3.3

Production Constraints: High sediment levels

Definition of Benefits: Debris jam barriers that partially blocked passage were selectively removed. Parr benefits for 1986-88 were based on densities in a single monitoring section. The barriers were assumed to block 50% of adult chinook salmon and steelhead trout passage, and this percent of the parr density is attributed to the project.

Low densities of steelhead trout parr and no chinook salmon parr have been observed in 1989-92.

Appendix B13-CH

LOCATION OF AFFECTED REACH: All of Dollar Creek.

DRAINAGE: Salmon R, S Fk Salmon R STREAM: Dollar Cr

SPECIES: Summer Chinook, Natural PROJECT TYPE: Barrier (partial) removal

YEAR INITIATED: 1986 EXPECTED PROJECT LIFE (YRS)SO+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated densit #/lOOms	Parr potential	
mouth to North Fork 1706020803200	1.77	6.1	100	6.1	10789	3	44	4747	
Upper Dollar Creek 1706020803201	9.33	4.6	52	2.4	22187	3	44	9762	
				8.5	32976			14509	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	1			0		0		0
1991	1			0		0		0
1990	1			0		0		0
1989	1			0		0	50	0
1988	1			0.23		0.12	50	38 a
1987	1			0		0	50	0
1986		1			0	0	50	0
1985								
1984								

a. Equates to 50% of parr estimated above barriers since barriers were assumed to block 50% of adult chinook salmon spawners.

Appendix B13-SH

LOCATION OF AFFECTED REACH: All of Dollar Creek.

DRAINAGE: Salmon R, S Fk Salmon R STREAM: Dollar Creek

SPECIES: Summer Steelhead, Wild Bs PROJECT TYPE: Barrier (partial) removal

YEAR INITIATED: 1986 EXPECTED PROJECT LIFE (YRS)50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
mouth to North Fork 1706020803200	1.77	6.1	100	6.1	10789	2	14	1510	
Upper Dollar Creek 1706020803201	9.33	4.6	52	4.6	22187	2	14	3106	
North Fork Dollar Creek 1706020808700	6.11	2.4	100	2.4	14909	2	14	2087	
				10.7	32976			4617	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to parr from benefit	Total benefit
1992	1			0.64		0.32	50	106
1991	1			3.09		1.545	50	509
1990	1			0.89		0.445	50	147
1989	1			3.8		1.9	50	627
1988	1			7.1		3.55	50	38
1987	1			3.1		1.55	50	511
1986		1			1.9		50	0
1985								
1984								

Appendix B-14. Proposed definition of mitigation benefits for implemented project in Boulder Creek.

Project Type: Passage barrier

Year Implemented: 1985

Sponsor: Idaho Department of Fish and Game

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type		natural
Hectares added		11.2

Production Constraints:

Definition of Benefits: A barrier falls that was a nearly complete block to adult chinook salmon was modified. Benefits will be based on total chinook salmon parr abundance.

Stratified sampling was used to estimate fry-to-parr survival in 1986 and eyed egg-to-parr survival in 1988. An estimated total of 28,100 chinook salmon parr were reared in 1986 from a May release of 99,000 fry. In 1988, 1,560 chinook salmon parr were estimated to have survived from a plant of 140,000 eyed-eggs in October, 1987. Survival rates to the summer parr life stage were 28.1% for planted fry and 1.1% for planted eggs.

Chinook salmon parr were observed above the barrier removal project in 1991, but not in 1990 or 1992.

Appendix B14-CH

LOCATION OF AFFECTED REACH: Upper Boulder Creek, beginning at the barrier removal site, approximately 6.4 km above the mouth.

DRAINAGE: Salmon River, Little Salmon River

STREAM: Boulder Creek

SPECIES: Spring Chinook, Natural

PROJECT TYPE: Barrier removal

YEAR INITIATED: 1985

EXPECTED PROJECT LIFE (YRS)50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated Density #/l00m2	Parr potential	
Squirrel to Pony creek 170602100090l	3.06	10.7	100	1.13	12091	3	44	5320	
Pony Creek to Headwaters 170 6 021000902	22.85	6.1	72	22.85	139385	2	77	107326	
				24.0	151476			112646	Totals

Year	Sample size: Treat	Control	Densities (parr/l00m2) Mean	Treat	Control	Benefit	%Density due to Benefit	Total parr from benefit	
1992	2			0		0	100	0	
1991	2			6.91		6.91	100	10467	
1990	2			0		0	100	0	
1989	2			102.5		102.5	100	56200 c	(115104) b
1988	7			7.8		7.8	100	1560 a	
1987	2			0		0	100	0 b	
1986	10			28.9		28.9	100	28112 a	
1985		2			0.2			(225) b	
1984		2			0				

a. Estimates from stratified sampling.

b. Estimates from average parr density*surface area/l00. Parr observations in 1985 demonstrated that some chinook were able to pass the barriers at least in high water years such as 1984.

c. Number of fry stocked times the fry to parr survival rate (28.1%) measured in 1986.

Appendix B-15. Proposed definition of mitigation benefits for implemented project in Meadow Creek.

Project Type: Passage barrier

Year Implemented: 1987

Sponsor: Nez Perce National Forest

Enhancement	Species benefitted	
	B-Run steelhead trout	SPring chinook salmon
Production type		natural
Hectares added		8.9

Production Constraints: Grazing impacts: sediment production and riparian degradation.

Definition of Benefits: A barrier to adult chinook salmon passage was removed in 1987, and chinook salmon fry were planted above the barrier in 1988 and 1989. Parr density was monitored at two sections in 1988 and 1989, but estimated summer parr population from the fry stocking was based on the project-wide fry-to-parr survival rate of 15%.

Chinook salmon parr were observed in 1990, but not in 1991-92.

Appendix Bl5-CH

LOCATION OF AFFECTED REACH: From mouth to headwaters Meadow Creek.

DRAINAGE: Clearwater River, S Fk Clearwater R

STREAM: Meadow Creek

SPECIES: Spring Chinook, Natural

PROJECT TYPE: Barrier Removal

YEAR INITIATED: 1987

EXPECTED PROJECT LIFE (YRS): 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
1706030504800	21.72	6.1	67	14.55	88755	2	44	39052	
				14.6	88755			39052	Totals

Year	Sample size: Treat	Control	Densities (parr/lOOm2) Mean Treat	Control	Benefit	%Density due to parr from benefit	Total benefit	
1992	2		0		0	100	0	
1991	2		0		0	100	0	
1990	2		0.11		0.11	100	98	
1989	2		24.2		24.2	100	5874	a
1988	2		31.27		31.27	100	15000	a
1987		2		0				
1986								
1985								
1984								

a. This equals 15% of the 100,000 fry planted that spring. This (15%) is the avera e fry to part survival observed from stratified sampling in the prolect, state wi*%e.

Appendix B-16. Proposed definition of mitigation benefits for implemented project on Valley Creek.

Project TU[e" Passage Barrier (irrigation diversion)

Year implemented: 1988

Sponsor: Boise National Forest (Sawtooth National Recreation Area)

Enhancement	Species benefitted	
	B-Run steelhead trout	Spring chinook salmon
Production type		Wild
Hectares enhanced		20.0

Production Constraints:

Definition of Benefits: A partial barrier to adult chinook salmon, in the form of an irrigation diversion, was removed in 1988. Benefits will be determined as a fraction of chinook salmon parr rearing above the barrier. Tentatively, an annual average benefit will be 70% of the parr density, based on a pre-treatment assessment that adults would be blocked seven of 10 years.

Some modest benefit to chinook salmon parr was observed in 1989-91; no parr were observed in 1992.

Appendix B16-CH

LOCATION OF AFFECTED REACH: Beginning at irrigation diversion near mouth of Trap Creek and continuing from there to headwaters.

DRAINAGE: Salmon River STREAM: Valley Creek

SPECIES: Spring Chinook, Wild PROJECT TYPE: Barrier (partial) removal

YEAR INITIATED: 1988 EXPECTED PROJECT LIFE (YRS) 50+

Affected EPA-reach	EPA-reach length (km)	Width (m)	Percent of reach utilized	KMS of reach affected	M2 of reach affected	Habitat rating	Rated density #/100m2	Parr potential	
Trap Creek to headwaters 17060201105500	19.63	6.1	100	19.63	119743	2	77	92202	
				19.6	119743			92202	Totals

Year	Sample size: Treat	Control	Densities (parr/100m2) Mean	Treat	Control	Benefit	%Density due to benefit	Total parr from benefit
1992	1			0	0	0	70	0
1991	1			0.69	0	0.69	70	826
1990	1			0.37	0	0.37	70	443
1989	1			17.3	0	12.1	70	14489
1988		1			0			
1987		1			5			
1986		1			0			
1985		8			12.4			
1984								

Appendix C.

Chinook salmon and steelhead trout parr production in habitat enhancement project areas.

Appendix Cl. Chinook salmon parr carrying capacities, average (1986-92) production in treated areas, percent of carrying capacity (PCC) achieved, and the parr production and PCC attributed to the enhancement project.

From appendix number	Stream and project type	Parr potential[1]	Treatment production[2]	Parr PCC[3]	Parr benefit[4]	PCC from project[5]	1986-92 Fry Stocked?
Instream Structure Projects:							
B1-ch	Lolo Creek	148,848	29,243	20%	4,972	3%	yes
Bbb-ch	Crooked River	47,190	10,731	23%	721	2%	yes
B7a-ch	Red River	63,942	34.411	54%	7,949	12%	yes
		259,980	74,385 (29% cc)		13,642 (5% cc)		
Barrier Removal Projects:							
B2-ch	Eldorado Creek	128,463	45,053	35%	10,054	8x	yes
B4-ch	Crooked Fork Creek	57,499	1,315	23%	13,157	23%	yes
BI2-ch	Johnson Creek	294,734	18,764	6%	18,618	6%	yes
B14-ch	Boulder Creek	112,646	31,617	28%	13,763	12%	yes
B15-ch	Meadow Creek	39,052	9,866	25%	4,194	11%	yes
		632,394	118,455 (19% cc)		59,786 (9% cc)		
Partial Barrier Removal Projects:							
Bba-ch	Crooked River	60,938	9,584	16%	3,000	5%	yes
BP-ch	Pole Creek	29,924	8	<1%	6	<I%	yes
Bll-ch	Knapp Creek	60,708	913	2%	456	1%	no
B13-ch	Dollar Creek	14,509	13	<1%	5	<I%	no
B16-ch	Valley Creek	92,202	5,496	6%	3,940	4%	no
		258,281	16,014 (6% cc)		7,407 (3% CC)		
Off-Channel Developments:							
B6c-ch	Crooked River (OCD)	13,641	7,444 (55% CC)	55%	7,444 (55% cc)	55%	yes
Sediment Removal Projects:							
BlO-ch	Bear Valley Creek (SR)	529,960	12,509 (2% cc)	2%	-22,925 (4% cc)	4%	no
	Totals:	1,694,256	228,807 (14% cc)		65,354 (4% cc)		

1 Rated parr capacity for project area (derived from System Planning)
2 (Average annual treatment densities) x (m^2 affected)/100
3 Treatment Production/Parr Potential
4 Average annual total parr from benefit
5 Parr Benefit/Parr Potential

Appendix C2. Steelhead trout parr carrying capacities, average (1986-92) production in treated areas, percent of carrying capacity (PCC) achieved, and the parr production and PCC attributed to the enhancement project.

From appendix number	Stream and project type	Parr potential[1]	Treatment production[2]	Parr PCC[3]	Parr benefit[4]	PCC from project[5]
Instream Structure Projects:						
BI-sh	Lolo Creek	31,452	**12,983**	41%	3,760	12%
B6b-sh	Crooked River	10,237	5,284	52%	1,826	18%
B7a-sh	Red River	15.041	2,079	14%	146	1%
		56,730	20,346 (36% cc)		5,732 (10% CC)	
Barrier Removal Projects:						
B2-sh	Eldorado Creek	16,684	5,680	34%	5,607	34%
B4-sh	Crooked Fork Creek	12,313	75	1%	68	1%
B5-sh	Colt Creek	8,446	169	2%	169	2%
		37,443	5,924 (16% cc)		5,844 (16% cc)	
Partial Barrier Removal Projects:						
B6a-sh	Crooked River	23,863	**1,357**	6%	892	4%
B9-sh	Pole Creek	3,886	182	5%	97	3%
B13-sh	DoL lar Creek	4.617	**1.023**	22%	277	6%
		32,366	2,562 (8% cc)		1,266 (4% cc)	
Off-Channel Development Projects:						
B6c-sh	Crooked River	1,768	1,704 (96% cc)	96%	1,704 (96%)	96%
Sediment Removal Projects:						
BIO-sh	Bear Valley Creek	103,721	1,018 (1% cc)	1%	-4,921 (5% cc)	5%
	Totals:	242,028	31,554 (13% cc)		9,625 (4% cc)	

1 Rated parr capacity for project area (derived from System Planning)
2 (Average annual treatment densities) x (m^2 affected)/100
3 Treatment Production/Parr Potential
4 Average annual total parr from benefit
5 Parr Benefit/Parr Potential

Appendix D.

Project 91-73 data collection sheets.

Appedix Dl. Biological data sheet.

STREAM _____ DATE_ / _/_____ **LEADER/RECORDER** _____

AGENCY: (circle one) NPT, SBT, IFC, **FRO, ICU**

PROGRAM: (circle **one) R2, R3, R7, CPM, PEL, ISM, CSUP, SSUP**

STRATA _____ **SECTION** _____

CHANNEL TYPE: B, C, OTHER SECTION TYPE: MONR, CSUP, SSUP, EVAL

QUAD MAP _____ **UTM X/Y** _____

IDAEPA REACH # _____

LENGTH _____ **TRANSECT WIDTHS** _____

H20 TEMP _____ TIME _____ **MEAN** WIDTH _____

SEC AREA _____

VISIBILTIY _____

METHODS: ( ) Snorkel (circle corridor or entire stream width)
( ) Electrofish
( ) Other _____

HABITAT TYPE: (circle one) Pool Riffle **Run Pocket Water**

Length Class (in)	RAINBOW - STEELHEAD				RESIDENT SPECIES			
	Total	Wild & Natural	Adipose Clipped	Hatchery Catchable	Cutthroat	Brook	Bull	Whitefish
< 2								
2								
3								
4								
5								
6								
7								
8								
9								
10								
11								
12								
>12 specify length								

Aae 0 Chinook Adults

Age 1 Chinook Redds

STREAM _____ DATE _____ COLLECTORS _____

EPA REACH _____ LENGTH _____ COMMENTS _____

STRATA _____ VERTICAL DROP _____

SECTION _____ GRADIENT % _____

CHANNEL TYPES: B - confined, flushing
c - meandered, depositional

HABITAT TYPE: (Circle One) pool, riffle, run, pocket water

Transect Length from Bottom	Width	Location on transect (1 to r)	Depth	Substrate Class by Area				
				Sand	Gravel	Rubble	Boulder	Bedrock
		l/4						
		1/2						
		3/4						
		l/4						
		1/2						
		3/4						
		1/4						
		1/2						
		3/4						
		l/4						
		1/2						
		3/4						

Appendix D2. Physical data sheet.

Submitted by:

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IDAHO DEPARTMENT OF FISH AND GAME

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