ANNUAL PROGRESS REPORT

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OREGON

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

CONTRACT NUMBER: 14-16-0001-84118

PROJECT PERIOD: 1 April 1984 to 31 March 1985

PROJECT TITLE: Evaluation of the Benefits Provided by Releasing Spring Chinook Salmon Presmolts in the Grande Ronde River and Its Tributaries

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PROJECT TITLE: Evaluation of the Benefits Provided by Reprogramming Spring Chinook Salmon from Lower Columbia River Hatcheries.

CONTRACT NUMBER: 14-16-0001-84119

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Evaluation of Lower Snake River Compensation Plan Facilities in Oregon

Objectives for FY 1985

1. Mark Ad+CWT 4 groups of 70,000 (replicate tag codes of 35,000 for each group) Carson spring chinook salmon.

2. Release marked groups in September, November, and April at Lookingglass Hatchery and in September at Big Canyon Creek.

3. Mark Ad+CWT 2 groups of 50,000 (replicate tag codes of 25,000 for each group) Imnaha spring chinook salmon and release fish during September and April at the Imnaha temporary facility.

4. Document egg take, egg-to-smolt survival, growth, condition and disease profile of spring chinook salmon and summer steelhead reared and released at LSRCP facilities.

5. Compare growth, size at release, and size variation of spring chinook salmon juveniles reared under different rearing regimes at Lookingglass Hatchery.

6. Determine length frequency and sex ratio and document run timing for spring chinook salmon that return to Lookingglass Hatchery and the Imnaha facility and for summer steelhead that return to Wallowa Hatchery and the Little Sheep Creek facility.

7. Collect and analyze scales from spring chinook salmon and summer steelhead adults that return to LSRCP facilities to determine age composition and life history patterns.

8. Complete a five-year study plan for the evaluation of LSRCP facilities in Oregon.

9. Summarize release and return information for Ad+CWT marked summer steelhead released at Wallowa Hatchery from 1978-1981.

Accomplishments in FY 1985

All objectives except number 5 were accomplished. Those groups of fish that we were going to monitor were released as presmolts in June instead of being released as smolts.

Findings in FY 1985

The egg to smolt survival rate for 1983 brood Imnaha spring chinook salmon was 70.7% and the survival rate for the 1984 brood Little Sheep Creek summer steelhead was 44.1%. The specific cause for these poor survival rates is unknown. We feel that faults with the temporary collection, holding, and spawning facilities and the stresses of transporting eggs from the spawning site to the hatchery facilities are the primary causes.

Carson stock spring chinook salmon smolts that were released at a size of 15.5 fish/lb in the spring showed much greater size variation than smolts that were released at 23.5 fish/lb.

Over 90% of the adult summer steelhead returns to Little Sheep Creek and Wallowa Hatchery in 1984 were one-salt adults. Four year old adults totaled 76.7% of the spring chinook salmon that returned to Lookingglass Hatchery and 34.3% of the adults that returned to the Imnaha River facility.

Survival rates, exploitation rates, and age composition of marked summer steelhead released from Wallowa Hatchery in 1978-1981 were highly variable. Survival rates ranged from 0.01% to 0.59% and exploitation rates varied from 7.7% to 66.8%.

Evaluation of the Benefits Provided by Releasing Spring Chinook Salmon Presmolts in the Grande Ronde River and Its Tributaries.

Objectives for FY 1985

1. Mark Ad+CWT 2 groups of 100,000 (replicate tag codes of 50,000 each group) Carson spring chinook salmon premolts at Lookingglass Hatchery and release marked fish in Lookingglass Creek and the upper Grande Ronde River.

2. Complete a five-year study plan to evaluate the benefits of releasing presmolts in the Grande Ronde River.

Accomplishments in FY 1985

All objectives were accomplished.

Findings in FY 1985

Spring chinook salmon presmolts released in Lookingglass Creek during July were recovered as migrant smolts at Lower Granite Dam in September by the United States Army Corps of Engineers.

The presmolts that migrated past Lower Granite Dam in September grew an average of approximately one milimeter per day between 13 July and September. We expect that a portion of the presmolts that are released each year will reach smolt size by the fall and will begin their seaward migration. Fall migrating smolts are not desirable in the Snake River basin because of poor passage conditions at the hydro projects. Presmolts should be released at a size approximately that of the wild fish to reduce the competitive advantage associated with size and to reduce the numbers that begin seaward migration in the fall.

Evaluation of the Benefits Provided by Reprogramming Spring Chinook Salmon Smolts from Lower Columbia River Hatcheries.

Objectives for FY 1985

1. Mark Ad+CWT 70,000 (replicate tag codes of 35,000) spring chinook salmon juveniles at Oxbow Hatchery. Transport the fish to Lookingglass Hatchery for a short acclimation period and then release in September.

2. Complete a five-year study plan to evaluate the benefits of reprogramming lower Columbia River hatcheries.

Accomplishments in FY 1985

All objectives were accomplished.

GENERAL INTRODUCTION

The Oregon Department of Fish and Wildlife (ODFW) began operation of Lookingglass Hatchery in 1982 as part of the spring chinook salmon production program under the Lower Snake River Compensation Plan (LSRCP). New facilities at Irrigon to hatch and rear summer steelhead and at Wallowa to trap and spawn summer steelhead are under construction and will be completed in 1986. Satellite facilities for rearing and releasing juveniles and for broodstock collection will be completed at Big Canyon Creek and Little Sheep Creek in 1986 and on the mainstem Imnaha River in 1987 (Figure 1).

LSRCP hatchery facilities are being constructed to compensate for losses of summer steelhead and spring chinook salmon in spawning areas, sport fisheries, and tribal fisheries in the Grande Ronde and Imnaha rivers. Oregon's adult mitigation goals are 5,813 spring chinook salmon and 9,184 summer steelhead for the Grande Ronde River basin and 3,259 spring chinook salmon and 2,000 summer steelhead for the Imnaha River basin (United States Army Corps of Engineers 1975). We are evaluating the production and release of salmon and steelhead to ensure that mitigation requirements are met and that the long term objectives *(see* Carmichael and Wagner 1983) of the LSRCP are achieved. Three projects were conducted under the LSRCP hatchery evaluations during the report period: (1) Evaluation of Lower Snake River Compensation Plan Facilities in Oregon; (2) Evaluation of the Benefits Provided by Releasing Spring Chinook Salmon Presmolts in the Grande Ronde River and Its Tributaries; (3) Evaluation of Benefits Provided by Reprogramming Spring Chinook Salmon Smolts from Lower Columbia River Hatcheries. In this report we present a review of our activities under all three projects for the period 1 April 1984 through 31 March 1985.

EVALUATION OF LOWER SNAKE RIVER COMPENSATION PLAN FACILITIES IN OREGON

Introduction

Evaluation of LSRCP facilities began in the fall of 1983. Work throughout the first year focused on planning and on survival studies of spring chinook salmon at Lookingglass Hatchery (Carmichael and Wagner 1983). A wide variety of activities were conducted during this report period. Much of our work focused on summarizing existing hatchery information that had not been previously reported as well as initiating new investigations to accomplish our long term goals. Spring chinook salmon and summer steelhead hatchery production programs are in developmental stages and fine tuning will continue for several brood years. Documentation of fish cultural practices during the early stages of hatchery operations will prove beneficial in evaluating program success in future years.

Study Goals

The goals of this study are: 1) To evaluate the success of achieving LSRCP objectives; and 2) to develop and recommend hatchery practices for LSRCP facilities that will meet mitigation requirements and management objectives for production of spring chinook salmon and summer steelhead lost as a result of construction of Lower Snake River dams.

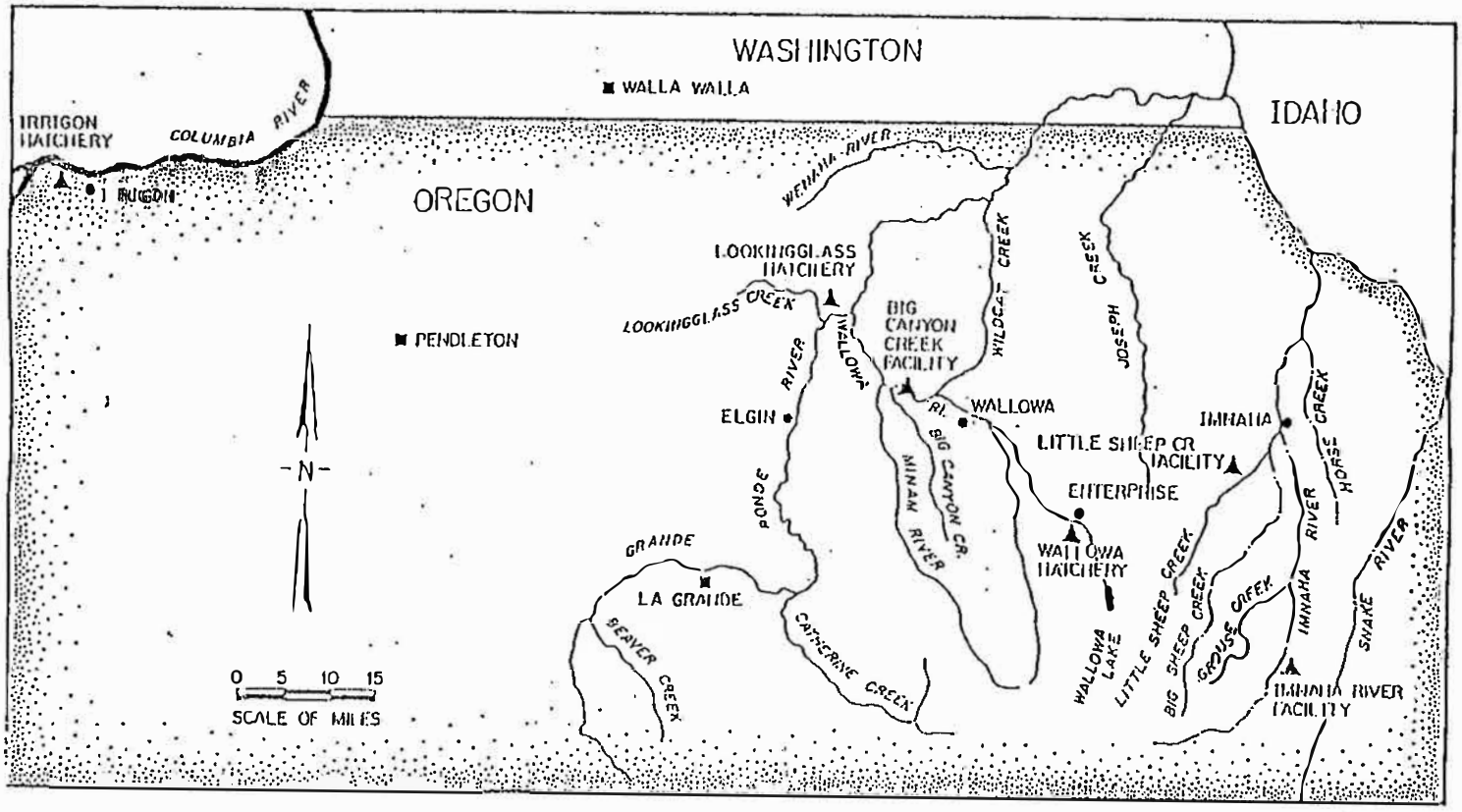

Figure 1. Map of northeastern Oregon showing the Grande Ronde and Imnaha river systems and the location of Lower Snake River Compensation Plan facilities.

Objectives and Tasks

Objective 1: Determine survival (catch plus escapement) to adult for 1983 brood Carson stock spring chinook salmon smolts that were released during September and November 1984 and April 1985 at Lookingglass Hatchery and during September 1984 at Big Canyon Creek.

Task 1.1: Mark (Ad+CWT) 4 groups of 70,000 (replicate tag codes of 35,000 for each group) Carson spring chinook salmon.

Task 1.2: Release marked groups in September, November, and April at Lookingglass Hatchery and in September at Big Canyon Creek.

Objective 2: Determine survival (catch plus escapement) to adult for 1983 brood Imnaha spring chinook salmon released in September 1984 and April 1985 in the Imnaha River.

Task 2.1: Mark (Ad+CWT) 2 groups of 50,000 (replicate tag codes of 25,000 for each group) Imnaha spring chinook salmon.

Task 2.2: Release marked fish in the Imnaha River during September and April at the temporary release site.

Objective 3: Document fish rearing activities and results for 1983 and 1984 brood spring chinook salmon and for the 1984 brood summer steelhead reared at LSRCP facilities.

Task 3.1: Document egg takes and egg-to-smolt survival; monitor growth, condition, and size; and maintain a disease profile of spring chinook salmon and summer steelhead reared and released from LSRCP facilities.

Task 3.2: Compare growth, size at release, and size variation of spring chinook salmon juveniles kept inside on well water until May with the same attributes of juveniles ponded outside in river water during March at Lookingglass Hatchery.

Objective 4: Determine freshwater and ocean residence time and monitor sex, size, and run timing of spring chinook salmon and of summer steelhead that return to LSRCP facilities.

Task 4.1: Measure lengths, determine sex, and document run timing of spring chinook salmon that return to Lookingglass Hatchery and to the Imnaha trap and of summer steelhead that return to Wallowa Hatchery and to the Little Sheep Creek trap.

Task 4.2: Collect and analyze scales from adult spring chinook salmon and summer steelhead adults that return to LSRCP facilities.

Objective 5: Complete a five year study plan to evaluate LSRCP facilities in Oregon.

Task 5.1: Review pertinent literature and write a detailed five-year study plan for evaluation of LSRCP facilities.

Objective 6: Summarize existing release and return information for Ad+CWT marked summer steelhead released at Wallowa Hatchery from 1978-1981.

Methods

Replicate groups of Carson spring chinook salmon were marked Ad+CWT and released during September, November, and April at Lookingglass Hatchery for time of release comparisons. All marked fish originated from a common pool of eggs. Replicate groups of Imnaha spring chinook salmon were marked and released at the Imnaha temporary facility in September and April. The entire production of Imnaha spring chinook salmon was marked. Mean fork length, mean weight, and condition factor, $K_{FL} = \frac{Wg}{\overline{L}_{cm}^3}(100)$, were determined for each marked group at time of release. The first adult returns from these releases are expected in 1987. Time of release comparisons are planned for five years to allow for adequate evaluation. Adult returns and fishery recoveries of marked fish will be used to determine optimum time of release and to determine annual adult production of spring chinook at LSRCP facilities.

We monitored the operational and fish cultural practices at Lookingglass Hatchery, Wallowa Hatchery, Little Sheep Creek trap, and the Imnaha River facility. Numbers, size, location of release, and condition factor were determined and summarized for each release group of spring chinook salmon and summer steelhead. Records of eggs taken, eggs lost, fry lost, and smolts released were obtained from hatchery personnel and from hatchery records. Egg-to-smolt survival rates were determined for each stock of summer steelhead and spring chinook. Preliberation and routine disease examinations were conducted by the ODFW pathology staff. All adults that were spawned were sampled for Infectious Hematopoietic Necrosis Virus (IHNV) and Infectious Pancreatic Necrosis Virus (IPNV).

Run timing of Imnaha and Lookingglass spring chinook salmon and Imnaha and Wallowa summer steelhead was determined. Trapping data from the Imnaha trap does not accurately reflect run timing of spring chinook salmon because the weir was installed after a significant portion of the run had passed the weir location. Fork lengths were recorded to the nearest millimeter, scales were taken from the key scale area, and sex was determined for all adults that were spawned or killed, or that died. Height of dorsal fins were recorded to the nearest millimeter for all summer steelhead. Total adults that returned, number of females that were spawned, and prespawning mortality were documented for each stock of fish. Coded-wire tags were recovered and decoded from all marked fish.

Scales were read using a microfiche reader that projected an image of the scale at 88x to determine freshwater and ocean residence time. Scales that were collected in 1981-83 at Wallowa Hatchery and in 1983 at Little Sheep Creek were read to determine age composition of returning adults for these years.

Long term project goals and objectives were developed in cooperation with district biologists, hatchery managers, and other ODFW staff. A five-year study plan was developed under the guidelines of LSRCP Hatchery Evaluations and was submitted to the United States Fish and Wildlife Service (USFWS). The study plan is being reviewed and will be completed in the spring of 1986.

Six groups of summer steelhead that were marked Ad+CWT were released at Wallowa Hatchery between 1978 and 1981. We acquired all available release, fishery recovery, and hatchery return information for all six groups. Two marked groups (brood year 1977, code 09 16 36; and brood year 1978, code 07 16 14) were split after marking and some were released as 1-year smolts and some as 2-year smolts. Scales were collected by the district biologist from marked adults that returned to Wallowa Hatchery between 1980 and 1983. We read the scales to determine time of freshwater and ocean residence. Escapement and harvest data were summarized, and smolt-to-adult survival rates were estimated for each marked group. We calculated survival rates for fish released as both 1-year and 2-year smolts for tag codes 09 16 36 and 07 16 14. We determined exploitation rates based on recoveries in ocean, Deschutes River, and Columbia River fisheries. We analyzed scales to determine residualism rates. Fish which had spent one year in freshwater following release were defined as residuals. This residualism rate does not account for those fish that remained in freshwater and did not migrate to the sea.

Results

Release information for marked spring chinook salmon is presented in Table 1. A summary of production releases from Lookingglass Hatchery for the 1983 brood spring chinook salmon is presented in Table 2. The length frequency distribution for fish released in the spring is presented in Figures 2 and 3. A total of 977,789 Carson stock presmolts reared at Lookingglass Hatchery were released during the spring and early summer. Total smolt releases included 899,543 during the fall and 980,123 during the spring. Included in the fall release were 148,544 smolts that were reared at Oxbow hatchery (reprogrammed smolts) and transported to Lookingglass Hatchery for acclimation two weeks before release. A total of 115,830, 1983 brood, Imnaha spring chinook were reared at Lookingglass Hatchery and released into the Imnaha River. We were unable to compare growth and size of spring chinook salmon ponded outside in March with those ponded outside in May because the fish ponded in March were released as presmolts in June.

Egg take numbers and egg-to-smolt survival rates for 1983 and 1984 brood spring chinook salmon are presented in Table 3. A summary of steelhead smolt releases in LSRCP areas is presented in Table 4. Egg take numbers and egg to smolt survival rates for the 1984 brood Wallowa and Imnaha summer steelhead are presented in Table 5. The results of the pathological examinations are presented in Table 6.

Table 1. Release information for spring chinook salmon reared at Lookingglass Hatchery, marked Ad+CWT and released in the Grande Ronde and Imnaha river basins, 1983 brood. CI = confidence interval.

Stock, location of release	Tag code	Date of release	Number released	Mean weight (g)	Mean fork length (mm ± 95% CI)	Mean condition factor[a] (mm ± 95% CI)
Carson:						
Lookingglass Creek	07 30 01	07/13/84	50,742	5.8	81 ± 2	-
	07 30 02	07/13/84	50,395	5.8	81 ± 2	-
	07 31 52	09/15/84	37,977	13.8	100 ± 1	1.309 ± 0.003
	07 31 52	09/15/84	36,673	13.8	100 ± 1	1.309 ± 0.003
	07 31 49	09/29/84	35,376	19.3	114 ± 1	1.279 ± 0.005
	07 31 50	09/29/84	34,837	19.3	114 ± 1	1.279 ± 0.005
	07 31 53	11/01/84	33,559	16.0	111 ± 10	1.189 ± 0.001
	07 31 54	11/01/84	29,992	16.0	111 ± 10	1.189 ± 0.001
	07 31 55	04/04/85	37,533	20.6	121 ± 3	1.127 ± 0.005
	07 31 56	04/04/85	37,694	20.6	121 ± 3	1.127 ± 0.005
Upper Grande Ronde River	07 30 03	07/17/84	50,454	5.3	75 ± 4	-
	07 30 04	07/17/84	50,091	5.3	75 ± 4	-
Big Canyon Creek	07 31 57	09/11/84	35,087	27.8	131 ± 15	1.356 ± 0.005
	07 31 58	09/11/84	34,386	27.8	131 ± 15	1.356 ± 0.005
Imnaha:						
Imnaha River	07 30 12	09/14/84	28,334	18.6	117 ± 3	1.275 ± 0.003
	07 30 13	09/14/84	27,537	18.6	117 ± 3	1.275 ± 0.003
	07 30 16	03/25/85	26,336	26.0	134 ± 9	1.179 ± 0.002
	07 30 17	03/25/85	26,745	26.0	134 ± 9	1.179 ± 0.002

[a] *Fulton's condition factor.*

Table 2. Release information for spring chinook salmon reared at Lookingglass Hatchery and released in the Grande Ronde and Imnaha river basins, 1983 brood. CI = confidence interval.

Stock, date of release	Number released	Location of release	Size (fish/lb)	Mean fork length (mm ± 95% CI)
Carson:				
06/13-15/84	382,500	Catherine Creek	187.5	61 + 1
06/18/84	159,750	Upper Grande Ronde River	108.0-141.0	68 ± 3
07/12-13/84	243,565	Lookingglass Creek	76.7-79.1	81 ± 2
07/17/84	191,974	Upper Grande Ronde River	85.5	75 ± 4
09/11/84	171,612	Big Canyon Creek	13.9-16.3	131 ± 15
09/16/84	112,044	Lookingglass Creek	32.8	100 ± 1
09/16/84	149,887	Lookingglass Creek	21.5-23.3	-[a]
09/29/84	148,544	Lookingglass Creek	23.5	114 ± 1
11/01/84	149,124	Lookingglass Creek	17.0	127 ± 18
11/01/84	112,097	Lookingglass Creek	28.3	111 ± 10
04/04/85	694,974	Lookingglass Creek	15.5	136 ± 14
04/04/85	225,554	Lookingglass Creek	23.5	121 ± 3
Imnaha:				
09/14/84	56,235	Imnaha River	24.4	117 ± 3
03/25/85	59,595	Imnaha River	17.4	134 ± 9

[a] *No lengths taken.*

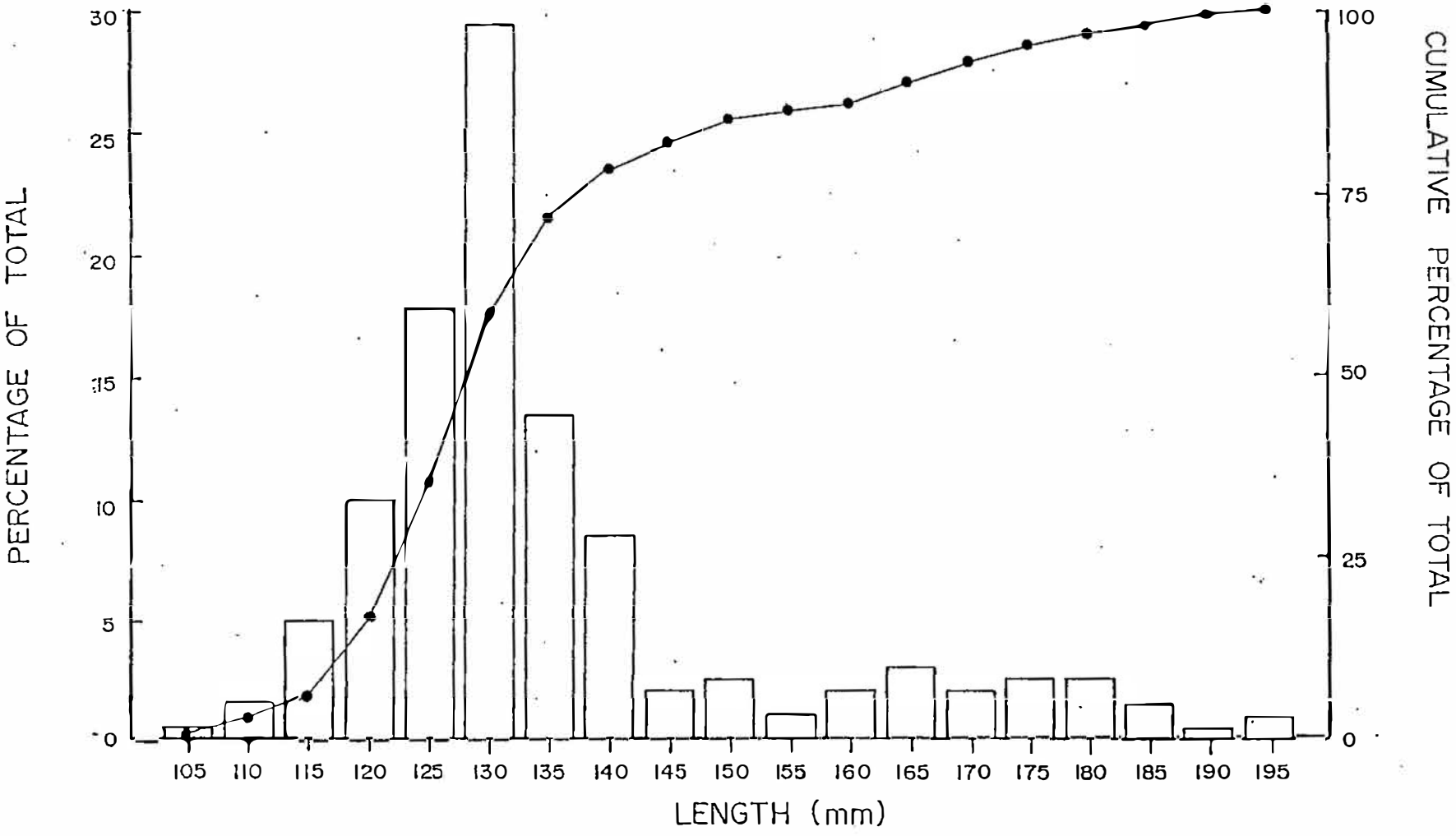

Figure 2. Length frequency distribution of large (15.5 fish/lb) Carson spring chinook salmon smolts released at Lookingglass Hatchery.

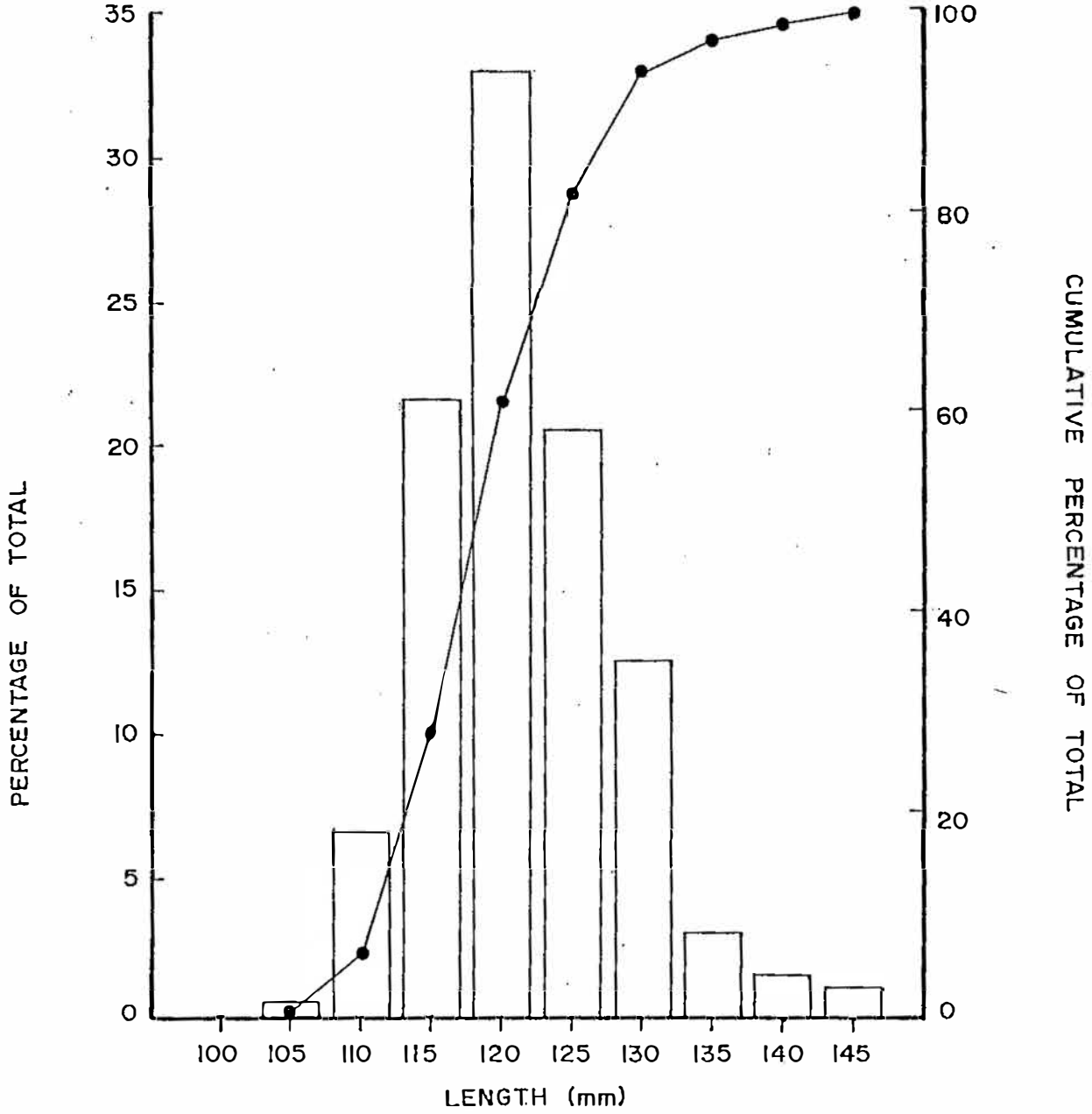

Figure 3. Length frequency distribution of small (23.5 fish/lb) Carson spring chinook salmon smolts released at Lookingglass Hatchery.

Table 3. Egg take and egg survival of 1983 and 1984 brood Imnaha, Lookingglass, and Carson spring chinook salmon at Lookingglass Hatchery.

Stock, brood year	Number of eggs taken or received	Egg loss (%)	Egg-to-fry survival (%)	Egg-to-smolt survival (%)
Imnaha:				
1983	163,862	23.7	74.6	70.7
1984	51,800	25.8	72.0	(a)
Lookingglass:				
1983	14,863	10.5	23.1[b]	(c)
1984	62,396	12.7	84.5	(a)
Carson:				
1983	1,586,717	1.0	94.5	90.9
1984	654,637	0.1	99.0	(a)

[a] *1984 brood smolts will be released in the spring of 1986.*
[b] *Severe sac-fry loss occurred due to the loss of water during an intake ice-up in December 1983.*
[c] *Lookingglass fry were ponded with Carson fry so survival rate to the smolt stage could not be calculated.*

A summary of returns for spring chinook salmon to Lookingglass Hatchery and to the Imnaha River trap for 1982-84 is presented in Table 7. Table 8 illustrates the run timing of spring chinook salmon that returned to Lookingglass Hatchery and to the Imnaha River trap. Age composition of adults at Lookingglass Hatchery is presented in Figure 4, and the age composition of spring chinook salmon adults at Imnaha is presented in Figure 5. Mean length of age specific groups of spring chinook salmon is presented in Table 9.

Table 4. Release information for summer steelhead released in the Grande Ronde and Imnaha river basins, 1983 brood. CI = confidence interval.

Stock, hatchery of rearing	Number released	Date of release	Location of release	Size (fish/lb)	Mean fork length (mm ± 95% CI)
Wallowa:					
Wallowa	~~46,818~~ 40,818	04/24/84	Wallowa Hatchery	7.1-9.0	184 ± 1
Lyons Ferry	443,175	04/23-05/02/84	Wallowa Hatchery	5.0-9.3	190 ± 3
Lyons Ferry	57,100	~~04/27-05/03/84~~ 04/2-5/84	Big Canyon Creek	6.8-9.3	190 ± 3
Imnaha:					
~~Irrigon~~ Wallowa	~~22,819~~ 40,819	04/23/84	Little Sheep Creek	4.7	188 ± 2
Irrigon	~~35,786~~ 24,606	04/30-05/02/84	Little Sheep Creek	7.8-10.2	176 ± 2

Table 5. Egg take and egg survival of Wallowa and Imnaha summer steelhead, 1984 brood.

Stock	Eggs taken or received	Egg loss (%)	Egg to fry survival (%)	Egg to smolt survival (%)
Wallowa	1,670,780[a]	10.7	88.2	81.1
Imnaha	179,550	32.6	63.5	44.1

[a] *836,318 eggs and 100,320 fry were shipped to Lyons Ferry Hatchery of the Washington Department of Game. The survival of this group is not included.*

Table 6. Fish disease examinations at Lower Snake River Compensation Plan hatcheries, 1 April 1984 to 31 March 1985, StS = summer steelhead, ChS = spring chinook salmon, CWD = cold-water disease, BGD = bacterial gill disease, BKD = bacterial kidney disease, and VEN = viral erythrocytic necrosis.

Hatchery species-stock	Brood year	Reason--Diagnosis	Month of Examination
Irrigon:			
StS-Wallowa	1984	Increased loss--Internal fungus, CWD, nonfeeding dropouts.	Jun 1984
StS-Wallowa	1984	Increased loss--Light BGD and CWD in pond 2.	Jul 1984
StS-Wallowa	1984	Increased loss--BGD.	Aug 1984
StS-Wallowa	1984	Increased loss--BGD.	Aug 1984
StS-Wallowa	1984	Increased loss--Low grade chronic BGD.	Mar 1985
Oxbow:			
ChS-Carson	1983	Preliberation--No disease.	Sep 1984
Lookingglass:			
ChS-Carson	1984	Increased loss--Coagulated yolk, white spot with CWD involvements.	Jan 1985
ChS-Carson	1984	Routine-- *Costia*, Low grade chronic CWD.	Mar 1985
ChS-Carson	1983	Preliberation--Low grade CWD and BKD. VEN inclusions, *Costia*.	Mar 1985
ChS-Imnaha	1983	Preliberation--Low grade CWD and BKD.	Mar 1985
Wallowa:			
StS-Wallowa	1984	Increased loss--Skin abrasions. CWD-like cytophaga bacteria, CWD.	Mar 1985
Big Canyon Creek:			
ChS-Carson	1983	Scale loss--BKD.	Mar 1985

Table 7. Adult spring chinook salmon that returned to Lookingglass Hatchery and the Imnaha River trap, 1982-84.

Location, year of return	Total number	Jacks Number (%)	Males Number(%)	Females Number (%)	Number females spawned
Lookingglass Hatchery:					
1982	44	0	20 (45.5)	24 (54.5)	18
1983	20	0	13 (65.0)	7 (35.0)	4
1984	43	8 (18.6)	10 (23.3)	25 (58.1)	17
Imnaha River trap:					
1982	28	0	14 (50.0)	14 (50.0)	10
1983	64	8 (12.5)	21 (32.8)	35 (54.7)	31
1984	36	10 (27.8)	9 (25.0)	17 (47.2)	11

Table 8. Run timing for adult spring chinook salmon that returned to Lookingglass Hatchery and the Imnaha River trap, 1984.

Time interval	Lookingglass Hatchery Number	% of total	Imnaha Trap[a] Number	% of total
06/4-10	1	2.3		
06/11-17	16	37.2		
06/18-24	4	9.3		
06/25-07/01	5	11.6		
07/02-08	10	23.3		
07/09-15	0			
07/16-22	0			
07/23-29	6	14.0		
07/30-08/5	1	2.3		
08/06-12	0		11	29.8
08/13-19	0		10	27.0
08/20-26	0		13	35.1
08/27-09/02	0		3	8.1
09/03-04	0		0	

[a] *Imnaha River trap operated from 08/06 to 09/04.*

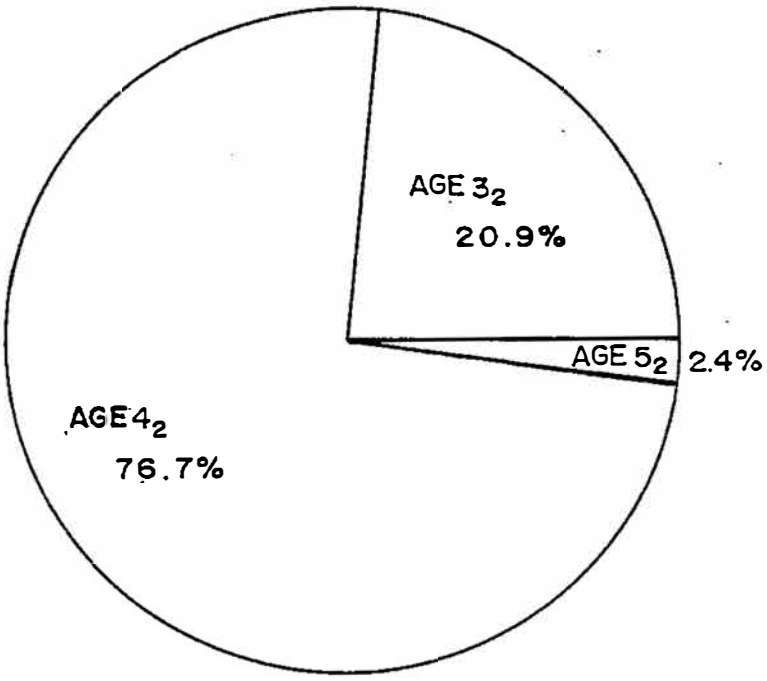

Figure 4. Age composition of spring chinook salmon at Lookingglass Hatchery, 1984. (N = 43.)

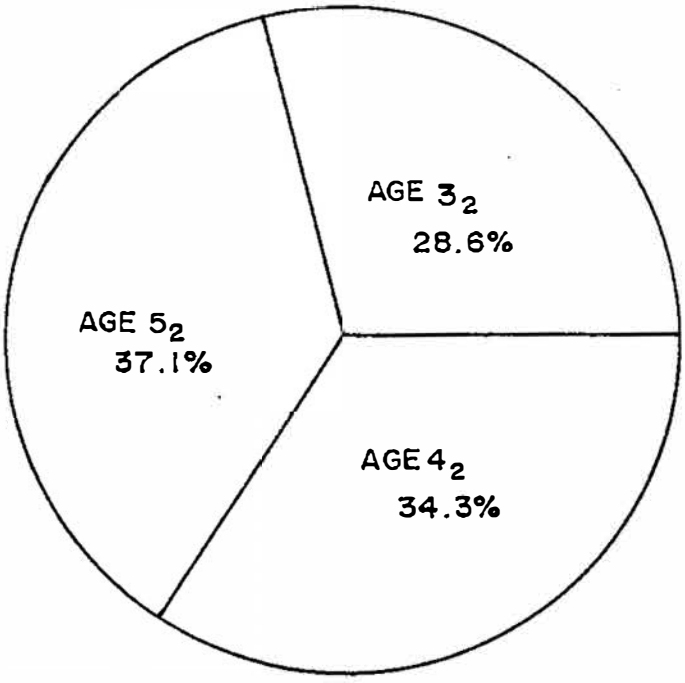

Figure 5. Age composition of wild spring chinook salmon trapped in the Imnaha River, 1984. (N = 36.)

Table 9. Mean fork length (mm ± 95% confidence interval) for age-specific groups of adult spring chinook salmon, 1984. Age nomenclature is that of Gilbert and Rich (1927).

Location	Age 3_2 Males	Age 3_2 Females	Age 4_2 Males	Age 4_2 Females	Age 5_2 Males	Age 5_2 Females
Lookingglass Hatchery:	527 ± 19	(a)	683 ± 25	706 ± 18	(a)	975[b]
Imnaha River Trap:	(c)	(a)	690[b]	800 ± 29	1,035[c]	904 ± 38

[a] *No fish in this age group.*
[b] *One fish in this age-group.*
[c] *Ten jacks trapped but lengths not recorded.*

A summary of summer steelhead returns to Wallowa Hatchery and Little Sheep Creek is presented in Table 10. Run timing for Wallowa summer steelhead and for Little Sheep steelhead is presented in Table 11.

Table 10. Adult summer steelhead that returned to Wallowa Hatchery and Little Sheep Creek, 1980-84.

Location, year of return	Total number	Males Number (%)	Females Number (%)	Number of females spawned
Wallowa Hatchery:				
1980	142	57 (40.1)	85 (59.9)	85
1981	205	52 (25.4)	153 (74.6)	142
1982	140	29 (20.7)	111 (79.3)	111
1983	308	83 (27.0)	225 (73.0)	216
1984	906	475 (52.4)	431 (47.6)	384
Little Sheep Creek:				
1982	53	9 (17.0)	44 (83.0)	25
1983	45	15 (33.3)	30 (66.7)	24
1984	72	27 (37.5)	45 (62.5)	34

Table 11. Run timing for adult summer steelhead that returned to Wallowa Hatchery and the Little Sheep Creek trap, 1984.

Time interval[a]	Wallowa Hatchery Number	Wallowa Hatchery % of total	Little Sheep Creek Number	Little Sheep Creek % of total
03/01-04	4	0.4		
03/05-11	3	0.3		
03/12-18	52	5.8		
03/18-25	168	18.6		
03/26-04/01	65	7.2	11	15.3
04/02-08	85	9.4	12	16.7
04/09-15	155	17.1	27	37.5
04/16-22	193	21.3	5	6.9
04/23-29	61	6.7	17	23.6
04/30-05/06	62	6.8		
05/07-13	51	5.6		
05/13-15	7	0.8		
			72	

[a] *Wallowa Hatchery trap opened 03/1 closed 05/15. Little Sheep Creek trap opened 03/30 closed 04/24.*

Six life history patterns were identified from scale analysis of adult summer steelhead that returned to Wallowa Hatchery from 1981 through 1984 and that returned to Little Sheep Creek from 1983 through 1984. The life history patterns are designated with the American method as follows:

1:1. Three-year-old fish; one year in freshwater before seaward migration and one year in the ocean.

1:2. Four-year-old fish; one year in freshwater before seaward migration and two years in the ocean.

1:3. Five-year-old fish; one year in freshwater before seaward migration and three years in the ocean.

2:1. Four-year-old fish; two years in freshwater before seaward migration and one year in the ocean.

2:2. Five-year-old fish; two years in freshwater before seaward migration and two years in the ocean.

3:1. Five-year-old fish; three years in freshwater before seaward migration and one year in the ocean.

The age composition of summer steelhead adults that returned to Wallowa Hatchery and the Little Sheep Creek trap is presented in Table 12. Mean length of age specific groups of summer steelhead is presented in Table 13. A summary

of dorsal fin height for summer steelhead from Wallowa Hatchery and Little Sheep Creek is presented in Table 14.

Table 12. Percent age composition for adult summer steelhead that returned to Wallowa Hatchery and to the Little Sheep Creek trap, 1981-84.

Location, year of return	Sample size	Age group 1:1	1:2	1:3	2:1	2:2	3:1
Wallowa Hatchery:							
1981	70	0	4.8	0	81.5	11.0	2.7
1982	92	4.1	2.0	3.0	34.3	56.6	0
1983	192	2.1	8.9	2.1	43.5	43.4	0
1984	577	30.0	0.1	0	62.4	6.9	0.4
$\bar{x}$		9.0	4.0	1.3	55.4	29.5	0.8
Little Sheep Creek:							
1983	25	0	1.9	0	68.0	32.0	0
1984	63	0	0	0	94.3	3.8	0
$\bar{x}$		0.0	1.0	0.0	81.1	17.9	0.0

The five-year study plan was completed and submitted to the USFWS for review. Prior to the preparation of the plan, no format or schedule had been identified. After the review was complete a format was developed and a schedule was established. The study-plan has been rewritten to conform to the new format and has been resubmitted for review.

Release information for marked summer steelhead released at Wallowa Hatchery from 1978 through 1983 is presented in Table 15. Estimates of catch and escapement are presented in Table 16. Age composition, survival rates, exploitation rates, and residualism rates are presented in Table 17.

Table 13. Mean fork length (mm ± 95% confidence interval) of age-specific groups of adult summer steelhead at Wallowa Hatchery and Little Sheep Creek, 1980-84.

Location, year of return	Sample size	Age group 1:1	1:2	1:3	2:1	2:2	3:1
Wallowa Hatchery:							
1980	85[a]	587 ± 48	(b)	(b)	589 ± 7	(b)	(b)
1981	70	(b)	691 ± 138	(b)	590 ± 6	699 ± 18	590 ± 21
1982	92	578 ± 50	732 ± 102	(b)	602 ± 1	706 ± 11	655 ± 98
1983	192	582 ± 60	693 ± 16	736 ± 53	620 ± 7	725 ± 9	(b)
1984	577	584 ± 4	678[c]	755[c]	548 ± 7	723 ± 10	593 ± 80
Little Sheep Creek:							
1983	25	(b)	(b)	(b)	581 ± 13	681 ± 21	(b)
1984	63	(b)	729[c]	(b)	577 ± 6	670 ± 28	(b)

[a] *Based on lengths of coded-wire tagged fish.*
[b] *No fish with this pattern.*
[c] *One fish with this pattern.*

Table 14. Dorsal fin length summaries for adult summer steelhead, 1984.

Location	N	Mean length (mm)	Range (mm)	Percent ≥ 51 mm
Wallowa Hatchery	585	33.8	1-71	8.4
Little Sheep Creek	53	55.0	50-66	90.0

Table 15. Release information for summer steelhead reared at Wallowa Hatchery, marked Ad+CWT, and released at Wallowa Hatchery, 1976-80 and 1982 broods.

Stock, brood year	Tag code	Date of release	Number released	Mean weight (g)
Snake River:				
1976	09 06 13	05/08/78	66,960	73.2
1977	09 16 36	05/12/78	18,160	34.9
	09 16 36	04/30/79	66,228	73.2
1978	07 16 14	05/16/79	19,322	30.9
	07 16 14	04/05/80	30,733	90.8
Pahsimeroi:				
1979	07 22 01	04/21/80	25,283	42.8
	07 22 02	04/31/81	55,180	87.3
Wallowa:				
1980	07 16 27	04/03-15/81	37,043	79.6
1982	63 28 39[a]	05/15/83	31,911	90.8
	63 28 40[a]	05/15/83	31,167	103.2

[a] *Also freeze-branded RA-S-1.*
[b] *Also freeze-branded RA-S-2.*

Discussion

We have been releasing spring chinook salmon in the fall of the year based on our assumption that the fish will overwinter in the mainstem and begin their seaward migration as smolts in the spring following release. Fall migration from tributary streams into the mainstem and mainstem rearing historically played an important role in the production of native spring chinook salmon in Lookingglass Creek (Burck 1974) and in the Imnaha River (Gaumer 1968). Work by Smith and Zakel (1980) in the Willamette River suggests that hatchery-reared smolts larger than 140 mm will begin seaward migration in the fall.

We released 171,612 Carson spring chinook salmon on 11 September 1984 in Big Canyon Creek, which is a small tributary to the Wallowa River *(see* Table 2). This release was made to initiate a broodstock program for the Big Canyon facility. We sampled Big Canyon Creek with electrofishing gear on 26 March, 2 April, and 23 May, 1985 to determine if the chinook salmon had remained in Big Canyon Creek overwinter. Although we did not make quantitative estimates of densities, large numbers of hatchery chinook were found throughout Big Canyon Creek below the release site on 26 March and 2 April. No fish were found on 23 May. The fish that we collected were extensively descaled. Thirty fish were killed, and sent to the ODFW pathology laboratory in Corvallis for examination.

Table 16. Estimated catch and escapement of coded-wire tagged summer steelhead released at Wallowa Hatchery from 1978-1981.

Stock, tag code	Run year	Columbia River		Deschutes River			Total catch	Escapement to Wallowa Hatchery	Total
		Sport	Net	Sport	Indian	Trap			
Snake River:									
09 06 13	79-80	8	24	--	--	--	60[a]	82	142
	80-81	0	9	--	--	--	9	20	29
	81-82	0	2	0	0	0	2	0	2
09 16 36	79-80	0	0	--	--	--	0	5	5
	80-81	0	9	--	--	--	9	126	135
	81-82	0	17	8	3	0	28	59	87
	82-83	0	4	0	0	0	4	3	7
07 16 14	81-82	0	5	6	0	0	11	36	47
	82-83	0	12	7	0	1	20	123	143
	83-84	0	0	0	0	1	1	0	1
Pahsimeroi:									
07 22 01	81-82	3	0	0	0	1	4	4	8
	82-83	0	2	2	0	1	5	19	24
	83-84	0	3	0	0	0	3	0	3
	83-84	0	0	0	0	1	1	1	2
07 22 02	82-83	13	2	0	0	2	17	71	88
	83-84	0	23	0	8	5	36	38	74
Wallowa:									
07 16 27	82-83	0	0	0	0	1	1	4	5
	83-84	4	3	6	8	0	21	6	27

[a] *Includes 26 fish recovered in British Columbia northern net fishery and 2 recovered at Warm Springs Hatchery.*

Table 17. Vital statistics for coded-wire tagged adult summer steelhead that were reared at Wallowa Hatchery, marked Ad+CWT, and released at Wallowa Hatchery from 1978-1981. Age composition is expressed as years spent in the ocean, survival rate is expressed as the percentage of smolts released that were caught and that escaped to Wallowa Hatchery.

Stock, tag code	Age composition (%)			Survival rate (%)	Exploitation rate (%)	Residualism[a] rate (%)	Sex ratio F:M
	1-salt	2-salt	3-salt				
Snake River:							
09 06 13	84.0	16.0	0	0.26	41.0	4.0	2.6:1
09 16 36[b]	41.7	58.3	0	0.07	7.7	20.0	3.0:1
09 16 36[c]	67.4	30.9	1.7	0.33	18.1	1.7	4.3:1
07 16 14[b]	0	33.3	66.7	0.05	22.2	0	(d)
07 16 14[c]	22.3	77.7	0	0.59	19.1	0	15.9:1
Pahsimeroi:							
07 22 01	18.1	81.9	0	0.14	35.1	4.5	2.7:1
07 22 02	66.1	33.9	0	0.29	32.7	0.9	2.3:1
Wallowa:							
07 16 27	90.0	10.0	0	0.07	68.8	50.0	1.0:1

[a] *Percentage of returning adults that remained in freshwater one additional year after release and before seaward migration.*
[b] *Smolts released after one year of rearing.*
[c] *Smolts released after two years of rearing.*
[d] *No males returned.*

Eighty-one percent were diagnosed with fluorescent antibody detection methods as positive for bacterial kidney disease (BKD). The BKD infected fish showed gross visual signs of bacterial infection. This group of fish had received two treatments of medicated feed, (4.5% Gallimycin, 2% of body weight per day for 21 days) prior to release. BKD was probably present in low levels when the fish were released. We believe the severely crowded conditions in Big Canyon Creek, limited food availability, and cold water conditions through the fall, winter, and spring were the primary reasons why these fish were so heavily infected with bacterial kidney disease in the spring.

Apparently we cannot expect the Carson stock spring chinook salmon, which have been artificially propagated for many years, to migrate out of tributary streams during late summer and fall. Future releases of pre-smolts in the summer and fall should be made so that the fish are distributed throughout the rearing areas in the mainstem and in tributary streams. This will insure that the fish are not subjected to crowded conditions while rearing in the natural habitat through the fall and winter.

The spring chinook salmon production program during this report period was complex. A variety of rearing-release strategies, which included incubation and early rearing at Oxbow Hatchery, at Irrigon Hatchery, and at Lookingglass Hatchery were used. The 1,567,086 smolts of the 1983 brood that were released into the Grande Ronde River from Lookingglass Hatchery exceeded the smolt mitigation goal of 900,000. These releases represent the first successful major production releases from Lookingglass Hatchery. The 115,830 1983 brood Imnaha chinook salmon reared at Lookingglass and released into the Imnaha River was below the mitigation goal of 490,000. Because the egg needs for the Grande Ronde program were not met at Lookingglass Hatchery in 1983 or 1984, we acquired Carson stock spring chinook salmon eggs from Carson National Fish Hatchery and from ODFW hatcheries in the Willamette system. In 1985 we will obtain eggs from Rapid River Hatchery in Idaho. We will gradually switch the broodstock for the Grande Ronde program from Carson stock to Rapid River stock as eggs are available. Carson stock will continue to serve as a backup to the Lookingglass broodstock and to the Rapid River stock. We anticipate that a complete switch from Carson stock to Rapid River stock could occur as early as 1989.

A majority of the 1983 brood of summer steelhead smolts released in the Grande Ronde basin were reared at the Lyons Ferry Hatchery of the Washington Department of Game. We began rearing summer steelhead at ODFW's new Irrigon Hatchery in November 1984.

The number of smolts released in the Grande Ronde and Imnaha rivers in 1984 and 1985 was below the mitigation goals. The disease monitoring program revealed the presence of viral erythrocytic necrosis-like (VEN) inclusions in the Carson stock spring chinook salmon at Lookingglass Hatchery. The significance of this finding is unknown at this time. No infectious pancreatic necrosis virus or infectious hematopoietic virus was found in ovarian, sperm, or tissue samples from 1984 brood Imnaha spring chinook salmon and summer steelhead, Wallowa stock summer steelhead, and Lookingglass spring chinook salmon.

Adult returns to Lookingglass Hatchery and the Imnaha River trap were far below those needed to meet egg take needs. The weir on the Imnaha River was not

installed until 8 August because of high water conditions, and many fish passed upstream before the weir was installed. Management biologists counted 121 redds above the weir on spawning ground surveys in 1984 (Witty 1984). In each of the three years that we have operated the weir, 1982-84, substantial numbers of fish have passed above the weir and spawned. We will continue to have problems meeting our egg take needs at the Imnaha facility until we develop a weir that can be installed prior to the beginning of the adult migration.

At present we collect broodstock for our hatchery program from the latest part of the run in the Imnaha River, and we are removing this component of the run from the wild population. A weir designed so that it can be installed during the high runoff period the first of June is essential. This would enable us to develop the hatchery broodstock with a run timing similar to that of the wild fish.

The coded-wire tagging program that was conducted at Wallowa Hatchery from 1976 through 1981 was designed to evaluate stocks of summer steelhead and to provide some basic information on catch and escapement. This program began under the Columbia River Evaluation study sponsored by the Pacific Northwest Regional Commission. No adult return information was evaluated in the past. Little consistency among the marked groups in age composition at return, survival rates, exploitation rates, and residualism rates is apparent *(see* Table 15,), which is expected, because few variables were held constant from one year to the next. The size at release, time of release, rearing history, and stock origin varied among marked groups. Sample sizes of recoveries were generally small and that further contributed to the variability.

Even with all the inconsistencies, some general trends are apparent. For those brood years where fish were released as both 1-year and as 2-year smolts, the 2-year smolts consistently survived at a better rate and produced a greater percentage of 1-salt adults. This may be attributable to the larger size at release.

Based on Ad+CWT returns, the exploitation rates for Wallowa Hatchery steelhead ranged from 7.7% to 66.8%. These estimates are considered low because harvest estimates were not made for Snake River sport fisheries during the years that these marked fish returned. With additional fisheries occurring on the mainstem Columbia River and in the Grande Ronde River we can expect an increase in the exploitation rates of the Wallowa stock summer steelhead. We will determine the exploitation rates for Imnaha and Wallowa stock summer steelhead annually beginning with the 1985 brood.

Survival rates for marked steelhead of the 1976-80 brood years were poor. To achieve adult compensation goals for summer steelhead the smolt to adult return rate to the area above Lower Granite Dam must equal 0.69%. Although we do not have estimates of return rates to Lower Granite Dam for marked groups of the 1976-80 brood years, the only brood year that could have attained this rate, based on the return rate to the hatchery was the 1978 brood (0.49% return). All other marked groups returned at rates ranging from 0.03% to 0.27%. The new hatchery at Irrigon and the expansion of Wallowa Hatchery should enable us to consistently produce larger (5-6/lb) and healthier smolts than have been produced in the past.

EVALUATION OF THE BENEFITS PROVIDED BY RELEASING SPRING CHINOOK SALMON PRESMOLTS IN THE GRANDE RONDE RIVER AND ITS TRIBUTARIES

Introduction

Surplus spring chinook salmon eggs are taken each year to cover unanticipated losses at Lookingglass Hatchery. This will assure that the total spring chinook salmon production under the LSRCP is achieved. In 1983 the surplus produced 1.1 million Carson spring chinook salmon in excess of the rearing capacity at Lookingglass Hatchery. These fish were released as presmolts in the Grande Ronde River basin during the spring and summer of 1984. Representative groups of presmolts were marked (Ad+CWT) for evaluation.

Study Goals

Our goals are: 1) to assess the use of presmolts as a means of restoring spring chinook runs and 2) to determine their adult contribution to the Grande Ronde Basin.

Objectives and Tasks

Objective 1: Determine the survival to adult (catch plus escapement) of 1.1 million 1983 brood Carson spring chinook salmon presmolts released in the Grande Ronde River and its tributaries.

Task 1.1: Mark Ad+CWT 2 groups of 100,000 (replicate tag codes of 50,000 for each group) spring chinook salmon juveniles at Lookingglass Hatchery by 1 July 1984.

Task 1.2: Monitor growth, condition, and size and maintain a disease profile until release.

Objective 2: Complete a five-year study plan to evaluate the benefits of releasing spring chinook salmon presmolts in the Grande Ronde River and its tributaries.

Methods

Groups of marked presmolts were released in Lookingglass Creek and in the upper Grande Ronde River. Marked adults that return from fish released in Lookingglass Creek will be trapped at Lookingglass Hatchery. Adult contributions for the entire release will be estimated from catch and escapement of marked fish. Numbers, size, location, and date of release was documented for each release group. Disease was monitored by the ODFW pathology staff.

Results and Discussion

A total of 1,128,677 presmolts was released between 16 May and 13 July 1984. These fish were progeny of Carson spring chinook salmon spawned at the ODFW Willamette River hatcheries and Carson National Fish Hatchery. Two groups of 50,000 marked fish were released in Lookingglass Creek and two groups of 50,000 marked fish were released in the upper Grande Ronde River. Release information for coded-wire tagged presmolts was presented in Table 1, (tag codes 07 30 01, 07 30 02, 07 30 03, 07 30 04). No disease was detected in these fish

prior to or at the time of release. However, fish from the same group of eggs, which were reared to smolts, were diagnosed as having low levels of bacterial kidney disease and VEN-like blood inclusions. The significance of the VEN is unknown at this time.

Test dipping in a gatewell at Lower Granite Dam was conducted by biologists of the United States Army Corps of Engineers from 14 August to 28 September 1984 (John Ferguson, United States Army Corps of Engineers, Walla Walla, Washington, unpublished data 1984), to determine the extent of fall migration of spring chinook salmon in the Snake River. Twelve adipose marked spring chinook salmon were killed and the coded-wire tags were decoded. Eleven of the marked fish were presmolts that were released in Lookingglass Creek on 13 July 1984. The mean fork length of this group of fish at release was 81 mm (range 68-96 mm). The mean fork length of the 11 marked presmolts that passed the dam was 152 mm (range 140-173 mm) indicating a minimum growth rate of 0.8 mm/day and a mean growth rate of 1.1 mm/day following release.

The presmolts released in Lookingglass Creek that migrated past Lower Granite Dam showed rapid growth following release. Some of these fish reached smolt size and migrated down the Snake River in the fall. Presmolt releases were made to take advantage of the extensive rearing habitat in the mainstem of the Grande Ronde River. Releases were timed so fish would overwinter in the mainstem and begin seaward migration in the spring. Passage conditions on the Snake and Columbia rivers are poor in the fall, and so fall migrating smolts are not desirable. The percentage of presmolts that migrated in the fall is unknown; however, few fish passed Lower Granite Dam during the test sampling period. We believe that a large proportion of the presmolts remained in the Grande Ronde River over winter and migrated during the spring. We will be able to determine from adults that return in 1987 if the presmolt release strategy will provide adult returns to the basin. We will use scale analysis to separate returning adults into two groups -- those that were produced by fall migrants and those that were produced by spring migrants.

EVALUATION OF THE BENEFITS PROVIDED BY REPROGRAMMING SPRING CHNIOOK SALMON SMOLTS FROM LOWER COLUMBIA RIVER HATCHERIES

Introduction

State and federal agencies and Indian tribes are involved in reprogramming lower Columbia River hatcheries to produce salmon and steelhead for release in upriver areas. One-hundred fifty thousand 1983 brood Carson spring chinook salmon were reared at Oxbow Hatchery and released in the Grande Ronde basin in the fall of 1984. By 1987 more than 1 million hatchery smolts produced in the lower Columbia River could be available for release in northeastern Oregon streams. Smolts produced at lower Columbia River hatcheries will be released in LSRCP areas. We are evaluating the contribution of smolts that have been reprogrammed to LSRCP areas in order to determine if LSRCP hatcheries have met mitigation goals and to determine the effectiveness of releasing smolts, which have been reared at lower river hatcheries, in upriver areas.

Study Goal

Our goal is to separate adult contributions that result from releases of smolts produced at lower Columbia River hatcheries from adults that result from smolts produced at Oregon's LSRCP hatcheries.

Objectives and Tasks

Objective 1: Determine survival to adult (catch plus escapement) for spring chinook salmon smolts produced at lower Columbia River hatcheries and released in the Grande Ronde basin.

Task 1.1: Mark Ad+CWT 70,000 (replicate tag codes of 35,000) juvenile spring chinook salmon at Oxbow Hatchery.

Task 1.2: Monitor growth, condition, and size and maintain a disease profile until release.

Task 1.3: Transport the fish to Lookingglass Hatchery and release in September 1984 after a short acclimation period.

Objective 2: Complete a five-year study plan to evaluate the benefits of reprogramming lower Columbia River hatcheries.

Methods

We marked two groups of spring chinook salmon at Oxbow Hatchery in May. Marked fish were transported with 80,000 unmarked fish to Lookingglass Hatchery in September and were acclimated for two weeks before release. Numbers, size at release, and date of release was documented, and incidence of disease was monitored by the ODFW pathology staff.

Results and Discussion

A total of 148,544 reprogrammed smolts were released at Lookingglass Hatchery on 29 September 1984. Included in this release were 70,213 Ad+CWT marked fish. Release information for Ad+CWT marked fish was presented in Table 1 (tag codes 07 31 49 and 07 31 50). No disease was detected during the rearing period.

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