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OREGON

PROJECT TITLE: Evaluation of Lower Snake River Compensation Plan Facilities in Oregon

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Prepared By: Rhine T. Messmer
Richard W. Carmichael
Michael W. Flesher
Timothy A. Whitesel

Oregon Department of Fish and Wildlife
2501 S.W. First Avenue
P.O. Box 59
Portland, OR 97207

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GENERAL INTRODUCTION

The background of the Lower Snake River Compensation Plan (LSRCP) is given in the LSRCP five-year study plan (Carmichael 1989). Oregon's mitigation goals for adult salmonids are 5,820 spring chinook salmon and 9,184 summer steelhead for the Grande Ronde Basin and 3,210 spring chinook salmon and 2,000 summer steelhead for the Imnaha River Basin (U.S. Army Corps of Engineers 1975).

The means of mitigation for Oregon's LSRCP is through the production and release of hatchery smolts. A complex of hatcheries and satellite facilities exists to produce spring chinook salmon and summer steelhead for release in the Grande Ronde and Imnaha river basins. A description of these facilities is found in Carmichael (1989).

In this report we present a review of our activities under all projects for the period 1 January 1992 to 31 December 1992. Previous annual progress reports include Carmichael and Wagner (1983), Carmichael and Messmer (1985), and Carmichael et al. (1986a, 1987, 1988a 1988b, 1989, 1990), Messmer et al. (1989, 1990, 1992), and Flesher et al. (1991, 1992).

SUMMARY

EVALUATION OF LOWER SNAKE RIVER COMPENSATION PLAN FACILITIES IN OREGON

Objectives for FY 1992

1. Document egg take, egg-to-smolt survival, and growth of spring chinook salmon and summer steelhead reared and released at Lower Snake River Compensation Plan (LSRCP) facilities in Oregon.

2. Determine fin condition, degree of descaling, degree of smolting, and the prevalence of precocious development for Wallowa and Imnaha stock summer steelhead.

3. Document number, size, time, and location of releases for spring chinook salmon and summer steelhead produced at Lower Snake River Compensation Plan facilities in Oregon.

4. Determine sex ratio, run timing, and spawning timing for spring chinook salmon that return to Lookingglass Hatchery, the Big Canyon facility and the Imnaha River weir and for summer steelhead that return to the Big Canyon facility, Wallowa Hatchery, and the Little Sheep Creek facility.

5. Collect and analyze scales from spring chinook salmon and summer steelhead adults to determine age composition and length-age relationships.

6. Release 1990 brood Rapid River and Imnaha stock spring chinook salmon that were marked (Ad+CWT) and cold branded for size-at-release comparisons and production survival estimates.

7. Mark (Ad+CWT) and cold brand the following groups of 1991 brood chinook salmon: Rapid River stock for rearing density comparisons, and production survival estimates; and Imnaha stock for size-at-release comparisons, and production survival estimates and acclimation evaluation.

8. Mark (AdLV+CWT), cold brand, and release the following groups of 1991 brood summer steelhead: Wallowa stock for production survival estimates, and acclimation evaluation (at Big Canyon facility); and Imnaha stock for production survival estimates and acclimation evaluation.

9. Collect and decode coded-wire tags from marked spring chinook salmon and summer steelhead adults that return to adult collection facilities.

10. Summarize catch and escapement information for groups of coded-wire tagged spring chinook salmon and summer steelhead as information becomes available.

11. Summarize information from cold branded spring chinook salmon and summer steelhead smolts recovered at Snake River collection sites.

12. Conduct spring chinook salmon spawning ground surveys on the Minam and Wenaha rivers in cooperation with Oregon Department of Fish and Wildlife (ODFW) management personnel and recover carcasses of marked hatchery strays.

13. Participate in planning activities associated with anadromous fish production, management, and research in the Grande Ronde and Imnaha river basins.

14. Determine the success of maintaining genetic and life history characteristics of endemic summer steelhead and spring chinook salmon in the Imnaha River basin while pursuing mitigation and management goals.

15. Determine the effectiveness of the summer steelhead and spring chinook salmon supplementation programs in the Imnaha River basin by comparing life history characteristics of natural and hatchery produced fish.

16. Determine adult progeny:parent ratios to assess the effectiveness of Imnaha River basin summer steelhead and spring chinook salmon hatchery supplementation programs in increasing stock productivity.

Accomplishments and Findings 1992

Fish Culture Monitoring

In 1992, a total of 6 Carson stock and 823 Rapid River stock spring chinook salmon returned to Lookingglass Hatchery. All of the Carson stock returns to Lookingglass Hatchery were left-ventral fin marked strays from direct stream smolt releases into Catherine Creek or from Big Canyon facility releases. Six Carson stock and 90 (4 jacks) Rapid River stock chinook salmon returned to the Big Canyon facility in 1992. We trapped 844 chinook salmon at the Imnaha River weir of which 431 were marked hatchery fish. We estimated that 242 of the 431 unmarked fish were of hatchery origin. Jack returns to the Imnaha weir totalled 73 of which 47 were marked hatchery fish and 26 were unmarked fish. We estimated that 11 of the 26 unmarked jacks were of hatchery origin.
other findings: CHS fish culture monitoring
1. 1990 brood RR and IM 100% marked
2. passing CHS above LGH weir.
3. Lookingglass Creek fishery Nez Perce Umatilla Harvest Dates
4. Imnaha CHS prespawning mortality, Imnaha trapping
5. run timing,

Releases of 1990 brood Rapid River and Imnaha stock spring chinook salmon targeted for 12 and 15 fish/lb respectively exhibited length frequency distributions that were (need summary from Tim Whitesel)

Mean fecundity of Imnaha stock chinook females sampled in 1992 was 4,867 and 5,295 for age 4 and 5 umnarked females, respectively and 4,897 and 5,071 for age 4 and 5 marked hatchery females respectively.

A total of 1,522 summer steelhead adults returned to Wallowa Hatchery in 1992. We trapped 128 natural and 661 hatchery steelhead adults at the Little Sheep Creek facility in 1992. At the Big Canyon Creek facility we trapped 38 natural and 498 hatchery steelhead adults.

other findings: STS fish culture monitoring
1. Big Canyon Weir operation
2. Strategy for releases above weirs, Little Sheep, Big Canyon
3. run timing

Survival Studies

Smolt-to-adult survival rate for coded-wire-tagged 1987 brood subyearling Rapid River stock spring chinook salmon released from Lookingglass Hatchery in May of 1988 at a mean weight of 15.1 grams was <0.01%. Rapid River stock (1987 brood) spring chinook salmon released from Lookingglass Hatchery in April of 1989 at a mean weight of 22.0 grams survived at 0.04% and fish released at a mean weight of 34.0 grams

survived at 0.09%. Rapid River stock (1987 brood) spring chinook salmon released from Lookingglass Hatchery in September and November of 1988 at 20.9 and 22.5 grams respectively, survived at <0.01%. The survival rate for 1987 brood Imnaha chinook salmon averaged 0.22% for fish released in March of 1989 at 28.4 grams.
other CHS cwt survival findings:
1. exploitation, contribution,
2.

Smolt-to-adult survival rate (catch plus escapement) for coded-wire-tagged Wallowa stock summer steelhead smolts of the 1988 brood that were acclimated and released at Wallowa Hatchery at a mean weight of 118.2 grams (4 fish/lb release group) and 86.4 grams (5 fish/lb release group) was 0.21% and 0.38%, respectively. The smolt-to-adult survival rate for 1988 brood Wallowa stock steelhead released directly into Spring Creek at Wallowa Hatchery was 0.18%. These survival rates are lower than observed for 1985 brood (1.93% for 4/lb and 1.06% for 5/lb), 1986 brood (1.04% for 4/lb, 1.08% for 5/lb, and 0.62% for direct stream), and 1987 brood (0.72% for 4/lb, 0.74% for 5/lb, and 0.53% for direct stream). The hatchery return rates (percent of total recoveries which were recovered at Wallowa Hatchery) for 1988 brood Wallowa stock steelhead acclimated and released at Wallowa Hatchery was 0.08% compared to 0.06% for direct stream release groups. The survival rate for 1988 brood Imnaha stock summer steelhead was 0.30% with a hatchery return rate of 0.13%. The survival rate of the 1988 brood Imnaha stock summer steelhead releases was lower than the 1985 brood (0.81%) and 1987 brood (0.56%), but greater than the 1985 brood (0.18%).

The smolt passage index for 1990 brood Rapid River stock spring chinook salmon released at Lookingglass Hatchery in the spring of 1992 at a mean weight of 45.9 grams and 23.8 grams was 36.3% and 31.8%, respectively. The smolt passage index for acclimated 1990 brood Imnaha chinook salmon smolts released in the spring of 1992 at a mean weight of 40.8 and 21.6 grams was 31.1% and 16.2%, respectively. The smolt passage index for 1990 brood Imnaha chinook salmon smolts released directly into the Imnaha River in the spring of 1992 at a mean weight of 21.3 grams was 20.6%. Passage indices were slightly higher (1.8%) in 1992 than in 1991 for all groups of Rapid River stock spring chinook salmon chinook. For Imnaha stock chinook salmon, passage indices were 8.5% greater for the 15/lb release group, but 6.4% lower for the 25/lb release group when compared to the 1991 smolt passage indices for the respective release groups.

other smolt passage findings: CHS
1. timing, peaks, first arrival,

The smolt passage index for 1991 brood Wallowa stock summer steelhead acclimated and released at Wallowa Hatchery in 1992was 66.5%. The smolt passage index for 1991 brood Wallowa stock summer steelhead released directly into Deer Creek at the Big Canyon Facility was 20.6% while the passage index for groups of Wallowa stock summer steelhead acclimated at the Big Canyon Facility was 22.4%. The smolt passage index for Wallowa Stock steelhead released on the upper Grande Ronde River (at Perry) was 28.1%. The smolt passage index for 1991 brood Imnaha stock

summer steelhead was 7.1% for fish released directly into Little Sheep Creek and 10.0% for acclimated fish. The 1991 brood summer steelhead passage indices for Wallowa stock summer steelhead were the highest observed for Wallowa Hatchery releases (1.5 times greater than the 1991 brood passage index of 44.0%). The 1992 passage indices for 1991 brood Wallowa stock summer steelhead released into Deer Creek were 2.4 times lower for acclimated fish, and 1.9 times lower for direct stream releases, when compared to the 1990 brood releases which migrated in 1991. The smolt passage indices for the Little Sheep Creek releases were lower than observed in 1991, with acclimated releases being 4.0 times lower and direct stream releases 5.6 times lower.

other smolt passage findings: sts

1. timing, duration, why did wallowa stock do so much better than Big Canyon releases?

Natural Escapement Monitoring

In 1992 there were 12 recoveries of Ad+cwt marked, and one right-ventral fin marked spring chinook salmon on spawning ground surveys in the Minam River. One Ad+cwt marked spring chinook were recovered on the Lostine River in 1992. Right-ventral fin marked fish were from releases of Rapid River stock chinook at Lookingglass Hatchery. Fifteen Ad+cwt spring chinook salmon were recovered on the Wenaha River spawning ground surveys in 1992. All but one of the Wenaha River recoveries were from Lookingglass Hatchery releases, the one recovery was a Umatilla Hatchery release.

Management Implications

1.

2.

3.

4.

Recommendations

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2.

3.

4.

EVALUATION OF LOWER SNAKE RIVER COMPENSATION PLAN FACILITIES IN OREGON

Introduction

The evaluation of LSRCP facilities in Oregon began in the fall of 1983. Work conducted during this report period encompassed four areas of study: fish culture monitoring; survival studies; natural escapement monitoring; and planning. The specific objectives and tasks for this report period are reviewed in the five-year study plan (Carmichael 1989) and in the summary section of this report. Work conducted under fish culture monitoring, and survival studies was a continuation of ongoing studies. We began comprehensive spring chinook spawning ground surveys in 1986 because of the need for better escapement information for the Pacific Salmon Treaty. These surveys were funded in part with LSRCP and Pacific Salmon Commission funds. Results pertinent to straying of hatchery chinook salmon into the Minam, Lostine, and Wenaha rivers are presented in this report.

Methods

Fish Culture Monitoring

Methods are generally described in the 1985-1990 annual reports (Carmichael and Messmer 1985; Carmichael et al. 1986a, 1987, 1988a; Messmer et al. 1989, 1990, 1991) and in the five-year study plan (Carmichael 1989).

other methods Fish Culture Monitoring:

Survival Studies

Methods are described in the 1985-1989 annual reports (Carmichael and Messmer 1985; Carmichael et al. 1986a, 1987, 1988a; Messmer et al. 1989, 1990).

other methods Survival Studies:

Natural Escapement Monitoring

Methods are described in the 1985-1990 annual reports (Carmichael and Messmer 1985; Carmichael et al. 1986a, 1987, 1988a, Messmer et al. 1989, 1990, 1991). Methods used for estimating straying levels of hatchery chinook salmon were made using methods described in Messmer et

al. (1989, 1990, 1991). Spawning population size was estimated as described in Carmichael et al. (1986b).

We conducted spawning ground surveys cooperatively with ODFW management personnel on the Minam River from 29 to 31 August and 14 September 1990 and from 27 to 29 August and 9 September 1991, and on the Wenaha River from 3 to 5 September 1990 and from 2 to 4 September 1991. We examined all carcasses for fin marks and collected snouts from all adipose fin marked fish.

other methods Natural Escapement Monitoring:

Planning

We continued our involvement in research and management planning activities in the Grande Ronde and Imnaha basins. Specifically, we worked on: the Upper Grande Ronde Task Force to develop the upper Grande Ronde River anadromous fish habitat protection, restoration, and monitoring plan; Endangered Species Act permit preparation and permit review; production and facility planning for Northeast Oregon Hatcheries Master Plan; and weirs on the Minam and Imnaha rivers.
(Rich Carmichail update)

Results

Fish Culture Monitoring

Results of fish culture monitoring for spring chinook salmon are presented in Tables 1-13 and Figures 1-3, and for summer steelhead in Tables 14-24 and Figure 4-5.
update figures used

Survival Studies

Results related to survival studies of spring chinook salmon and summer steelhead appear in Tables 25-35 and Figures .

Natural Escapement Monitoring

We recovered 12 Ad+cwt marked and one right ventral fin marked hatchery strays on the Minam River in 1992. All of the Ad+cwt wire tagged fish were from 1988 brood Rapid River stock releases from Lookingglass Hatchery, and the right-ventral fin marked fish was an age 5 (1987 brood) Rapid River stock release form Lookingglass Hatchery. We examined a total of 45 adult carcasses for marks which was estimated to be 17.3% of the spawning population. The marked hatchery fish recovered on the Minam River surveys were 28.9% of the carcasses recovered.

A total of 15 Ad+cwt spring chinook salmon were recovered on the Wenaha River stock chinook released from Lookingglass hatchery in 1992.

Thirteen of these fish were from 1988 brood and 1 from 1987 brood releases of Rapid River stock spring chinook from Lookingglass Hatchery. One of the Ad+cwt fish was from a Umatilla Hatchery release (1988 brood year) into the Umatilla River. We examined 56 adult carcasses for marks which was estimated to be only 12.1% of the spawning population.

The one Ad+cwt marked fish recovered on the Lostine River in 1992 was from the 1988 brood Rapid River stock releases from Lookingglass Hatchery. We examined a total of 30 adult carcasses for marks which was estimated to be 33.9% of the spawning population.

Scale analysis: percent of unmarked fish wild/hatchery, percent of estimated spawning population. will have to put into methods section

Planning

We assisted in the completion of the Grande Ronde and Imnaha river subbasin plans under the Northwest Power Planning Council (NWPPC) Columbia Basin system planning process. We completed ESA Section 10 permit applications for scientific research involving direct take of listed chinook salmon.

(Rich Carmichael update)

Discussion

Fish Culture Monitoring

Prespawning mortality of 1992 brood Imnaha chinook salmon was 40.0% and 27.9% for wild and hatchery females respectively, and 17.1% and 14.4% for wild and hatchery adult males respectively. Most of the adult loss occurred during and following periods of high water turbidity when we were unable to administer formalin treatments to adults in the holding pond. Turbidity in the Imnaha River was caused by massive bank failures following severe thunder showers in the upper Imnaha river drainage. We also observed higher than normal adult loss for adults holding above the weir. The fish/redd ratio calculated for 1992 was 4.2 compared to 2.9 and 3.2 in 1990 and 1991 respectively. It is very important that adult prespawning mortality is minimized because any reduction in adult prespawning mortality will result in an increased level of natural production because fewer adults will be needed for broodstock.

do we have flow or turbidity data in Imnaha River; relate to adult losses: check with Brad Smith on specifics (location by RM of slide, when first observed) also check with Warren Groberg on analysis, cause of losses, formalin treatments, dose, duration.

For 1992 brood Imnaha stock chinook, we achieved an egg take of 542,005 green eggs. Production levels for Imnaha hatchery chinook are dependent on the number of returning hatchery and wild origin adults and broodstock collection criteria. The broodstock collection guidelines specified taking 3 of 5 unmarked age 4 fish by sex, 1 of 2 marked age 5

fish by sex, 1 of 3 unmarked age 4 and age 5 fish by sex, 1 of 3 unmarked age 3 males (jacks), and pass 2 hatchery jacks for every wild jack passed. At this level of production we will be able to evaluate the effectiveness of the hatchery supplementation program by conducting size-at-release experiments (15 and 25 fish/lb release groups), and acclimation vs. direct stream releases, and still maintain natural production above the weir.

ESA, wild fish policy guidelines for broodstock development, releases above the weir.

Egg loss of Imnaha stock chinook salmon in 1992 was 13.5%, which was the lowest for fish spawned at the Imnaha River Facility since the program began in 1982. We initiated matrix spawning for Imnaha chinook salmon in 1992. We used a 2x2 matrix for spawning where eggs from each of 2 females were split and fertilized by an individual male. The eggs from each female were then recombined after fertilization. The lower than normal egg loss may have been a result of matrix spawning or better handling of eggs (spawning smaller groups of fish, reduced time between egg fertilization and transportations to Lookingglass Hatchery.

check with LGH to see if any other precautions, changes made in 1992. to reduce egg loss. may want a figure of matrix spawning procedures. Egg loss study, determine if loss attributable to males or females. make a figure

Fecundity sampling conducted in 1992 showed no differences in mean fecundity between hatchery and wild origin age 5 females. There were also no differences in mean fecundity between age 4 wild and hatchery origin females, but there were an unknown number of unmarked hatchery fish in the wild origin group. Any reduction in mean fecundity of Imnaha stock chinook salmon will result in a decrease in reproductive potential if age-ar-return survival rates are the same. We will continue fecundity sampling in the future as part of the hatchery evaluation program.

determine what percent of wild age 4 and wild age 5 fish in fecundity sampling were of hatchery origin, recalculate mean fecundities.

We estimated that of the 26 unmarked jacks that returned to the Imnaha Weir in 1992, 11 of the jacks were of hatchery origin and 15 of the jacks were of wild origin. For unmarked age 4 returns, we estimated that 242 of the 387 returns were of hatchery origin and 145 returns were of wild origin. Estimates were based on the marked to unmarked release ratio of the 1988, and 1989 brood. We plan to use discriminant score analysis to classify all unmarked returns of 1988 and 1989 brood chinook. Starting with the 1990 brood year, all Imnaha chinook releases will be 100% fin marked so we can determine the origin of fish when fish are trapped and released or retained for broodstock.

The age composition for 1987 brood of Imnaha chinook salmon was to that observed for the 1982-86 broods in that hatchery produced fish returned at a younger age as compared to wild fish, and the majority of the hatchery males returned as jacks (Figure 1). We are uncertain of all the factors contributing to this difference in age-composition at return

but we believe the large release size of the hatchery smolts is a significant factor. We have reduced the size-at-release for the 1990 brood to 15 and 25 fish/lb in a attempt to shift age-at-return to be similar to the wild fish. Diversified life history strategies of wild smolts (Gaumer 1968) may also be a factor contributing to this difference. More information is needed on the survival and age-at-return of different life history strategies that are expressed by wild fish. We may need to determine if these strategies can be mimicked with the hatchery program to help meet management and mitigation goals.

1987 brood age comp analysis, compare wild to hatchery fish.

Lower than average flows in the Imnaha River in the spring of 1992 allowed us to install the Imnaha weir on 09 June. We estimated that only 13% of the Imnaha run had passed the weir site before the weir was installed and that 16% of the early run fish were wild origin compared to 20% of the run which was trapped being wild fish. This indicates that we were able to trap fish from all segments of the run except the early returning fish, and that run timing of hatchery and wild origin fish in 1992 was similar to each other (Figure 2). Unmarked age 4 hatchery origin adult returns in 1992 no doubt contributed to the similarity in runtiming, but unless we mark individual fish, and subsequently determine the origin of that fish by scale analysis, we can not accurately determine run timing of hatchery and wild origin fish.

In 1992, a total of 1,352,799 Rapid River stock eggs were collected from returns to Lookingglass Hatchery and the Big Canyon Facility. The egg take exceeded our production goal of 929,000 green eggs. A total of 308,088 viable eggs, and 109,950 eyed eggs were shipped to Idaho Department of Fish and Game's Rapid River Hatchery.

Six left-ventral fin marked Carson stock chinook salmon (age 5 adults) returned to Lookingglass hatchery in 1992. These adults were from the 1987 brood smolts released into Catherine Creek or at the Big Canyon Facility. These stray adults were probably from the Catherine Creek releases because these fish were unacclimated and had to swim past the mouth of Lookingglass Creek en route to Catherine Creek. It is likely that previous releases into Catherine Creek have strayed to Lookingglass Hatchery, however this was the first Catherine Creek release group that was marked. The 1987 brood Carson stock returns to the Grande Ronde basin in 1992 were the last Carson stock adult returns from Lower Snake River Compensation Plan releases.

Lookingglass Hatchery produced a total of 55,979 lbs of 1990 brood Rapid River stock smolts for the Grande Ronde Basin which was 124% of the mitigation goal of 45,000 lbs, and 16,267 lbs of Imnaha stock chinook salmon for the Imnaha Basin which 66.4% of the mitigation goal of 24,500 lbs. Lookingglass Hatchery produced a total of 72,246 pounds of 1990 brood smolts which was 104% of the production goal for Grande Ronde and Imnaha basin smolt releases.

Although we met or were near our mitigation goals in terms of total pounds, a substantial portion of the spring released fish may not have

smolted. Chinook salmon (1989 brood year) which were targeted for the largest release sizes exhibited nonuniform patterns of growth. The length-frequency distributions of Rapid River fish released at 11.4/lb and Imnaha River fish released at 15.7/lb were bimodal and skewed towards the larger sizes. In contrast, Rapid River fish released at 19.6/lb were only slightly skewed towards larger sizes and Imnaha River fish released at 22.1/lb had a normal length-frequency distribution (Figures 3 and 4). These growth patterns emphasize a need to evaluate more closely asynchronous developmental patterns within groups of juvenile chinook salmon being reared in a hatchery at accelerated rates. Studies that focused on bimodal development in cherry salmon (O. masou: Hirata et al. 1988), coho salmon (O. kisutch: Clarke and Shelbourn 1986), and Atlantic salmon (Salmo salar: Thorpe et al. 1980; Duston and Saunders 1992) have suggested that juveniles in the upper modal group exhibit smolt-like characteristics while those in the lower modal group do not. Thus, if modal groups of chinook salmon also represent distinct developmental populations, we are concerned that the lower modal groups are not making substantial contributions to the smolt portion of our releases. The pattern observed in 1989 brood chinook prompted us to examine previous data for the presence of bimodal development in fish reared at Lookingglass Hatchery. We found that varying degrees of bimodality also existed in the 1984 and 1986 broods of chinook salmon.
(Tim Whitesel update)

We nearly exceeded the program goal of 1.35 million smolts (1991 brood year) for the Wallowa stock steelhead program. We released a total of 1,408,272 smolts of Wallowa stock into the Grande Ronde River Basin in 1992. A total of 243,941 Wallowa stock presmolts were released into the Snake River. Direct stream releases of smolts in the Grande Ronde basin were limited to Catherine Creek and the upper and lower Grande Ronde River because results from our acclimation studies to date at Wallowa Hatchery have shown that acclimated fish have higher total smolt-to-adult survival rates. Smolt releases from other direct stream releases were reallocated to Wallowa Hatchery and the Big Canyon facility. After the first group of acclimated fish were released from these facilities, we backfilled acclimation ponds for a second acclimated release group. This strategy will result in more adult returns per smolt release (higher smolt-to-adult return rate for acclimated releases) and fewer hatchery fish potentially spawning naturally. Acclimation studies were initiated at the Big Canyon and Little Sheep Creek facilities with the 1991 smolt releases (1990 brood).

get Mike Flesher's analysis, acclimation benefits,

Wallowa hatchery adult trapping, run timing, High exploitation, how did the run timing do, low flow year, was it early, compressed? relate to figure 5 in 1991 annual. other walowa trapping spawning. Giving first egg takes to Lyons ferry hatchery, may loose early segment of run, higher contribution to early fisheries.

We were exceeded the smolt production goal of 330,000 smolts of 1991 brood Imnaha stock steelhead. We released 335,022 summer steelhead smolts into the Imnaha Basin in 1992. Smolts were again released

directly into the lower Imnaha River (at Cow Creek) to increase sport harvest opportunities. We had only achieved 61% of our egg take goal for the 1991 brood year, but higher than normal egg-to-smolt survival (61%), and elimination of the grade-out program enabled us to achieve our smolt release goal.

Big Canyon trap operations, wild fish policy, trapping passing,

A total of 128 naturally produced summer steelhead adults were trapped at the Little Sheep Creek facility was the second highest observed since the program began (163 wild adults trapped in 1985). Only 15.3% of the fish spawned for hatchery broodstock were naturally produced and 40.8% of the fish released above the weir were naturally produced. Hatchery returns were predominantly (86.4%) age 3 fish from the 1989 brood year. The wild component of the Little Cheep Creek run was composed of 93% age 4 fish (1 ocean, 1988 brood year) and 7% age 5 fish (2 ocean, 1987 brood year). Naturally produced fish of the 1988 brood year were a result of 18 wild and 223 hatchery females released above the weir. The outmigration in 1990 of these 2-year old smolts was good, at least for the hatchery origin fish (Messmer et al 1991).

Little Sheep Creek hatchery/wild run timing comparison, 1992. compare to pervious years. low flow years in 1992.
Little Sheep Creek age/ sex composition 1 salt runs strong to males, 2 salt run heavy to females. consequence in broodstock management, releases above the weir.

Survival Studies

The fifth brood year (1990 brood) of cold branded Rapid River stock spring chinook salmon was released from Lookingglass Hatchery in 1992 for evaluation of out migration performance and survival. The passage index at Lower Granite Dam for yearling smolts released in the spring at a mean weight of 23.8 grams was 14.2% lower (31.8% vs. 36.3%) than the passage indexes for smolts released at a mean weight of 45.9 grams (Table 31). The average passage index in 1992 was only 8% greater than the passage index in 1991 for Rapid River yearling smolt releases.
Passage timing at Lower Granite was

The sixth brood year (1990 brood) of cold branded Imnaha chinook salmon smolts was released in the Imnaha River in 1992. Smolts released for size-at-release comparisons at mean weights of 21.6 and 40.8 grams had passage indices of 16.2% and 31.1% respectively, the larger fish having a passage index that was 92% greater than the smaller fish (Table). The passage indices for direct stream releases in 1992 was 27% greater (20.6%) than the acclimated release groups (16.2%). The passage indices in 1992 were 1.4 times greater for the 15/lb releases and 1.4 times lower for the 25/lb releases than the 1991 passage indices.

Passage timing large vs small, acclimated vs.direct stream. why 25/lb lower, different timing and duration.

The second year (1991 brood) of summer steelhead was released at the Big Canyon and Little Sheep Creek facilities in 1992 for acclimation studies. In 1991, there were also differences in release sizes between these acclimated and direct stream release groups at both locations, but release sizes between acclimated and direct stream releases were similar in 1992. reasons why? better fish culture, recognized problem getting fish to size at Irrigon Hatchery, water shortages, less growth in acclamation ponds, or programmed for additional growth.

The 1992 passage index at Lower Granite Dam for 1991 brood Wallowa stock summer steelhead released from Wallowa Hatchery was 66.5%, the highest observed to date(Table). The previous best passage indices occurred in 1991 and was 44.2%, but the 1992 passage index was 1.5 times greater. Flow conditions in the Grande Ronde Basin and Snake river were not as favorable for fish passage in 1992 as they were in 1991 so we do not know why this group of fish had such a high passage index. look at passage timing, brand quality release time,

The passage index for Wallowa stock steelhead released at the Big Canyon facility was only 22.4%, and was 8.9% greater than the passage index (20.6%) for direct stream release group. The passage index for the upper Grande Ronde River (at Perry) release group was 28.1%, 1.3 times greater than the acclimated Big Canyon Facility released, but 2.4 times lower than the Walowa Hatchery releases. The passage indices for groups of Imnaha stock summer steelhead released at the Little Sheep Creek Facility were 10.0% for acclimated fish, and 7.1% for direct stream releases. The passage index for Little Sheep acclimated releases in 1991 was 4.6 times lower than the 1991 releases, and is similar to the passage indices observed in 1986, 1989, and 1990.
look at passage timing, duration, first, 50%, peak

Returns are complete for 1987 brood Rapid River stock spring chinook salmon released from Lookingglass Hatchery for time-of-release and size-at-release comparisons (Table). Releases of yearling smolts was the only release strategy which produced smolt-to-adult survival rates >0.01%. There was only one adult recovered from May subyearling smolt releases. The 12/lb release group survival rate was twice the survival rate of the 20/lb release group which is opposite of the 1986 brood year when the 12/lb release group survived at twice the rate as the 20/lb release group. The 1986 brood year had survival rates which were 3.1 times greater than the 1987 brood year.

1987 brood releases, were they bimodal, age (3,4,5), sex ratios for each release group. Compare to previous broods, bimodal and nonbimodal.

Returns are complete for the 1987 brood Imnaha stock chinook salmon (Table). The smolt-to-adult survival rate for hatchery release groups ranged from 0.12-0.19%. The progeny-to-parent ratios for 1987 and 1988 brood year of Imnaha chinook salmon was respectively(Figure 6). We expect the 1988 brood hatchery progeny-to-parent ratio to approach with returns of Age 5 adults.

compare 1987 brood to previous years, hatchery and wild, implications for stock management, hatchery fish replacing wild fish, wild fish continuing decline, get AFS stuff.

We will continue to monitor progeny-to-parent ratios of hatchery and naturally produced fish as a means of determining the effectiveness of the hatchery supplementation program. We are especially concerned with how well hatchery fish will perform in the natural environment and what level natural production will be influenced by the hatchery program.

Returns are complete for the 1988 brood Wallowa stock summer steelhead released for size-at-release comparisons. Larger (4/lb) smolts tended to survive at a higher rate than smaller (5/lb) smolts. Smolt-to-adult survival for fish released at a mean weight of 118.2 grams (4 fish/lb release group) was 0.38% and was 0.21% for fish released at a mean weight of 86.4 grams (5 fish/lb release group) (Table). Total survival (catch and escapement) of the 1988 brood of summer steelhead released for size-at-release comparisons was less than the 1985, 1986, and 1987 brood years. The 4 fish/lb release group survived at 1.94%, 1.04%, and 0.72 for the 1985, 1986, and 1987 broods respectively and the 5 fish/lb release groups survived at 1.06%, 1.08%, and 0.74% for the 1985, 1986, and 1987 broods respectively. The 4 fish/lb release groups had higher survival in 2 of the four completed brood years (1985 and 1988), but survival rates were similar in the other two brood years (1986 and 1987). The largest difference in mean weights at release between 4/lb and 5/lb were in the 1985 (40%) and 1988 (37%) brood years. The 1986 and 1987 broods had differences in mean weights of 29% and 22% respectively. When returns are complete for all size-at-release comparisons we will determine which strategy is cost effective, and produces most adults/lb of fish released. Does the increase in survival outweigh the decrease in numbers of fish released? We can raise and release more fish at 5/lb, but in average do we get as many adults returning from 4/lb releases? For the four completed broods released, it appears that interbrood variability has a greater influence on survival than an xx% difference in smolt weight (4/lb grams, and 5/b grams).

Figure showing survival of release groups

The 1988 brood Wallowa stock direct stream release group survived at 0.18% compared to the acclimated release group survival of 0.21%, a 17% increase in survival from acclimation. The hatchery return rate for the 1988 brood summer steelhead acclimated at Wallowa Hatchery was 18% greater than the direct stream release group. This may indicate better imprinting or homing ability resulting from acclimation or, alternatively, higher exploitation of direct stream release groups. We have observed consistently better smolt-to-adult survival for smolts that have been acclimated at Wallowa Hatchery. These differences exist even though acclimation conditions at Wallowa Hatchery are less than ideal due to poor water quality. Acclimation studies were initiated at the Little Sheep Creek facility and the Big Canyon facility with the 1991 releases.

Mike Flesher's discussion AFS paper, figure showing survival of groups. some discussion in fish culture section, combine.

Returns are complete for the 1988 brood Imnaha summer steelhead. Total survival (catch and escapement) was 0.30% compared to 0.19% for the 1986 brood year and 0.81% for the 1985 brood year, and 0.56 for the 1987 brood year.

A comparison of ocean residence for hatchery and wild origin summer steelhead is shown in Figure 7. The brood years (1981-1987 for wild fish and 1982-1988 for hatchery fish) represent similar migration and ocean rearing conditions. Wild smolts generally spent two years in freshwater before
seaward migration whereas hatchery smolts are reared one year before release. Both hatchery and wild adult steelhead return predominantly after one year in the ocean (Age 3 for hatchery and Age 4 for wild). A higher proportion of females spend two years in the ocean.

age and sex comparisons, discussion, broodstock availability

Progeny-to-parent ratios for hatchery origin Imnaha stock summer steelhead has been above 1.0 since the 1984 brood year (Figure 8). A ratio above 1.0 means that the population is above replacement and the hatchery program is producing adults in excess of that taken for broodstock. The 1982 and 1983 brood years had progeny-to-parent ratios below 1.0, mainly due to high prespawning mortality and poor rearing conditions caused by inadequate temporary facilities. Smolt-to-adult survival rates were also low for these two years. The progeny-to-parent ratio for the 1988 brood year was . compare to previous years.

The progeny-to-parent ratios for 1987 brood naturally produced steelhead was .compare to hatchery fish, 1988 brood year, similar migration year. Since 1987, naturally produced steelhead have been from hatchery and wild origin steelhead adults which were released above the Little Sheep Creek weir.
We could not calculate progeny-to-parent ratios for naturally produced steelhead in Little Sheep Creek from the 1982-1986 brood years because we could not estimate escapement due to inadequate adult trapping facilities. We

Variation in the smolt-to-adult survival rates for summer steelhead will dramatically affect the availability of harvestable adults and broodstock at adult collection facilities. Brood years which have above average survival will cause surplus at adult traps, especially at the Little Sheep Creek facility because of low exploitation of Imnaha stock steelhead. Low surviving brood years will cause potential shortages of broodstock, specifically at Wallowa Hatchery because exploitation of Wallowa stock steelhead is nearly 80%. In years of poor survival, fisheries may have to be reduced or eliminated in order to provide for adequate broodstock escapement. If additional acclimation/adult collection facilities are constructed on the upper Grande Ronde River and Catherine Creek, then shortages of broodstock may be eliminated for Wallowa stock because of two additional sources of Wallowa broodstock. Discuss brood year strength, affect on sex ratios, fecundity, broodstock availability, natural production, trapping guidelines when shortages of wild fish, surplus of hatchery fish.

We did not achieve LSRCP mitigation goals for spring chinook in 1992. Spring chinook adult returns to the LSRCP compensation area in 1992 were only 28.4% of the mitigation goal of 5,820 adults for the Grande Ronde Basin (Table 35). We were only able to release 84.6% (74.4% Rapid River stock and 2.6% Carson stock) of the mitigation goal of 900,000 yearling smolts for the Grande Ronde Basin for the 1987 brood year, but achieved 101.6% of the mitigation goal for the 1988 brood year.

More discussion about achieving mitigation goals. survival rates needed, % increase over best rates observed, figure showing release numbers, survival rates, return numbers, and percent of mitigation goal,

We estimated that only 1,214 hatchery Imnaha chinook salmon adults returned to the LSRCP compensation area in 1992 which represented only 37.8% of Oregon's mitigation goal of 3,210 chinook for the Imnaha Basin (Table 35). Adults that returned in the 1992 run year were from releases of the 1987 and 1988 broods. These releases were only 29.0% (1987 brood) and 91.4% (1988 brood) of the yearly mitigation goal of 490,000 smolts.

More discussion about achieving mitigation goals. survival rates needed, % increase over best rates observed, figure showing release numbers, survival rates, return numbers, and percent of mitigation goal,

LSRCP mitigation goals for summer steelhead in the Grande Ronde and Imnaha basins were not achieved during the 1991-92 return year, but the number of adult returns to the LSRCP compensation area were the highest since the program began. We estimated that 6,937 Wallowa stock summer steelhead returned to the LSRCP compensation area (above Lower Granite Dam) in the 1991-92 run year, which was 75.5% of the mitigation goal of 9,184 adults for the Grande Ronde Basin (Table 35). Smolt releases that produced the 1991-92 run were 100% of the mitigation goal (1.35 million smolts) for the 1988 brood year and 97.4% for the 1989 brood year. The exploitation rates (not corrected for unaccounted interdam losses) of 1988 and 1989 brood Wallowa stock summer steelhead that returned in the 1991-92 run year averaged 83% (Table 35). Of the total fish we could account for in the 1991-92 run year, 54% were harvested below Lower Granite Dam. A total of 71% of this harvest occurred in the Columbia River Net fishery and 28% occurred in the Deschutes River. A higher proportion of harvest occurred in the tributary sport fishery than in previous years (Figure showing exploitation rates by run year). also site mike's creel report.

A total of 1,428 hatchery stock Imnaha summer steelhead returned to the LSRCP compensation area in the 1991-92 run year, which represented 71.4% of the mitigation goal of 2,000 steelhead for the Imnaha Basin (Table 35). The adult return of Imnaha stock steelhead in the 1991-92 run year is the largest number of fish returning to the LSRCP compensation area since the program began. Smolt releases that produced adults in the 1991-92 run year were 97.5% and 100% of the mitigation goal of 330,000 smolts for the Imnaha Basin for the 1988 and 1989 brood years, respectively. The exploitation rate (not corrected for unaccounted interdam losses) of 1988 and 1989 brood Imnaha stock summer steelhead

that returned in the 1991-92 run year averaged 65% (Table 35). Of the total fish we could account for in the 1991-92 run year, 46% were harvested below Lower Granite Dam. A total of 93% of this harvest occurred in the Columbia River Net fishery and 7% in the Deschutes River (figure similar to wallowa stock sts).

Natural Escapement Monitoring

We were only able to recover and examine 17.3% and 12.1% of the estimated adult spring chinook spawning population in the Minam and Wenaha rivers respectively in 1992. These recovery rates are among the lowest observed on northeast Oregon spring chinook spawning ground surveys despite increased survey efforts in 1992. It may be necessary to conduct more intensive surveys in these streams, but the remoteness of these areas make supplementation surveys more costly and difficult. Expansion of marked hatchery strays from such low recovery rates may not accurately reflect stray rates. It is likely that we are recovering a higher percentage of hatchery origin spawners if hatchery fish tend to spawn later in the year, and are there fore more likely to be recovered on supplemental surveys. For the Minam River, we do not conduct multiple surveys on spawning areas above Redd's Horse Ranch, and it may be possible that the percentage of hatchery strays is lower in the upper reaches because of the increase in distance strayed. In the Wenaha river, we plan to conduct multiple surveys of the entire south fork, and the first 3 miles of the mainstem in 1993. There still is the possibility that native fish may spawn before our index counts and carcasses may not be available for sampling at the same rate as hatchery fish. Starting with the 1992 chinook releases (1990 brood) all releases from Lookingglass hatchery will be 100% adipose fin or ventral fin marked so all hatchery strays will be identifiable on spawning ground surveys.

low flows in 1992, relate to stray rates, number of unmarked hatchery fish
also 1988 brood outplantings, where did they return
Upper Grande and Catherine Creek, no cwt recoveries, but cwt on Wenaha, Minam, and Lostine River. Scale analysis results, percent of hatchery fish on spawning grounds.

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