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SUMMARY

EVALUATION OF LOWER SNAKE RIVER COMPENSATION PLAN FACILITIES IN OREGON

Objectives for FY 1986

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

2. Determine fin condition, degree of descaling, degree of smolting, and percent precocious males for Wallowa and Imnaha stock summer steelhead.

3. Document number, size, time, and location of releases for chinook salmon and summer steelhead produced at LSRCP facilities.

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

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

6. Mark Ad-LV+CWT two separate groups of 60,000 (each group having replicate codes of 30,000) and freeze brand two separate groups of 30,000 (each group having replicate brands of 15,000) Wallowa stock summer steelhead and mark Ad-LV+CWT one group of 60,000 (replicate codes of 30,000) and freeze brand 30,000 (replicate brands of 15,000) Imnaha stock summer steelhead.

7. Collect and decode coded-wire tags from marked adults that return to adult collection facilities.

8. Mark Ad+CWT three separate groups of 100,000 (each group having replicate codes of 50,000) and freeze brand two separate groups of 40,000 (each group having replicates of 20,000) Carson stock chinook salmon, and mark Ad-LV+CWT 40,000 Lookingglass stock and 35,000 Imnaha stock chinook salmon. Release marked Carson stock in September, November, and April for time-of-release comparisons.

9. Estimate total number of summer steelhead in the 1984-85 run-year and total number of chinook salmon adults in 1985 run that were produced from smolts released at LSRCP hatcheries.

10. Complete design and construction of a six-station marking trailer.

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

12. Develop production reports for Imnaha and Grande Ronde river spring chinook salmon to benefit the *U.S. v. Oregon* management negotiations.

13. Complete a five-year study plan.

14. Develop creel survey and data analysis techniques and conduct creel surveys to estimate steelhead catch rate and effort for the Grande Ronde, Wallowa, and Imnaha rivers.

Accomplishments in FY 1986

We accomplished all of our original tasks for this report period. In addition, we developed creel survey techniques and conducted creel surveys on the Grande Ronde, Wallowa, and Imnaha rivers during the peak fishing periods. Consumptive fisheries for adipose-marked summer steelhead were opened in the Imnaha River on 15 September 1985 and on the Wallowa and Grande Ronde rivers on 1 January 1986. Creel surveys were conducted to provide harvest information needed to evaluate the effectiveness of meeting adult mitigation goals. We completed construction of a six-station marking trailer.

Findings in FY 1986

A total of 271 female, 166 male, and 10 jack spring chinook salmon returned to Lookingglass Hatchery in 1985. We spawned 255 females and collected 981,684 eggs. We collected 43 females, 76 males, and 45 jacks at the Imnaha River weir. Fourteen of the 45 jacks were hatchery fish that returned from the first release of hatchery smolts in 1984. We spawned 32 females and collected 162,481 eggs from Imnaha chinook salmon. We received 497,530 1985-brood eggs from Rapid River Hatchery in Idaho. Prespawning mortality was 5.3% at Lookingglass Hatchery and 30.5% at the Imnaha weir. Egg-to-smolt survival rate for 1984-brood Lookingglass, Imnaha, and Carson stock chinook salmon reared at Lookingglass Hatchery was 76.5%, 67.4%, and 95.5%, respectively.

The age composition of chinook salmon that returned to Lookingglass Hatchery was 2.2% age 3_2, 95.8% age 4_2, and 2.0% age 5_2. The age composition of wild chinook salmon trapped on the Imnaha River was 18.8% age 3_2, 64.1% age 4_2, 16.2% age 5_2, and 0.9% age 6_2. All hatchery chinook salmon that returned to the Imnaha weir were age 3_2 males.

Infectious hematopoeitic necrosis virus (IHNV) was isolated from Lookingglass chinook salmon adults for the first time in 1985. IHNV was also isolated from adults used for broodstock at Rapid River Hatchery. Viral erythrocytic necrosis (VEN) was detected in the 1984-brood Carson stock chinook salmon at Lookingglass Hatchery in November 1985. The VEN-infected fish suffered chronic cold water disease and three ponds of fish were held for one additional month past the scheduled release date.

A total of 325 female and 181 male summer steelhead returned to Wallowa Hatchery in 1985. We spawned 318 females and collected 1,571,535 eggs. At Little Sheep Creek weir we trapped 123 wild females, 40 wild males, 26 hatchery females, and 26 hatchery males. We spawned 94 females and collected 425,844 eggs. Prespawning mortality was 13.9% at Wallowa Hatchery

and 36.5% at Little Sheep Creek weir. Egg-to-smolt survival rate for the 1985-brood Wallowa stock and Imnaha stock summer steelhead, not including abnormal losses because of a power outage and an incidence of chlorine contamination, was 63.9% and 49.1%, respectively. The age composition of summer steelhead that returned to Wallowa Hatchery in 1985 was 59.6% 1-salt, 38.9% 2-salt, and 1.5% 3-salt. One-salt fish and two-salt fish each composed 50% of the wild steelhead trapped at Little Sheep Creek. All 30 of the hatchery summer steelhead trapped at Little Sheep Creek were 1-salt fish.

IHNV was isolated from adult summer steelhead at Little Sheep Creek weir and Wallowa Hatchery for the first time in 1985. We destroyed 155,392 eggs at Little Sheep Creek weir and 52,800 eggs at Wallowa Hatchery because of the presence of IHNV.

We estimated that the total adult production of Wallowa stock hatchery steelhead in the 1984-85 run years was 1,604. This included 344 fish that were harvested in the Columbia River net and sport fisheries, 104 that were harvested in Deschutes River fisheries, 3 that were harvested in the Snake River sport fishery below Lower Granite Dam, and 1,153 that passed Lower Granite Dam. We estimated that the total adult production of Imnaha hatchery steelhead in the 1984-85 run year was 165. This included 35 fish that were harvested in the Columbia River net and sport fisheries, 11 that were harvested in Deschutes River fisheries, and 119 that passed Lower Granite Dam.

We estimated that LSRCP releases produced 452 adult chinook salmon that returned to Lookingglass Hatchery and an estimated 22 that were harvested in Columbia River sport, net, test, subsistence, and ceremonial fisheries.

The first returns of marked hatchery chinook salmon to the Grande Ronde basin occurred in 1985 as 3-year-old fish. We conducted carcass surveys, in cooperation with ODFW management personnel, from 28 to 30 August 1985 on the Minam River and on 4 September 1985 on the Wenaha River. No marked fish were found.

We estimated that the adult chinook salmon escapement to the Grande Ronde Basin ranged from 477 to 998 between 1979 and 1984 and that adult escapement of 6,116 is needed to fully seed available habitat in the mainstem Grande Ronde and tributaries that are managed as wild plus hatchery. To achieve the adult escapement level needed to fully seed available habitat, extensive hatchery supplementation is needed on an annual basis.

We estimated that adult chinook salmon escapement into the Imnaha River ranged from 130 to 415 between 1979 and 1984 and that an adult escapement of 4,768 is needed to fully seed available habitat. Extensive hatchery supplementation on an annual basis is needed to achieve the escapement level needed for full seeding.

We estimated for the Grande Ronde River that 580 anglers fished 2,226 hours during October and November and caught and released 289 steelhead. On the Wallowa River, 2,385 anglers fished 9,340 hours during February and March. They caught and released 1,331 unmarked steelhead and caught and

kept 2 marked steelhead. Catch rates were good throughout the season on the Grande Ronde and Wallowa rivers. On the Imnaha River, 682 anglers fished 2,528 hours during October and November 1985 and March 1986. They caught and released 153 unmarked steelhead and caught and kept 18 marked steelhead. Fishing was poor in the fall and most of the catch occurred in the spring.

Management Implications

1. The numbers of chinook salmon scheduled for release at Lookingglass Hatchery (400,000) may have to be increased to meet broodstock needs if return rates remain at >0.1%. This would cause a corresponding decrease in numbers scheduled for off-station releases.

2. Escapement needs to Wallowa Hatchery and Little Sheep Creek weir are greater than originally planned because of poor egg survival and the presence of IHNV in the broodstock.

3. High angling pressure and good catch rates on the Wallowa River during the spring steelhead fishery indicates that the potential for extensive harvest of hatchery fish exists in this fishery.

4. We will continue to develop hatchery broodstock for the Imnaha chinook salmon program from the latest returning adults until the permanent weir is installed in 1987.

5. Catches of marked steelhead in the Imnaha River indicate that straying occurs. All marked fish were out-of-system strays.

6. We have switched the preferred chinook salmon for the Grande Ronde River from Carson broodstock to Rapid River broodstock. If adequate eggs are available from the Rapid River stock, no Carson stock eggs will be needed in the future.

Recommendations

1. Continue multiple release times for chinook salmom to (1) take advantage of available rearing habitat in the Grande Ronde River, (2) make the most efficient use of rearing space at Lookingglass Hatchery, and (3) define optimum time of release.

2. Develop broodstock management guidelines and plans for Little Sheep Creek steelhead and Imnaha River chinook salmon that will ensure persistence of the wild native populations. These guidelines should address (1) the number of wild and hatchery adults to be passed above the weir and the numbers to be spawned, (2) the importance of maintaining the diverse genetic characteristics of the wild populations, (3) consistency with guidelines developed in statewide species plans.

3. Conduct experiments at Irrigon Hatchery to determine if virus-free smolts can be produced from IHNV-positive parents with incubation and early rearing in virus-free water.

4. Mark all Rapid River stock chinook salmon smolts at Lookingglass Hatchery to permit distinct identification of adult broodstocks.

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

Objective for FY 1986

Mark Ad+CWT 100,000 (replicate codes of 50,000) Carson stock chinook salmon presmolts at Lookingglass Hatchery and release marked fish in Lookingglass Creek.

Accomplishments in FY 1986

The objective was accomplished.

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

Objective for FY 1986

Mark Ad+CWT 100,000 (replicate codes of 50,000) Carson stock chinook salmon at Bonneville and release fish at Lookingglass Hatchery in the spring.

Accomplishments in FY 1986

The objective was accomplished.

GENERAL INTRODUCTION

The Lower Snake River Compensation Plan (LSRCP) in Oregon was developed to compensate for losses of spring chinook salmon *Oncorhynchus tschawytscha* and summer steelhead *Salmo gairdneri* in the Grande Ronde River and Imnaha River basins as a result of construction of the four lower Snake River dams. Lookingglass Hatchery has been in operation since 1982. New facilities at Irrigon to hatch and rear summer steelhead and at Wallowa Hatchery to trap and spawn summer steelhead were completed in early 1986. Construction of satellite facilities for advanced rearing and adult recapture at Big Canyon Creek is scheduled to begin in summer of 1986 and at Little Sheep Creek and the Imnaha River in 1987 (Figure 1). Detailed descriptions of all fish production facilities and production programs are presented in the five-year study plan (Carmichael 1986).

Oregon's mitigation goals for adult salmonids are 5,813 spring chinook salmon and 9,184 summer steelhead for the Grande Ronde River basin and 3,159 spring chinook salmon and 2,000 summer steelhead for the Imnaha River basin. We are evaluating the production and return of chinook salmon and summer steelhead to ensure that smolt and adult mitigation goals are achieved and that the long term objectives of the LSRCP (Carmichael and Wagner 1983) are accomplished. Three projects were conducted under the

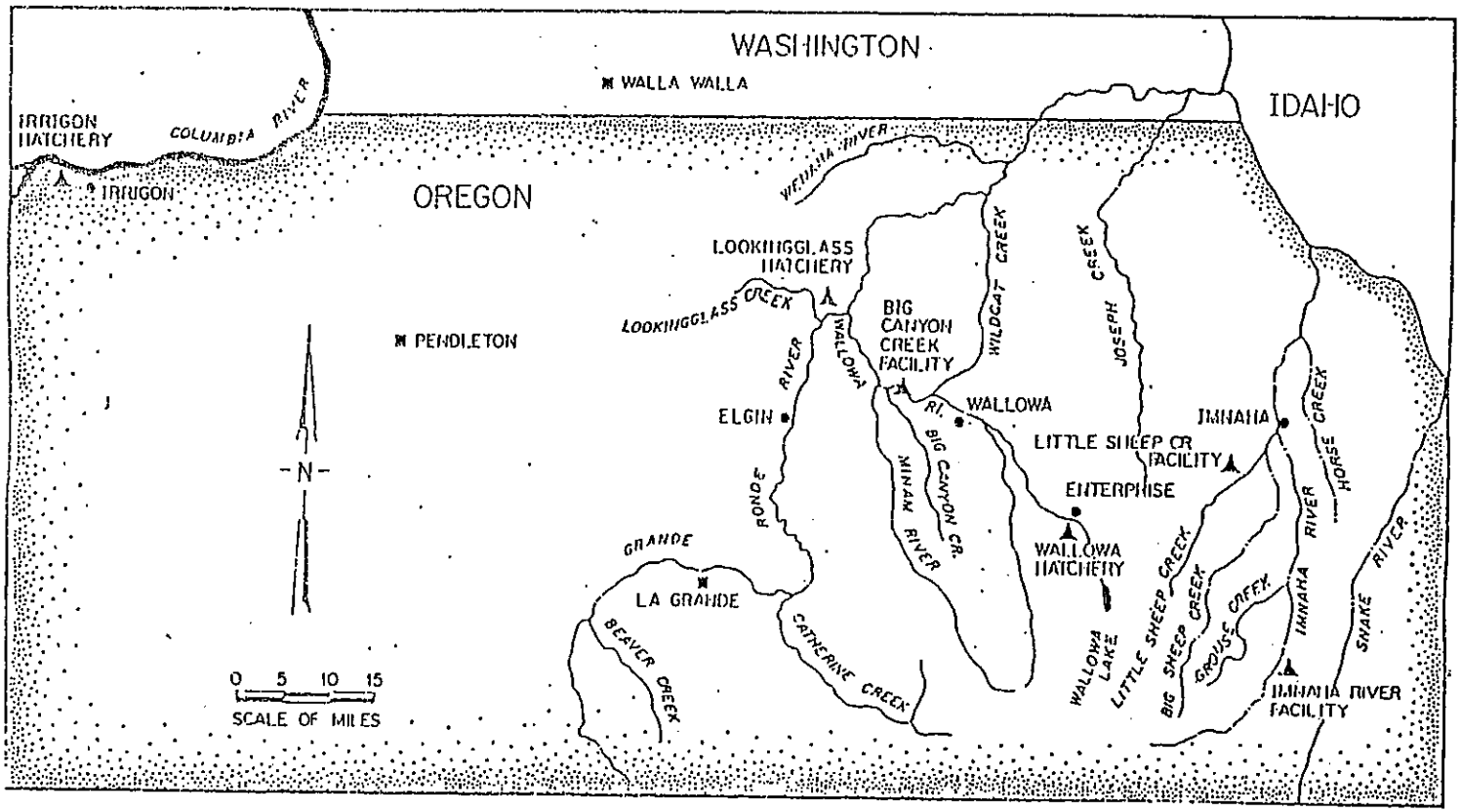

Figure 1. Map of northeastern Oregon showing the Grande Ronde and Imnaha river systems and the location of Lower Snake River Compensation Plan facilities.

LSRCP-Oregon Evaluation Studies 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, and (3) Evaluation of the Benefits Provided by Reprogramming Spring Chinook Salmon from Lower Columbia River Hatcheries. In this report we present a summary of our activities under all three projects for the period 1 April 1985 through 31 March 1986. Future annual reports will cover the period 1 July through 30 June.

EVALUATION OF LOWER SNAKE RIVER COMPENSATION PLAN FACILITIES IN OREGON

Introduction

The Evaluation of LSRCP Facilities in Oregon began in the fall of 1983. The goals of the project are (1) to develop and recommend hatchery practices for LSRCP facilities that will meet mitigation requirements and management objectives and (2) to evaluate the success of achieving the long term objectives of the LSRCP. We provide hatchery managers and fishery managers information that is used in production planning, basin planning, and harvest management.

Work conducted during this report period encompassed five major areas of study: fish culture monitoring; survival studies; straying study; planning; and creel surveys. The long-term objectives for this project are outlined in a five-year study plan (Carmichael 1986), and the objectives and tasks for this report period are presented in the 1985-86 project proposal and in the summary section of this report. Work conducted under fish culture monitoring and survival studies was a continuation of ongoing work started in 1984. We became involved in planning through the *U.S.* v. *Oregon* management negotiations. Staff members prepared production reports for spring chinook salmon in the Grande Ronde River and Imnaha River basins to provide information that was requested to determine production capacities and supplementation needs and strategies. We did not originally plan to conduct steelhead creel surveys until the fall of 1986; however, the Oregon Fish and Wildlife Commission authorized comsumptive fisheries for hatchery steelhead to begin on 15 September 1986 on the Imnaha River and on 1 January 1986 on the Grande Ronde and Wallowa rivers. We added creel surveys to our original work plan because estimates of the number of steelhead harvested annually in the Grande Ronde River and Imnaha River basins are needed to determine if adult mitigation goals are achieved.

Methods

Fish Culture Monitoring

Methods are described in the 1985 annual report (Carmichael and Messmer 1985) and in the five-year study plan (Carmichael 1986). Pathological examinations were conducted by ODFW pathology staff.

Survival Studies

Replicate groups of 1983 brood Carson stock chinook salmon were marked Ad+CWT and released during September and November 1985 and in April 1986 to identify the optimum time of release. We released replicate groups of cold-branded fish during September and April. Branded fish were recovered as migrant smolts at various collection sites in the Snake and Columbia rivers. Imnaha chinook salmon were marked Ad+CWT at Lookingglass Hatchery and were acclimated at the temporary holding pond on the Imnaha for a short period prior to release in March 1986. Imnaha and Wallowa stock summer steelhead were marked Ad-LV+CWT and cold branded for size-at-release comparisons and survival evaluation.

LSRCP adult mitigation goals were stated as the number of adults that passed above Lower Granite Dam. To evaluate mitigation success we want to be able to estimate escapement to Lower Granite Dam. We were able to make an estimate for summer steelhead in 1984-85, but not for chinook salmon. To estimate the total harvest of chinook salmon in 1985 that resulted from smolts produced at Lookingglass Hatchery (C_{LG}), we used the equation

$$C_{LG} = [(C_b + C_a)/(E_{BD} - C_a)]\ (E_{LG})$$

where

C_b = catch below Bonneville Dam,

C_a = catch above Bonneville Dam,

E_{BD} = count at Bonneville Dam, and

E_{LG} = count at Lookingglass Hatchery.

In future years we will use catch and escapement of marked fish to estimate total production; however, in 1985 no marked Imnaha or Lookingglass chinook salmon were available in the ocean or in-river fisheries. The first Imnaha stock hatchery adults and the first marked Lookingglass Hatchery adults will return in 1986. Estimated escapement of upriver bound spring chinook salmon was 92,541 (ODFW and WDF 1985) and the estimated catch was 4,197 (0.045 catch/escapement ratio) (Bowers and King 1986). We were unable to estimate ocean harvest. Total adult production was determined by summing escapement to Lookingglass Hatchery plus catch in the Columbia River.

At the request of the Washington Department of Game, the National Marine Fisheries Service monitored the number of branded-CWT Wallowa Hatchery steelhead adults that passed Lower Granite Dam for the 1984-85 run year. All of the one salt coded-wire tagged steelhead (codes 63-28-39 and 62-28-40) destined for Wallowa Hatchery carried either an RA-S-1 or RA-S-2 brand. We estimated adult survival from Lower Granite Dam to Wallowa Hatchery (S) based on the number of branded-CWT fish that passed Lower Granite Dam and the number of branded-CWT fish that returned to Wallowa Hatchery as follows:

$$S = \frac{N_{WA}}{N_{GD}}$$

N_{GD} = Number of branded-CWT Wallowa Hatchery adults that were observed at Lower Granite Dam.

N_{WA} = Number of branded-CWT adults that returned to Wallowa Hatchery.

We back calculated total number of adults that passed Lower Granite Dam for both the Wallowa and for the Imnaha stock hatchery steelhead based on escapement to the facilities and the survival rate. We believe the survival rate calculated for Lower Granite to Wallowa Hatchery is an overestimate of the actual rate because the trapping efficiency at Lower Granite Dam is less than 100% and because some coded-wire tagged steelhead undoubtedly had unreadable brands when they passed Lower Granite Dam.

We used catch/escapement ratios developed from groups of marked Wallowa stock summer steelhead to estimate catch of Imnaha and Wallowa Hatchery fish in the Columbia River and Deschutes River fisheries. A total of 106 marked fish were caught in the Columbia River, 32 marked fish were caught in the Deschutes River, and 155 escaped to Wallowa Hatchery. The fisheries recovery estimates are based on expanded recoveries. We estimated Snake River sport catch of Wallowa and Imnaha stock steelhead from the catch/escapement ratio for the Snake River below Lower Granite Dam. Sport catch in the Snake River below Lower Granite Dam in the 1984-85 run year was 285 fish (Mendel and Aufforth 1985) and escapement into the Snake River was 100,623 fish. Total adult production for each stock was determined by summing escapement passed Lower Granite Dam plus catch in the Columbia River sport and net fisheries, Deschutes River sport and tribal fisheries, and Snake River fishery below Lower Granite Dam.

Straying Study

We conducted spawning ground surveys cooperatively with ODFW management biologists on the Minam River from 28 to 30 August 1985 and on the Wenaha River on 4 September 1985. We examined all carcasses for fin marks and had planned to recover snouts from fish with coded-wire tags. However, no hatchery fish were found.

Planning

We reviewed available literature and methods to develop the most appropriate approach for determining smolt production capabilities and adult escapement needs for chinook salmon in the Grande Ronde and Imnaha basins. We used historical spawning survey data as a baseline for determining production capabilities and escapement needs for each chinook salmon stream in each basin. We estimated the annual escapement to each basin for the years 1979-84 to establish the present population status.

Smolt production capacities and annual escapement needs were derived using the maximum number of redds that had ever been observed; average fecundity estimates, egg-to-smolt survival rates, and smolt-to-adult survival rates. Annual hatchery supplementation needs were developed for each basin based on annual adult escapement deficits. A detailed description of the methods used to calculate production capacities,

escapement needs, and supplementation needs is presented in the Grande Ronde and Imnaha spring chinook salmon production plans (Carmichael et al. 1986a and 1986b).

Creel Surveys

The creel survey on the Grande Ronde River was conducted during October and November 1985 from the Oregon-Washington state line (RM 38.8) to the bridge at Wildcat Creek (RM 53.5). Road access from Wildcat Creek to Minam Park on the Wallowa River is limited, and fishing pressure in the fall is concentrated in the 14.7 miles from the bridge to the state line. Two levels of stratification, day type and month, were used. Days were stratified as weekend-holiday or weekday. We selected 2-day sampling periods randomly in each month. Hours of effort for each sample day (H_i) were estimated by developing a pressure curve from periodic pressure counts and calculating area under the curve (AUC) as follows:

$$H_i = 1/2 \sum_{k-1}^{r} (T_k - T_{k-1})(C_k + C_{k-1})$$

where

r = number of pressure counts per day,

C_k = angler count at time k, and

T_k = time at the k^{th} count.

We assumed the fishing day started 1/2-hour before sunrise and ended 1/2-hour after sunset. Pressure counts were conducted every 2 hours beginning within 2 hours after the start of the fishing day.

Anglers were interviewed periodically throughout the day to obtain catch rate information. The catch per hour each day (R_i) was estimated as:

$$R_i = \sum_{k=1}^{m_i} f_{ij} / \sum_{j=1}^{m_i} h_{ij}$$

where

m_i = number of anglers interviewed on the i^{th} day,

f_{ij} = number of fish caught by the j^{th} angler on the i^{th} day, and

h_{ij} = number of hours/fish by the j^{th} angler on the i_{th} day.

Then total daily catch (TC_i) was estimated by:

$$TC_i = (R_i)(H_i)$$

Total catch for a stratum within a month (TC) was determined by:

$$TC = (N/n) \sum_{i=1}^{n} TC_i$$

where

N = number of days in the stratum for the month, and
n = number of days sampled in the stratum.

The variance of catch V(TC) (Cochran 1977) for each stratum within each month was calculated as:

$$V(TC) = (N^2/n)(1-(n/N))(S_i^2) + (N/n)(\sum_{i=1}^{n} H_i^2/m_i)(1-(h_i/H_i))(S_{2i}^2)$$

where

$$S_i^2 = \sum_{i=1}^{n} (TC_i - \overline{TC})^2/(n-1),$$

$$S_{2i}^2 = \sum_{i=1}^{m_i} (f_{ij}/h_{ij} - R_i)^2/m_i-1, \text{ and}$$

$$\overline{TC} = \sum_{i=1}^{m_i} TC_i/n.$$

Total monthly catch and variance was determined by summing stratum totals and variances. Angler days were determined from total hours and the average length of an angler trip. Catch rate (CR), expressed in hours per fish, was calculated for each stratum within each month as follows:

$$CR = \sum_{i=1}^{n} H_i R_i / \sum_{i=1}^{n} H_i$$

Catch rates for combined monthly strata (CR_m) and total season (CR_s) were weighted by the proportion of total hours fished in each stratum, as follows:

$$CR_m = (CR_{wd})(\sum_{i=1}^{n} H_{i_{wd}}) \div (CR_{we})(\sum_{i=1}^{n} H_{i_{we}})/H_a$$

$$CR_s = (\sum_{a=1}^{n} H_a)(CR_a)/\sum_{a=1}^{n} H_a$$

where wd = weekday stratum,
we = weekend stratum,
H_a = total hours effort for combined strata sampled in the a^{th} month, and
CR_a = catch rate for the a^{th} month.

The Wallowa River survey was conducted during February and March 1986 from Minam State Park (RM 8.2) to the mouth of the Lostine River (RM 25.8). Sample days were selected randomly by stratum for each month. Pressure counts were conducted every three hours each sample day. Total catch and variance estimates were calculated as described for the Grande Ronde River survey.

We were able to make a complete census of catch and effort for the lower 11.0 miles of the Imnaha River on each sample day. Because there were no expansions required to estimate daily catch we used different data station located at Horse Creek, 11.0 river miles from the confluence of the Imnaha and Snake rivers. Although 12 miles of the river above the check station are open to fishing, river access in this area is limited. Historically most of the steelhead fishery occurred from Horse Creek downstream to the Snake River. All anglers were checked as they left the fishing area. At the end of each sampling day we drove downstream to the end of the road at Cow Creek and interviewed anglers that were camped and had not passed the check station.

Total daily catch for the Imnaha River was estimated by:

$$TC_i = \sum_{j=1}^{m_i} f_{ij}$$

where

m_i = number of anglers on the i^{th} day, and

f_{ij} = number of fish caught by the j^{th} angler on the i^{th} day.

Total catch for a stratum within a month was determined as described earlier.

Variance of total catch for a stratum was calculated as:

$$V(TC) = (N^2(N-n)/Nn)\left(\sum_{i=1}^{n} (TC_i-\overline{TC})^2/n-1\right)$$

Total monthly catch and variance was determined by summing stratum totals and variances.

Results

Fish Culture Monitoring

Results for chinook salmon are presented in Tables 1-6 and in Figures 2 and 3. Results for summer steelhead are presented in Tables 7-14. Results of pathological examinations are presented in Table 15.

Table 1. Egg take and survival of spring chinook salmon at Lookingglass and Irrigon hatcheries.

Stock, brood year	Number of eggs taken or received	Egg loss (%)	Egg-to-fry survival (%)	Egg-to-smolt survival (%)
Imnaha:				
1984	51,800	25.8	72.0	67.4
1985	162,481	22.0	75.5	(a)
Lookingglass:				
1984	62,396	12.7	84.5	76.5
1985	981,684	7.9[b]	91.7	(a)
Carson:				
1984	654,000	0.1	99.0	95.5
Rapid River:				
1985	497,520	14.3[c]	85.1	(a)

[a] *1985 brood smolts will be released in the spring of 1987.*
[b] *Estimate does not include the loss of 160,000 eggs that were destroyed because of the presence of IHNV in the parents.*
[c] *Estimate does not include the loss of 33,480 eggs that were destroyed because of the presence of IHNV in the parents.*

Eight life history patterns were identified from scale analysis of adult summer steelhead that returned to Wallowa Hatchery and to Little Sheep Creek weir in 1985 (Table 10). These 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.

2:3. Six-year-old fish; two years in freshwater before seaward migration and three years in the ocean.

Table 2. Release information for spring chinook salmon reared at Lookingglass Hatchery and released in the Grande Ronde River and Imnaha River basins, 1984 brood. Standard deviation is shown in parenthesis.

Stock, date released	Number released	Size (fish/lb)	Location released	N[a]	Mean fork length (mm)
Carson:					
07/19/85	104,800	32.0	Lookingglass Creek	204	108(0.1)
09/18/85	271,030	18.0-20.1	Lookingglass Creek	327	125(2.3)
09/18/85	102,424	29.5	Lookingglass Creek	382	107(0.1)
11/01/85	175,477	16.4-16.9	Lookingglass Creek	404	136(5.2)
11/01/85	102,520	23.3	Lookingglass Creek	201	120(0.6)
11/23/85	90,233	8.5-9.6	Lookingglass Creek	26[b]	158(3.5)
04/01/86	87,311	10.4-11.0	Lookingglass Creek	300	155(1.8)
04/01/86	100,072	10.4-10.8	Big Canyon Creek	300	155(1.8)
04/02/86	178,608	14.7-15.7	Lookingglass Creek	302	140(1.8)
04/02/86	49,694	8.8	Lookingglass Creek	300	157(4.0)
04/03/86	100,150	10.0-11.0	Catherine Creek	300	155(1.8)
Lookingglass:					
03/25/86	518	10.8	Imnaha River[c]		
04/01/86	47,190	15.6	Lookingglass Creek	300	131(2.6)
Imnaha:					
03/28/86	35,035	10.8	Imnaha River	404	150(7.6)

[a] *Samples are composed of replicate groups of approximately 100 fish.*
[b] *Samples are from mortalities remaining in pond after ice-up.*
[c] *Lookingglass stock mixed with Imnaha stock during 23 November ice-up.*

Table 3. Adult spring chinook salmon that returned to Lookingglass Hatchery and the Imnaha River weir, 1985.

Location, origin	Total number	Jacks	Males	Females	Number females spawned	Prespawning mortality (%)
Lookingglass Hatchery:						
Hatchery	452	10	172	270	252	4.4
Imnaha River:						
Wild	151	32	78	41	32	24.2[a]
Hatchery	14	14	0	0	0	(a)

[a] *Wild and hatchery fish were combined for prespawning mortality because hatchery records did not show origin of all mortalities.*

Table 4. Run timing for adult spring chinook salmon that returned to Lookingglass Hatchery and Imnaha River weir, 1985.

Time interval	Lookingglass Hatchery[a]		Imnaha weir[b]	
	Number	% of total	Number	% of total
14-20 May	3	0.7	--	--
21-27 May	0	0	--	--
28 May-03 June	49	11.0	--	--
04-10 June	223	50.0	--	--
11-17 June	60	13.5	--	--
18-24 June	0	0	--	--
25 June-01 July	57	12.8	--	--
02-08 July	13	2.9	--	--
09-15 July	8	1.8	0	0
16-22 July	0	0	33	18.8
23-29 July	4	0.9	14	8.0
30 July-05 August	0	0	0	0
06-12 August	0	0	17	9.7
13-19 August	6	1.3	22	12.6
20-26 August	0	0	37	21.1
27 August-02 September	14	3.1	29	16.6
03-09 September	9	2.0	22	12.6
10-16 September	0	0	1	0.6

[a] *Lookingglass trap operated from 13 May to 16 September 1985.*
[b] *Imnaha River weir operated from 9 July to 11 September 1985.*

Table 5. Mean fork length (mm) for age-specific groups of adult spring chinook salmon, 1985. Age nomenclature is that of Gilbert and Rich (1927). Standard deviation is shown in parenthesis.

Location, origin	Age 3_2 Males N	Age 3_2 Males Length	Age 3_2 Females N	Age 3_2 Females Length	Age 4_2 Males N	Age 4_2 Males Length	Age 4_2 Females N	Age 4_2 Females Length
Lookingglass Hatchery:								
Hatchery	10	544(25)	0	--	163	755(3)	264	737(3)
Imnaha River:								
Wild	22	580(8)	0	--	47	773(9)	28	810(6)
Hatchery	14	551(7)	0	--	0	--	0	--

Location, origin	Age 5_2 Males N	Age 5_2 Males Length	Age 5_2 Females N	Age 5_2 Females Length	Age 6_2 Males N	Age 6_2 Males Length	Age 6_2 Females N	Age 6_2 Females Length
Lookingglass Hatchery:								
Hatchery	4	985(19)	5	902(10)	0	--	0	--
Imnaha River:								
Wild	4	979(61)	15	924(9)	1	1,118	0	--
Hatchery	0	--	0	--	0	--	0	--

Table 6. Egg take and egg survival of Wallowa and Imnaha summer steelhead, 1985 brood. Mortality resulting from nonnormal factors was not included in the survival estimates.

Stock	Eggs taken	Egg Loss (%)	Egg-to-fry survival (%)	Egg-to-smolt survival (%)
Wallowa	1,571,536	20.2[a]	71.7[b]	63.9[c]
Imnaha	425,844	39.0[d]	56.0	49.1[e]

[a] *Estimate does not include the loss of 52,800 eggs that were destroyed because of the presence of IHNV in the parents.*
[b] *Estimate does not include the loss of 211,200 sac-fry that resulted from chlorine contamination at Irrigon Hatchery.*
[c] *Estimate does not include the loss of 421,399 Wallowa stock fingerlings that resulted from a power failure at Irrigon Hatchery.*
[d] *Estimate does not include the loss of 155,392 eggs that were destroyed because of the presence of IHNV in the parents.*
[e] *Estimate does not include the loss of 20,077 Imnaha stock fingerlings that resulted from a power failure at Irrigon Hatchery.*

Table 7. Release information for summer steelhead released in the Grande Ronde River and Imnaha River basins, 1984 brood. Standard deviation is shown in parenthesis.

Stock, hatchery of rearing	Date released	Number released	Size (fish/lb)	Location of release	N [a]	Mean fork length (mm)
Wallowa:						
Irrigon	03/01/85	15,690	6.0	Wallowa Hatchery	212	185(1.3)
Irrigon	04/29/85	346,334	5.9	Wallowa Hatchery	400	197(1.6)
Lyons Ferry	04/29/85	284,021	7.5	Wallowa Hatchery	509	186(1.5)
Lyons Ferry	04/25-26/85	96,040	7.8-8.8	Big Canyon Creek	300	172(0.9)
Imnaha:						
Irrigon	04/10/85	25,296	5.1	Little Sheep Creek	--	--
Irrigon	04/29-30/85	30,005	7.9-10.0	Little Sheep Creek	201	162(0.1)
Irrigon	04/30-05/01/85	23,924	4.9-5.0	Little Sheep Creek	202	203(2.4)

[a] *Samples are composed of replicate groups of approximately 100 fish.*

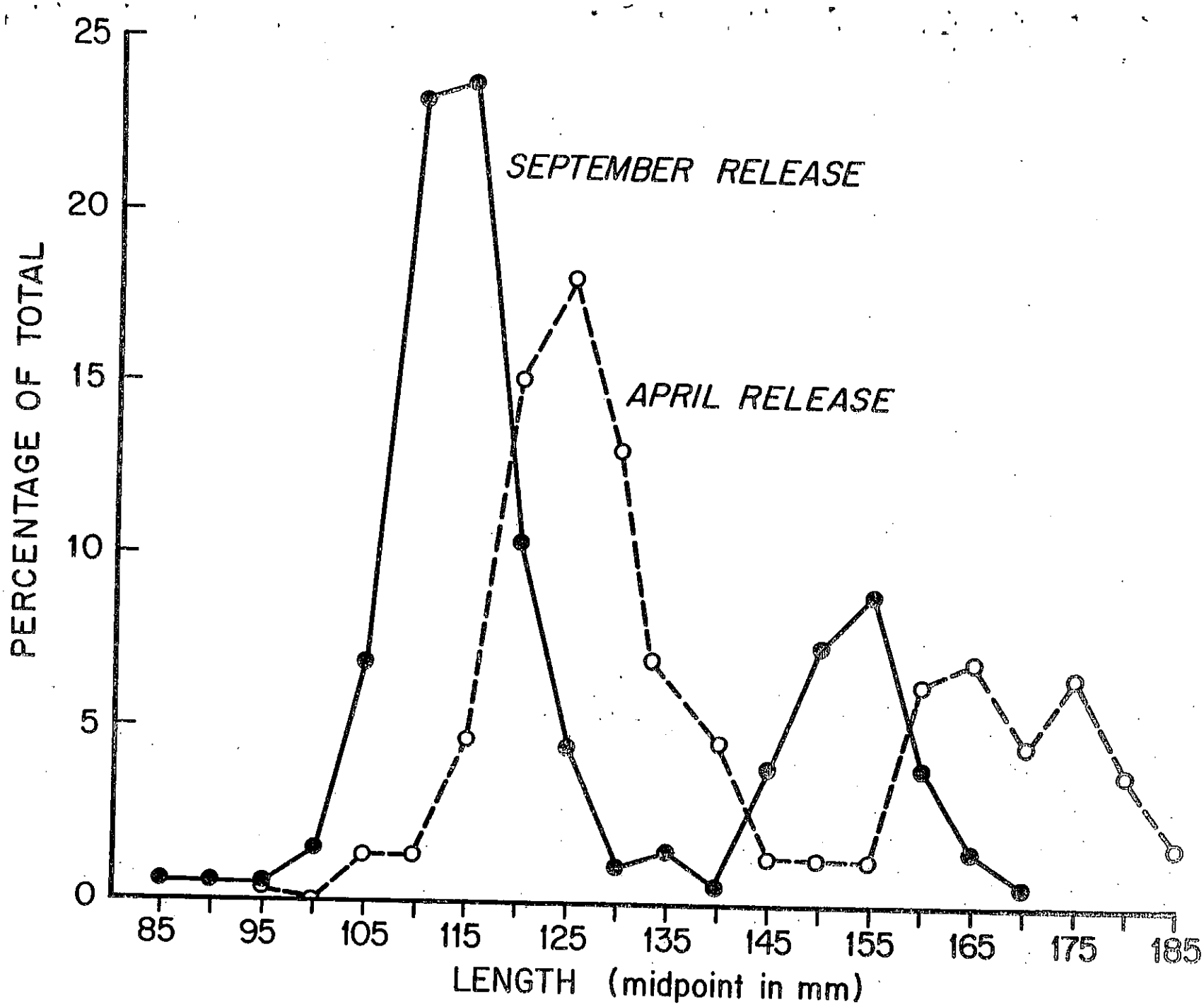

Figure 2. Length-frequency distributions of Carson stock spring chinook salmon released at Lookingglass Hatchery on 18 September 1985 at 19.2 fish/lb (n = 382) and on 2 April 1986 at 15.2 fish/lb (n = 302).

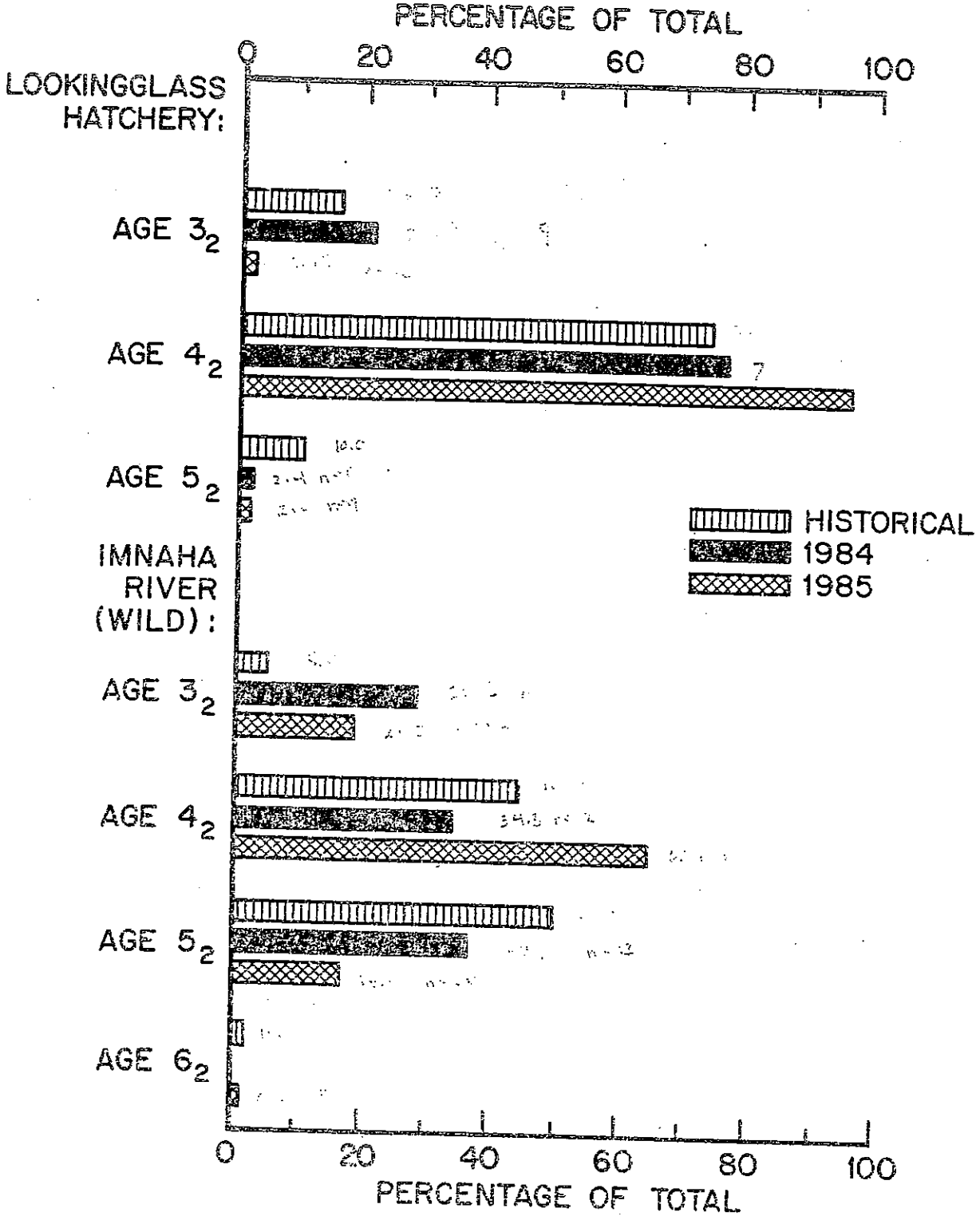

Figure 3. Age composition of chinook salmon that returned to Lookingglass Hatchery and to the Imnaha River, historical (wild), 1984, and 1985. Historical age composition for Lookingglass is the average of 1964-1970 (Burck 1966-1971; Mullarkey 1968) and historical age composition for the Imnaha is the average of 1961-1976 (Bennett 1975; ODFW unpublished data). Age nomenclature is that of Gilbert and Rich (1927).

Table 8. Numbers of adult summer steelhead that returned to Wallowa Hatchery and Little Sheep Creek weir, 1985.

Location, origin	Total number	Males	Females	Number of females spawned	% Prespawning mortality	
					Males	Females
Wallowa Hatchery:						
Hatchery fish	506	181	325	318	34.8	2.1
Little Sheep Creek weir:						
Wild fish	163	40[a]	123[b]	75	60.0	24.5
Hatchery fish	52	26[c]	26	19	80.8	26.9

[a] *Six wild males passed above the weir.*
[b] *Twenty-one wild females passed above the weir, and 2 wild females killed.*
[c] *One hatchery male passed above the weir.*

Table 9. Run timing for adult summer steelhead that returned to Wallowa Hatchery and the Little Sheep Creek weir, 1985.

Time interval	Wallowa Hatchery[a]		Little Sheep Creek weir[b]			
			Wild fish		Hatchery fish	
	Number	% of total	Number	% of total	Number	% of total
19-25 March	12	2.4	--	--	--	--
26 March-01 April	90	17.7	0	0	0	0
02-08 April	135	26.6	14	8.3	3	7.1
09-15 April	213	41.9	48	28.4	17	40.5
16-22 April	19	3.7	17	10.0	5	11.9
23-29 April	18	3.5	29	17.2	5	11.9
30 April-06 May	11	2.2	40	23.7	9	21.4
07-13 May	10	2.0	7	4.1	2	4.8
14-20 May	0	0	14	8.3	1	2.4
21-27 May	--	--	0	0	0	0
28 May	--	--	0	0	0	0

[a] *Wallowa Hatchery trap operated from 1 March to 20 May 1985.*
[b] *Little Sheep Creek weir operated from 1 April to 28 May 1985.*

Table 10. Percent age composition for adult summer steelhead, 1985.

Age group, number	Wallowa Hatchery[a]		Wild fish		Hatchery fish	
	Male	Female	Male	Female	Male	Female
1:1 3	24.4	17.7	0	0	25.9	74.1
1:2 4	7.7	36.7	0	4.0	0	0
1:3 5	0.2	1.4				
2:1 4	1.2	3.2	5.4	41.9	0	0
2:2 5	0.8	5.9	0	44.6	0	0
2:3 6	0	0.2	0	0		
3:1 5	0.4	0	0	2.7	0	0
3:2 6	0	0.2	0	1.4	0	0
Number of fish	172	324	4	70	7	20

[a] *All hatchery fish.*

Table 11. Mean fork length (mm) by age group for adult summer steelhead, 1985. Standard deviation is shown in parenthesis.

Age group	Wallowa Hatchery[a]			
	Males		Females	
	N	Length	*N*	Length
1:1	116	591(3)	86	584(3)
1:2	30	730(8)	154	696(3)
1:3	1	733	7	749(10)
2:1	6	591(18)	16	610(7)
2:2	3	699(18)	25	700(8)
2:3	0	--	1	772
3:1	2	467(27)	0	--
3:2	0	--	1	666

Age group	Little Sheep Creek weir							
	Wild fish				Hatchery fish			
	Males		Females		Males		Females	
	N	Length	*N*	Length	*N*	Length	*N*	Length
1:1	0	--	0	--	7	598(12)	20	570(3)
1.2	0	--	3	667(5)	0	--	0	--
2:1	4	600(15)	31	587(4)	0	--	0	--
2:2	0	--	33	687(5)	0	--	0	--
3:1	0	--	2	570(23)	0	--	0	--
3:2	0	--	1	655	0	--	0	--

[a] *All hatchery fish.*

Table 12. Dorsal fin heights (mm) for adult summer steelhead, 1985.

Location, origin	*N*	Mean fin height	Range	Percent ≥51 mm
Wallowa Hatchery:				
Hatchery	501	36.4	4-72	19.0
Little Sheep Creek:				
Wild	93	60.2	50-72	88.9
Hatchery	27	25.7	9-46	0

Table 13. Percentage of fish showing an eroded fin or fins for hatchery-reared summer steelhead smolts released in the Grande Ronde River and Imnaha River basins, 1984 brood.

Stock, hatchery of rearing	*N*	Eroded Fin (%)						No eroded fins (%)
		Dorsal	Adipose	Pectoral[a]	Ventral[a]	Anal	Caudal	
Wallowa:								
Irrigon	460	90.2	0.4	3.7	26.1	0.2	1.7	6.7
Lyons Ferry	509	10.4	0	0.1	0	0	0.8	88.8
Imnaha:								
Irrigon	201	89.5	0	2.0	11.2	0	1.5	8.9
Irrigon-Wallowa	202	97.0	0	8.4	15.3	3.5	1.0	3.0

[a] *One or both fins.*

Table 14. Degree of smolting and precociousness of summer steelhead released into the Grande Ronde River and Imnaha River basins, 1984 brood. Standard deviation is shown in parenthesis.

Stock, hatchery of rearing	N	Mean length (mm)	Degree of smolting[a](%)			Precocious males (%)
			Smolt	Intermediate	Parr	
Wallowa:						
Irrigon	612	192(5.9)	54.4	43.7	1.9	0.2
Lyons Ferry	509	186(1.5)	71.9	27.7	0.4	0
Lyons Ferry[b]	300	172(0.9)	35.9	59.1	5.0	2.0
Imnaha:						
Irrigon	201	162(0.1)	26.9	61.2	11.9	0
Irrigon-Wallowa	202	203(2.4)	48.0	51.0	1.0	0

[a] *Degree of smolting determined by visual inspection using the following criteria: Parr = parr marks and spotting prominent, body color not silver, and scales not deciduous. Intermediate = parr marks and spotting present but not distinct, body color beginning to appear silver, and scales not deciduous. Smolt = parr marks and spotting not visable, body color silver, and scales deciduous.*

[b] *Released into Big Canyon Creek.*

Table 15. Fish disease examinations at Lower Snake River Compensation Plan hatcheries, 1985-86. StS = summer steelhead; ChS = spring chinook salmon; CWD = cold water disease; BGD = bacterial gill disease; BKD = bacterial kidney disease; VEN = viral erythrocytic necrosis; IHNV = infectious hematopoietic necrosis virus; A-p = *Aeromonis pseudomonas*.

Hatchery, species-stock	Brood year	Reason--Diagnosis	Date of examination
Irrigon:			
StS-Wallowa	1985	Routine--no disease	Jun 1985
	1985	Routine--no disease	Sep 1985
	1985	Increased loss--no IHNV	Oct 1985
	1985	Routine--no disease	Dec 1985
	1985	Pretransfer--no disease	Feb 1986
	1985	Pretransfer and liberate--no disease	Apr 1986
StS-Imnaha	1985	Routine--no disease	Jun 1985
	1985	Pretransfer--no disease	Feb 1986
	1985	Pretransfer and liberate--no disease	Apr 1986
Wallowa:			
Sts-Wallowa	1985	Preliberation--no disease	Apr 1986
Irrigon:			
ChS-Carson	1984	Routine--no disease	Aug 1985
	1984	Routine--no disease	Sep 1985
ChS-Rapid River	1985	Routine--no disease	Dec 1985
	1985	Pretransfer--no disease	Feb 1986
ChS-Imnaha	1985	Increased loss--coagulated yolk, some A-p bacteria	Dec 1985
	1985	Increased loss--coagulated yolk, some A-p bacteria present at 50% incidence level	Feb 1986
Bonneville:			ChS-Carson
	1984	Routine--no disease	Jul 1985
	1984	Routine--no disease	Jul 1985
Lookingglass:			
ChS-Carson	1984	Increased loss, preliberation examination--slight erythromycin toxicity	Jun 1985
	1984	Increased loss, preliberation--gill fungus, BGD	Jul 1985
	1984	Routine--no disease	Sep 1985

Table 15. Continued.

Hatchery, species-stock	Brood year	Reason--Diagnosis	Date of examination
Lookingglass (continued): Chs-Carson (continued):	1984	Preliberation--no disease	Sep 1985
	1984	Increased loss--A-p bacteria in fungused fish, stick fungused fish in ponds 16-17 showed typical VEN inclusions	Nov 1985
	1984	Increased loss--CWD and VEN	Dec 1985
	1984	Increased loss--VEN	Jan 1986
	1984	CWD, VEN and BKD examination--tail fungus, CWD, VEN, BKD, A-p bacteria	Jan 1986
	1984	VEN and BKD examination--VEN and *trichondina*	Feb 1986
	1984	VEN examination--VEN as 50-60% infection	Apr 1986
ChS-Lookingglass	1984	CWD, VEN and BKD examination--no disease	Jan 1986
	1984	VEN and BKD examination--no disease	Feb 1986
	1984	Preliberation--VEN, CWD, BKD	Mar 1986
Chs-Imnaha	1984	CWD, VEN and BKD examination--no disease	Jan 1986
	1984	VEN and BKD examination--no disease	Feb 1986
	1984	Preliberation--VEN, CWD, BKD	Mar 1986

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

3:2. Six-year-old fish; three years in freshwater before seaward migration and two years in the ocean.

Survival Studies

Information for marked 1984 brood chinook salmon released in the Grande Ronde and Imnaha River basins is presented in Table 16. Recovery information for marked chinook salmon adults that returned to Lookingglass Hatchery and the Imnaha River weir is presented in Table 17. Release information for marked summer steelhead is presented in Table 18, and recovery information is presented in Table 19. Release information for cold-branded chinook salmon and summer steelhead is presented in Table 20. The estimated total adult production of chinook salmon and summer steelhead adults for 1984-85 resulting from LSRCP hatchery releases in Oregon is presented in Table 21.

Straying Study

No marked hatchery strays were recovered on the Minam River or the Wenaha River spawning ground surveys.

Planning

Grande Ronde and Imnaha basin spring chinook salmon production reports were drafted and distributed for review. Egg-to-smolt and smolt-to-adult survival rates for wild and hatchery fish were reevaluated and completed by an interagency production coordination committee after the first reports were prepared. Rates used in the calculations are presented in the Production Reports (Carmichael et al. 1986a and 1986b). In the Grande Ronde basin we developed estimates of smolt production capacity, adult escapement needs, and hatchery supplementation needs for the Minam and Wenaha rivers, which are managed as wild fish streams, separately from estimates for the remainder of the basin which is managed for natural production (hatchery-wild composite). The estimated escapement of spring chinook salmon to the Grande Ronde Basin from 1979-84 varied from 477 to 998. The adult spawning escapement needed for full seeding is 3,641 wild fish for the Minam and Wenaha rivers and 6,116 fish for the remainder of the basin. The smolt production capacity for rivers managed for wild fish is 179,000 and the smolt production capacity for the remainder of the basin is 253,500. The estimated escapement into the Imnaha basin from 1979-84 ranged from 154 to 415 fish. The adult spawning escapement needed for full seeding is 3,821 and the smolt production capacity is 245,000.

Creel Surveys

Catch statistics for summer steelhead fisheries on the Grande Ronde, Wallowa, and Imnaha rivers are presented in Tables 22, 23, and 24, respectively. A summary of angler origin for each river is presented in Table 25.

Table 16. Release information for spring chinook salmon reared at Lookingglass Hatchery, marked Ad+CWT and released in the Grande Ronde and Imnaha River basins, 1984 brood. Standard deviation is shown in parenthesis.

Stock, location of release	Tag code	Date released	Number released	N [a]	Mean weight (g)	Mean fork length (mm)	Mean condition factor[b]
Carson:							
Lookingglass Creek	07 33 13	07/19/85	49,042	204	14.2	108(0.1)	1.16
	07 33 14	07/19/85	48,234	204	14.2	108(0.1)	1.16
	07 33 57	09/18/85	52,683	327	23.6	125(2.3)	1.22
	07 33 58	09/18/85	50,722	327	23.6	125(2.3)	1.22
	07 33 59	11/01/85	50,825	404	27.3	136(5.2)	1.21
	07 33 60	11/01/05	50,442	404	27.3	136(5.2)	1.21
	07 33 15	11/23/85	47,739	26	47.3	158(3.5)	
	07 33 16	04/02/86	47,955	300	51.5	157(1.2)	1.04
	07 33 61	04/02/86	48,761	302	29.8	140(1.8)	1.03
	07 33 62	04/02/86	50,687	302	29.8	140(1.8)	1.03
Lookingglass:							
Lookingglass Creek	07 34 01	04/01/86	41,512	300	29.1	131(2.6)	1.02
Imnaha:							
Imnaha River	07 33 63	03/28/86	34,563	404	42.0	150(7.6)	1.15

[a] *Samples are composed of replicate groups of approximately 100 fish.*
[b] *Standard deviations of all mean condition factors are* $\leq$ *0.001.*
[c] *Samples are from mortalities remaining in pond after 23 November ice-up.*

Table 17. Recovery information for Ad+CWT spring chinook salmon at Lookingglass Hatchery and the Imnaha River weir, 1985. Standard deviation is shown in parenthesis.

Location	Tag code	Number recovered		Mean fork length (mm)		Mean weight (kg)	
		Male	Female	Male	Female	Male	Female
Lookingglass Hatchery	07 28 60	1	0	615	--	1.00	--
	23 16 21	1	1	630	741	2.63	3.40
	23 16 22	0	1	--	790	--	4.99
Imnaha River weir	07 28 20	13	0	548(8)	--	2.00(0.1)	--

Table 18. Release information for summer steelhead reared at Irrigon Hatchery, marked Ad-LV+CWT and released in the Grande Ronde River and Imnaha River basins, 1985 brood. Standard deviation is shown in parenthesis.

Stock, location of release	Tag code	Date released	Number released	*N*	Mean weight (g)	Mean fork length (mm)	Mean condition factor
Imnaha:							
Little Sheep Creek	07 37 60	04/25-30/86	27,128	300[b]	82.5	197(3.4)	1.00
	07 37 61	04/25-30/86	27,162	300[b]	82.5	197(3.4)	1.00
Wallowa:							
Wallowa Hatchery	07 37 62	04/29-05/05/86	26,908	100	120.0	227(2.1)	0.99
	07 37 63	04/29-05/05/86	28,094	99	110.6	222(1.8)	0.99
	07 38 01	04/29-05/05/86	26,316	100	84.0	204(2.0)	0.98
	07 38 02	04/29-05/05/86	26,117	100	84.0	204(2.0)	0.98

[a] *Standard deviations of the mean conditions factors are < 0.01.*
[b] *Three replicate groups of 100 fish.*

Table 19. Information for Ad+CWT summer steelhead recovered at Wallowa Hatchery, 1985. Standard deviation is shown in parenthesis.

Tag code	Number recovered		Mean fork length (mm)		Mean weight (kg)	
	Male	Female	Male	Female	Male	Female
63 28 39	43	45	583(4)	579(4)	1.74(0.8)	1.81(0.1)
63 28 40	41	25	599(5)	583(5)	1.91(0.1)	1.84(0.1)
07 16 27	0	1	--	651	--	2.45
07 22 02	0	2	--	719(53)	--	3.15(0.6)

Table 20. Release information for 1984 brood spring chinook salmon and 1985 brood summer steelhead, cold branded, and released in the Grande Ronde River and Imnaha River basins. Standard deviation is shown in parenthesis.

Species, stock, location of release	Brand	Date released	Number released	N [a]	Mean weight (g)	Mean fork length (mm)	Mean condition factor[b]
Chinook salmon:							
Carson:							
Lookingglass Hatchery	RA J 1	09/18/85	20,108	202	25.2	125(0.5)	1.22
	RA J 3	09/18/85	20,129	180	22.6	125(4.6)	1.22
	RA J 2	04/02/85	19,955	302	29.8	140(1.8)	1.03
	RA J 4	04/20/85	19,982	302	29.8	140(1.8)	1.03
Summer steelhead:							
Wallowa:							
Wallowa Hatchery	RA J 1	04/29-05/05/86	14,871	100	120.0	227(2.1)	0.99
	RA J 3	04/29-05/05/86	14,878	99	110.6	222(1.8)	0.91
	LA J 1	04/29-05/05/86	14,987	98	85.6	204(2.0)	0.98
	LA J 3	04/29-05/05/86	14,998	100	81.0	204(2.0)	0.97
Imnaha:							
Little Sheep Creek	RA J 2	04/25-30/86	13,240	300	82.5	197(3.4)	1.00
	RA J 4	04/25-30/86	13,217	300	82.5	197(3.4)	1.00

[a] *Some samples are composed of replicate groups of approximately 100 fish.*
[b] *Standard deviations of all mean condition factors are* $\leq$ *0.01.*

Table 21. Estimated production of spring chinook salmon and summer steelhead adults that resulted from smolts released in Oregon's LSRCP area. Return year for spring chinook salmon is 1985 and for summer steelhead is 1984-85.

Species, river basin	Escapement past Lower Granite Dam	Escapement to hatchery	Catch			Estimated total return to Columbia River[b]
			Deschutes River	Columbia River	Snake River[a]	
Chinook salmon:						
Grande Ronde	(c)	452	0	22	0	474
Imnaha	(c)	14	0	1	0	15
Summer steelhead:						
Grande Ronde	1,153	506	104	344	3	1,604
Imnaha	119	52	11	35	0	165

[a] *Catch above Lower Granite Dam.*
[b] *Chinook salmon total equals catch plus escapement to hatchery and steelhead total equals catch plus escapement past Lower Granite Dam.*
[c] *No estimate made.*

Table 22. Estimated catch statistics for summer steelhead in the Grande Ronde River during October and November 1985. Catch rates for total month and season are weighted by total hours fished within each component stratum.

Month, day type	Days sampled	Available days in stratum	Total hours fished	Total catch	Catch rate (hours/fish)	Angler days
October:						
Weekend	2	8	1,158.4	104	11.1	229.7
Weekday	2	23	912.4	156	5.8	314.6
Total	4	31	2,070.8	260	8.8	544.3
November:						
Weekend	2	11	61.1	12	5.1	18.3
Weekday	2	19	94.5	17	5.6	17.2
Total	4	30	155.6	29	5.4	35.5
Season total	8	61	2,226.4	289 ± 248[a]	8.6	579.8

[a] *95% confidence interval.*

Table 23. Estimated catch statistics for summer steelhead in the Wallowa River during February and March 1985. Catch rates for total month and season are weighted by total hours fished within each component stratum.

Month, day type	Days sampled	Available days in stratum	Total hours fished	Total catch	Catch rate (hours/fish)	Angler days
February:						
Weekend	2	10	407.7	0	--	265.5
Weekday	3	18	443.5	0	--	153.7
Total	5	28	851.2	0	--	419.2
March						
Weekend	4	9	2,145.0	300	7.2	762.0
Weekday	4	22	6,343.8	1,033	6.1	1,203.8
Total	8	31	8,488.8	1,333	6.4	1,965.8
Season total	13	59	9,340.0	1,333[a] ± 1,299[b]	5.8	2,385.0

[a] *Includes two adipose-clipped fish harvested.*
[b] *95% confidence interval.*

Table 24. Estimated catch statistics for summer steelhead in the Imnaha River during October and November 1985, and March 1986. Catch rates for total month and season are weighted by total hours fished within each component stratum.

Month, day type	Days sampled	Available days in stratum	Total hours fished	Total catch	Catch rate (hours/fish)	Estimated angler days
October:						
Weekend	4	8	373.0	4	93.3	88.0
Weekday	4	23	333.5	29	11.5	80.5
Total	8	31	706.5	33	54.7	168.5
November:						
Weekend	2	11	49.5	0	--	22.0
Weekday	1	19	19.0	0	--	9.5
Total	3	30	68.5	0	--	31.5
March:						
Weekend	4	10	409.8	39	10.5	156.2
Weekday	2	21	1,343.0	99	13.6	326.2
Total	6	31	1,752.8	138	12.9	482.4
Season total	17	92	2,527.8	171[a] ± 83[b]	24.2	682.4

[a] *Includes 18 adipose-clipped fish harvested.*
[b] *95% confidence inverval.*

Table 25. Origin of anglers as determined from creel surveys conducted during fall 1985 and spring 1986 on the Grande Ronde, Wallowa, and Imnaha rivers.

River	Anglers interviewed	Angler origin (%)		
		Wallowa and Union counties	Other Oregon residents	Out-of-state
Grande Ronde	78	74.4	1.3	24.3
Wallowa	361	88.4	6.9	4.7
Imnaha	145	80.7	10.3	9.0

Discussion

Fish Culture Monitoring

Poor egg survival continues to be a problem that affects the success of the Imnaha chinook salmon program. Observations made by hatchery personnel indicated that most of the mortality occurred within specific groups of eggs from individual females and was not a general mortality problem. We obtained eggs from Rapid River Hatchery in 1985 and we have given priority to development of the Rapid River stock for the Grande Ronde program. All adults that were spawned at Rapid River were sampled for Infectious Pancreatic Necrosis Virus (IPNV) and IHNV. Eggs were incubated in well water at Irrigon Hatchery and eggs from IHNV positive parents were destroyed. Rapid River smolts will be released at Lookingglass Hatchery in 1987.

The 1,305,227 smolts released in the Grande Ronde basin exceeded the smolt production goal of 900,000. The 35,035 smolts released in the Imnaha River was short of the smolt production goal of 490,000. Reaching the smolt production goal in the Imnaha River in the very near future is important. Spring chinook salmon hatchery programs throughout the Snake River basin are reaching full production and many hatchery produced adults will be returning to the Columbia River in the late 1980s. As the number of adults increases, fisheries will be restored to harvest surplus hatchery fish. If we do not reach full smolt production soon, the increased exploitation will make it difficult to meet broodstock needs with the Imnaha native stock.

The largest adult return to Lookingglass Hatchery since the hatchery was constructed occurred in 1985. Prespawning mortality was exceptionally low. The use of antibiotic injections and Malachite Green treatments for fungus was highly successful in combating bacterial infections and prespawning mortality. Fish returned to Lookingglass Creek earlier in 1985 than in 1984 or the 1964-70 average (Burck 1969-70). By 1 July 1985, 88% had returned to the hatchery compared with 60.4% in 1984 and 62.4% average for the 1964-70 years. We did not intentionally release any fish above the weir, however, 12 redds were observed in Lookingglass Creek above the weir.

As in past years, the weir on the Imnaha was installed after a major portion of the run had passed (Witty 1985). The fish used for broodstock were taken from the latest part of the run. The permanent weir that is being designed will enable us to trap fish throughout the entire run. The Imnaha facility should be completed in 1987.

IHNV was isolated from chinook salmon adults at Lookingglass Hatchery for the first time in 1985. VEN was found in the 1984 Carson stock chinook salmon at Lookingglass Hatchery. Fish that were heavily infected with VEN suffered chronic losses from cold water disease and were held for one month beyond release to allow for recovery. We do not plan to use any Carson stock in the future.

Irrigon Hatchery was completed in 1985, and we incubated our first brood of summer steelhead eggs at the new facility. Two major fish kills occurred at Irrigon during the summer. Much of the 1985 brood Wallowa stock steelhead were lost due to chlorine contamination and a power failure. A

total of 623,599 sac-fry and fingerlings were killed. Smolt releases in 1985 and 1986 were below production goals.

IHNV was isolated from Wallowa and Imnaha stock steelhead for the first time in 1985 and eggs from positive parents were destroyed. In cooperation with ODFW pathology staff we initiated experiments at Irrigon Hatchery with the 1986 brood Wallowa stock steelhead to determine if eggs from IHNV positive parents could be reared to smolts in virus-free water without becoming infected with IHNV. We plan to mark Ad-LV+CWT a group of smolts from positive parents and monitor survival and IHNV carrier rates.

Survival Studies

Chinook salmon marking programs began in 1983 and summer steelhead marking programs began in 1985. The primary objectives of survival studies are to determine if adult mitigation goals are achieved and to identify optimum rearing and release strategies. We are still in the process of developing broodstock for the Grande Ronde and Imnaha chinook salmon programs and for the Imnaha summer steelhead program. Smolt production goals have not been reached for the Imnaha chinook salmon or for summer steelhead programs. Full smolt production was achieved with the 1983 brood for the Grande Ronde chinook salmon program by using Carson stock eggs obtained from Carson National and ODFW Willamette River hatcheries and we anticipate that full production will be achieved with the 1986 brood steelhead for the Grande Ronde Basin. It is somewhat premature to evaluate adult mitigation success because we are still in developmental stages with our propagation program. Adult returns of marked fish will provide the information needed to determine if mitigation goals are reached in future years.

The survival rate of adult Wallowa Hatchery steelhead from Lower Granite Dam to Wallowa Hatchery was much lower than expected. Catch estimates for the Snake, Grande Ronde, and Wallowa rivers do not account for the 56% loss of adults from Lower Granite Dam to Wallowa Hatchery. The exploitation rate in the Snake River from the mouth to the Grande Ronde River was less than 7% for the 1984-85 run year (Mendell and Aufforth 1985) and the estimated harvest in the Grande Ronde and Wallowa rivers was 2 fish. We are unsure of the causes of the this loss. We plan to jaw tag branded Wallowa stock steelhead at lower Granite Dam in cooperation with WDG and NMFS in 1987 to further evaluate the survival of adults from Lower Granite Dam to Wallowa Hatchery.

We began fall release experiments with spring chinook salmon at Lookingglass Hatchery because fall migration from tributary streams into the mainstem apparently plays an important role in the production of chinook salmon in the Grande Ronde (Burck 1974) and Imnaha rivers (Gaumer 1968). Cold branded fish that were released from Lookingglass Hatchery on 18 September were recaptured as migratory smolts during October, March, April, and May at the Snake River collector dams. Although final estimates of numbers collected by time period are not available, preliminary data show that some fish overwintered above Lower Granite Dam and began seaward migration in the spring.

Straying Study

The first marked hatchery jacks returned to the Grande Ronde Basin in 1985. Few returned to the basin, and no hatchery fish were recovered on the spawning grounds. Identifying hatchery strays on the Wenaha River was difficult because most of the carcasses were consumed by bears.

Planning

Production reports were developed as an integral part of an extensive planning effort under the *U.S.* v. *Oregon* management negotiations. The estimates that were developed were based on the best available information, however, information was limited. A few important observations surfaced during the planning process. Escapement levels over the past 5 years have been at or below approximately 10% of the level needed for full seeding in both the Grande Ronde and Imnaha basins. Low smolt-to-adult survival rates appear to be the primary cause for the continually depressed level of these stocks. If these stocks of fish are to be restored to historic levels and consumptive fisheries resumed, smolt-to-adult survival rates must be increased. Emphasis should be placed on solving the upstream and downstream passage problems associated with the eight dams that exist between these basins and the ocean. Even with enhanced survival rates it appears that extensive hatchery supplementation is needed to restore populations to historic levels and to restore the extensive fisheries that occurred on these fish in the past. Information developed in these plans has been used in the Wallowa-Whitman National Forest Plan and for justification of additional spring chinook salmon hatchery production for northeast Oregon.

Creel Surveys

We started creel surveys in 1986 to become familiar with the fishing areas and fisheries and to develop appropriate survey techniques for each river. Few marked fish were available in the Grande Ronde basin, and only stray marked fish were available in the Imnaha River. The Grande Ronde and Wallowa rivers were managed under catch-and-release regulations until 1 January 1986. Fishing pressure was light throughout the season. Catch rates were consistently high until mid-November when it became too cold to fish. We anticipate that this fishery will become much more popular in fall 1986 because of the regulation change that will allow harvest of marked fish and because a substantial number of marked hatchery fish should be available to harvest.

Angling pressure on the Wallowa River was high, particularly in March. The estimated catch of 1,333 fish is larger than harvest estimates from punchcard data during 1959-1973, when harvest ranged from 35 to 453 fish. The catch rate was excellent; however, few fish caught on the Wallowa River were marked. The potential for extensive harvest exists on the Wallowa River. The 1986 fishery was the first fishery since the mid-1970s and this fishery should increase in the future as more fish are available for harvest.

Fishing pressure was low and catch rates were poor on the Imnaha River during the fall. No Imnaha steelhead were marked in past years and all of the steelhead harvested were strays. In the 1985-86 run year, few fish moved into the Imnaha River until the spring of the year.

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

Introduction

Surplus chinook salmon eggs are taken each year to assure that smolt production goals are achieved at Lookingglass Hatchery. In most years the surplus produces fish in excess of the hatchery rearing capacity. In 1984 and 1985 surplus fish were released as presmolts in the Grande Ronde basin. We began a marking program in 1984 to evaluate survival of presmolts to determine if they contribute to adult returns in the basin. Objectives and tasks are described in the summary section of this report and in the five-year study plan (Carmichael 1986).

Methods

Replicate groups of presmolts were marked Ad+CWT and released into Lookingglass Creek. Marked adults that return from fish released in Lookingglass Creek will be trapped at the hatchery.

Results and Discussion

A total of 104,800 presmolts were released on 4 July 1985 in Lookingglass Creek. These fish were progeny of Carson stock chinook salmon that were spawned at Willamette River hatcheries. Release information for marked presmolts was presented in Table 17 (CWT codes 07-33-13 and 07-33-14). Jacks from the first marked presmolt releases in 1984 returned in 1986.

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

Introduction

Extensive effort and planning has been underway to reprogram lower Columbia River hatcheries to produce salmon for upriver areas. At first our plans were to reprogram large numbers of chinook salmon smolts for the Grande Ronde basin. Although this has not happened yet, additional production will be provided in the future. It is possible that new hatchery facilities may be constructed to provide the additional production. In 1984 and 1985, 150,000 Carson stock chinook salmon were reared at Bonneville or Oxbow hatchery and were released at Lookingglass Hatchery.

We are evaluating the contribution of smolts that have been reprogrammed to LSRCP areas to determine if LSRCP hatcheries have met mitigation goals and to determine the effectiveness of releasing smolts, transported from lower river hatcheries, to upriver areas. Objectives and

tasks are described in the summary section of this report and in the Five-Year Plan (Carmichael 1986).

Methods

We marked Ad+CWT two groups of 50,000 Carson stock chinook salmon at Bonneville Hatchery. These fish were transported to Irrigon Hatchery during summer and were then transferred to Lookingglass Hatchery in September. Fish were brought to Lookingglass at a larger size than originally planned; therefore we decided to release these fish in spring 1986 instead of fall 1985.

Results and Discussion

On 23 November 1985 severe weather and cold temperatures hit northeastern Oregon. Slush ice in Lookingglass Creek caused the intake structures to nearly freeze up and water flow to ponds 1, 2, and 3 was drastically reduced. We were forced to release fish from ponds 1 and 2. A total of 90,233 fish, including all of CWT code 07-33-15, were released on 23 November. The remainder (CWT code 07-33-16) were released on 2 April 1986.

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