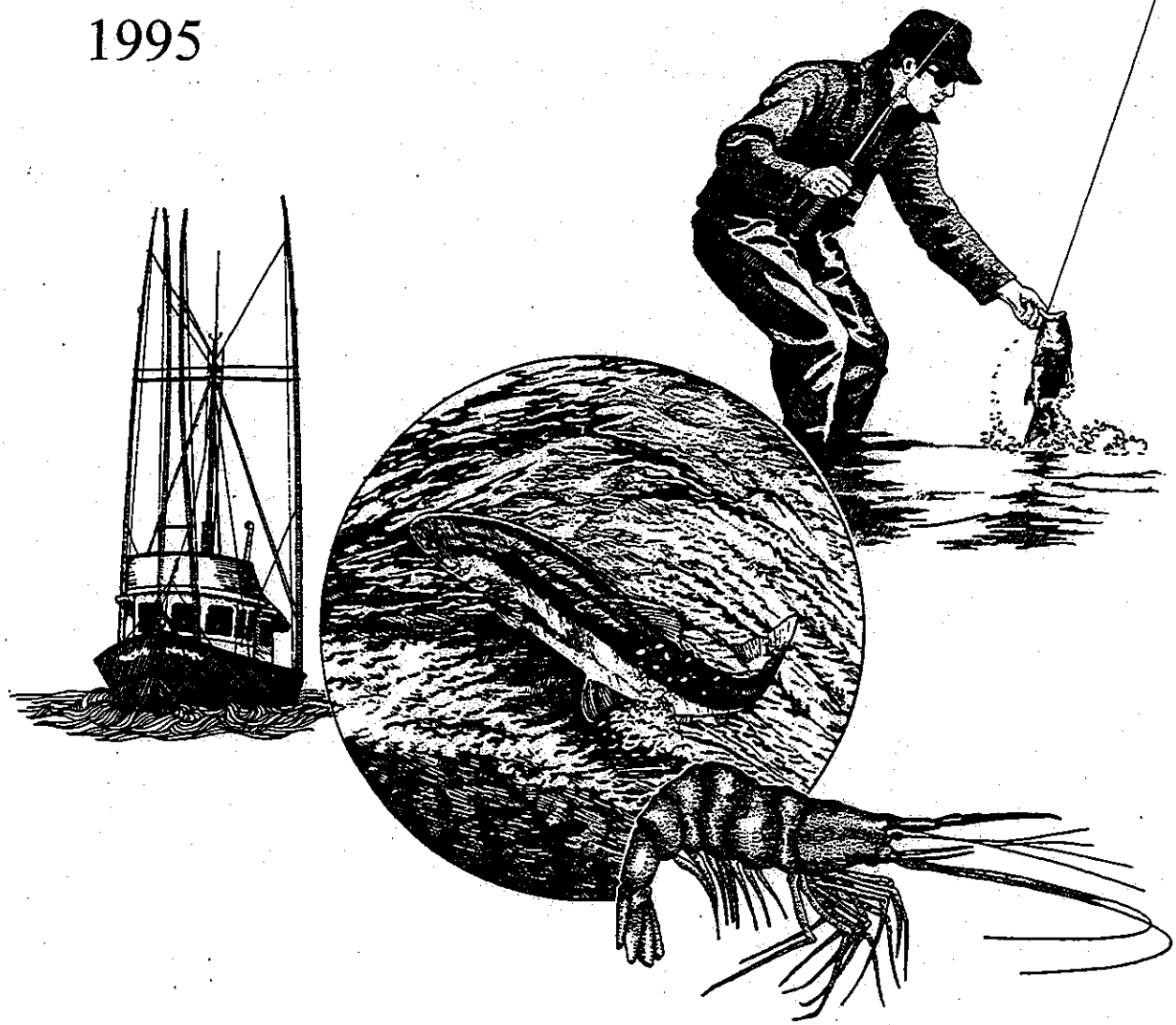
PROGRESS REPORTS

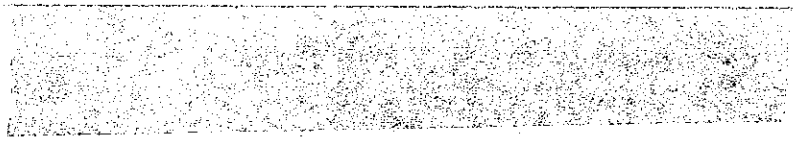
1995



FISH DIVISION

Oregon Department of Fish and Wildlife

Natural Escapement Monitoring of Spring Chinook Salmon in the Imnaha and Grande Ronde River Basins



ANNUAL PROGRESS REPORT

FISH RESEARCH PROJECT
OREGON

PROJECT TITLE: Natural Escapement Monitoring of Spring Chinook Salmon in the Imnaha and Grande Ronde River Basins

CONTRACT NUMBER: 14-48-0001-95560

PROJECT PERIOD: January 1, 1995 through December 31, 1995

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Executive Summary

Objectives

1. Estimate the number of adult spring chinook salmon that returned to streams in the Grande Ronde and Imnaha river basins in 1995.
   a. Survey selected sections of streams to determine the number of salmon redds.
   b. Using population estimates from streams with known numbers of redds and adults, calculate an approximate fish per redd conversion factor to estimate natural escapement for each basin.
   c. Plot the long term trend in estimated escapement for each river basin.

2. Use scale samples and length data from recovered carcasses to determine the length at age relationships and age composition of the returning adults from each system. Analyze to determine if age composition, sex composition, or length at age has changed during the past decade.

3. Analyze survey data for a trend in progeny to parent ratios during the past decade for the Imnaha River.

4. Document the number of hatchery strays found in each system surveyed and identify their origins if possible.

5. Report and summarize the results of 1995 natural escapement monitoring efforts. These data are reported in Appendices 1-6.

Accomplishments and Findings

Spawning ground surveys were conducted in 1995 in the Imnaha and Grande Ronde basins covering more than 200 river miles of potential spawning habitat. The data was compiled and used to estimate natural escapement, to document straying and to determine brood stock age composition. We observed a total of 80 redds and sampled 20 carcasses in the Grande Ronde Basin. In the Imnaha River Basin, we found 49 redds and sampled 23 carcasses. The total number of adults that returned to the Grande Ronde Basin in 1995 was estimated to be 261 (using a fish per redd conversion of 3.26). The estimated natural escapement to the Imnaha Basin was 154. The fish per redd ratio for 1995 could not be determined for the Imnaha River because no fish were passed above the weir to provide a population estimate. Therefore, the average ratio of 3.14 fish per redd (1990-1994) was used. Six marked carcasses were found. Five of the six marked fish found during the 1995 spawning ground surveys were in the Imnaha River; one was in the Wenaha River. Three of the five Imnaha fish had coded-wire tags and were from hatchery smolt releases in the Imnaha River. The marked chinook found in the Wenaha was a Rapid River stock fish released at Lookingglass Fish Hatchery.

Management Recommendations

1. Surveys on all index, extensive and supplemental stream sections should be continued until analysis of the database can be performed. These intensive surveys are necessary to provide the most accurate assessment of the size and composition of the spawning population. Additional surveys should be conducted in some extensive-area sections, at one and two weeks following the index survey, so that the change in these sections over time can also be monitored. This design will allow us to measure the temporal changes in spawning distribution that may be overlooked using only supplemental surveys in the index areas. As designed this survey scheme provides a relative index of the natural escapement in each basin and also provides a mechanism to evaluate specific effects of the Imnaha supplementation program.

2. Surveys should be continued in extensive areas to ensure an adequate recovery of carcasses in each basin for analysis of hatchery strays and determination of age composition of the adults. This is especially important in years of low abundance, as in 1995, when stray hatchery returns have a greater proportional influence on the spawning population.

General Introduction

Annual estimates of the natural escapement of spring chinook salmon provide valuable information about changes in the size and composition of a spawning population through time. Since the 1960s, standardized spawning ground surveys have been performed at designated times on selected stream sections in Northeast Oregon. They provided a relative index of the abundance of redds and therefore returning adults. To obtain more quantitative estimates of natural escapement, intensive surveys were incorporated into the spawning ground design in 1986. In addition to the standard historical "index" surveys, a number of additional sections of each stream (encompassing almost all potential spawning habitat) were surveyed on the same day as the index sections and termed "extensive" surveys, to document the spatial variation in spawning activity. To address temporal variability in spawning, "supplemental" surveys were conducted in the index survey sections one week after the initial "index" survey was done, and in some cases, again two weeks after the initial survey. This design, combined with carcass recovery information and estimated fish per redd ratios from weired systems, permitted a more accurate calculation of the number of returning adults in each system.

The use of extensive and supplemental surveys has continued from 1986 through 1995 to provide more accurate estimates of spawning escapement and to create a database that can be analyzed to determine the most appropriate stream sections to survey and when they should be surveyed. The extensive surveys also

provide an effective mechanism to recover carcasses, which may be deposited in poor spawning habitat regions downstream of normal spawning areas.

The aim of this progress report is to summarize the results of the 1995 spawning ground surveys, to estimate the size and composition of the spawning population in each basin, and to document the numbers and origins of hatchery strays in streams of northeast Oregon.

Methods

Stream surveys are conducted beginning the third week of August each year and occur in a predetermined order to coincide with the period just after the peak of spawning in each system (Keefe et al., 1994). This helps to maximize the number of redds observed and carcasses recovered in systems that are only surveyed once. Surveys are usually completed by the second week in September. Usually, the surveys are conducted by one or two people walking downstream in each section. Stream sections average 2-3 miles in length depending on accessibility. We count the number of redds (occupied and unoccupied), the number of live fish observed (on redds and off redds), and the number of carcasses. In streams that will be surveyed again, the location of the redd is marked on shore along with it's number and status, so that the number of new redds can be determined with each additional survey. When a carcass is found, it is measured (fork length), sex is confirmed, and percent of eggs spawned is estimated for females. Any identifying marks or tags are noted, and scales are removed from the key scale area (Nicholas and Van Dyke, 1982) to identify age. If any fin marks are observed, the snout of the fish is removed to be examined for the presence of a coded-wire tag. Once sampled, the tail is removed to prevent repeated sampling on future surveys and the carcass is placed back in the stream.

The fish per redd ratio is calculated using the total number of redds observed above the Imnaha River weir, and the population size. The population size is estimated using a mark-recapture analysis of carcasses recovered above the weir from a known number of marked fish released above the weir. This method was used on Lookingglass Creek to generate the fish per redd ratio used in the Grande Ronde Basin. Adults are not released above the weir every year, so the Grande Ronde Basin conversion factor is an average of the ratios calculated for 1992, 1993 and 1994 (Lofy and McLean, 1995; M. McLean, Personal Communication).

Results and Discussion

Redds and Escapement

In 1995, we surveyed a total of 238 miles (44 miles were repeated during supplemental surveys) in the Grande Ronde River basin and found only 80 redds. As expected, the redd count in 1995 was much lower than redd counts in recent years, ranging from 139 to 707 in 1990-1994 (Figure 1). Lower numbers of redds have been found despite a large increase in survey effort in the past few years. Most of the redds were found in the index areas on the index days, indicating that

spawning did not occur later than normal (see Appendix 5). We estimate that only 261 adult salmon returned to the Grande Ronde Basin in 1995, based on a fish per redd ratio of 3.26 (Figure 2). This is somewhat different from the ratio of 2.4 used in previous years from the calculations of Carmichael and Boyce (1986). Escapement was similar in the Imnaha Basin. We observed only 49 redds during a total of 60 miles of stream surveys (plus 31 repeated miles during supplemental surveys). No redds were found in Big sheep Creek or in Lick Creek. The Imnaha River weir was installed on July 26th, 1995 (late due to high water conditions) and operated through September 7th. After installation all trapped fish were retained for broodstock, and no fish were released to spawn upstream of the weir. All natural production upstream of the weir was derived from fish passing the weir location prior to July 26th. Therefore, data is not available to calculate a specific fish per redd ratio for 1995. Assuming the average fish per redd ratio for the 1990-1994 period of 3.14, we estimate that only 154 salmon returned to the Imnaha River Basin in 1995. The raw data collected during surveys are reported by stream section in Appendix 1.

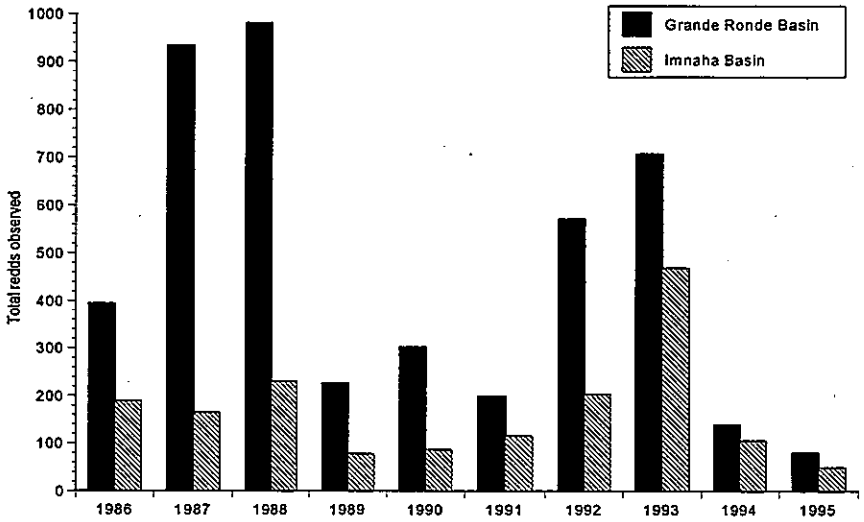

Figure 1. Total number of redds actually observed in the Imnaha and Grande Ronde river basins from 1986 through 1995.

The intensive survey design coupled with the population estimate accuracy available in the Imnaha allows us to reconstruct each year class of fish and show trends in population size over time. Figure 3 shows the progeny to parent ratios for hatchery and natural groups from the Imnaha River for the completed brood years 1982-1990. The strong hatchery advantage seen in the 88-89 brood years appears to have been lost by 1990 to an equal replacement rate for both the hatchery and natural groups. Given the survival advantage of hatchery-reared fish prior to migration, the equal replacement ratios suggests a strong relative survival disadvantage of hatchery releases during smolt migration, ocean residence or adult migration. Given that the unmarked progeny:parent ratios have only been above one for two years at the start of the hatchery program, and that the ratios for

hatchery fish were only above one for 1987, 1988 and 1989, the effectiveness of the hatchery program and its influence on natural production should be evaluated.

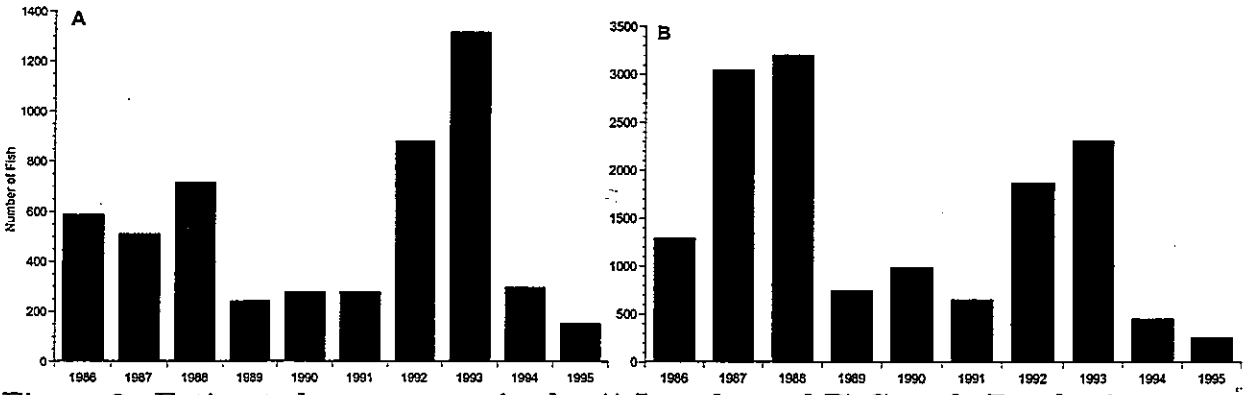

Figure 2. Estimated escapement in the A) Imnaha and B) Grande Ronde river basins from 1986-1995.

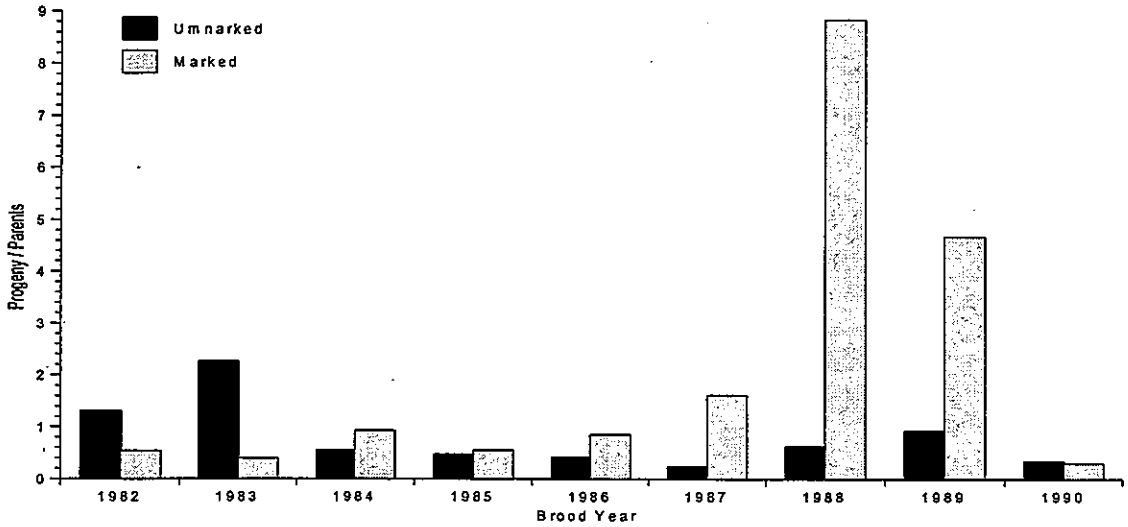

Figure 3. Progeny to parent ratios for Imnaha River brood years 1982-1990.

Age Composition

We sampled a total of 20 carcasses in the Grande Ronde Basin and 23 in the Imnaha Basin (Table 1). Most of the fish were age 4, and the percentage is roughly comparable with the percentages observed in previous years when analyzed by brood year (Figure 4). Length at age was also similar to previous return years. With extremely low numbers of recovered carcasses, caution should be used with the age composition and length at age data. It is reported here but should not be used in analysis unless sample size is included. No trends in age composition are apparent from completed brood years 1986-1991 (Figure 4). Variation in age at return for a given brood year is likely due to variation in environmental factors affecting survival and the decision to return at a given age.

Table 1. Age composition of chinook salmon carcasses recovered in 1995 during surveys in the Imnaha and Grande Ronde river basins. Data are mean (standard deviation).

Age/Sex	3		4		5	
Basin	M	F	M	F	M	F
Grande Ronde River						
Number*	1	1	6	9	0	0
Percent	6	6	35	53	0	0
Fork Length	480 (0)	570 (0)	760 (35)	696 (63)	NA	NA
Imnaha River						
Number	4	0	8	2	3	6
Percent	17	0	35	9	13	26
Fork Length	609 (17)	NA	843 (84)	768 (25)	1017 (25)	906 (44)

* Three additional carcasses could not be identified to age or sex.

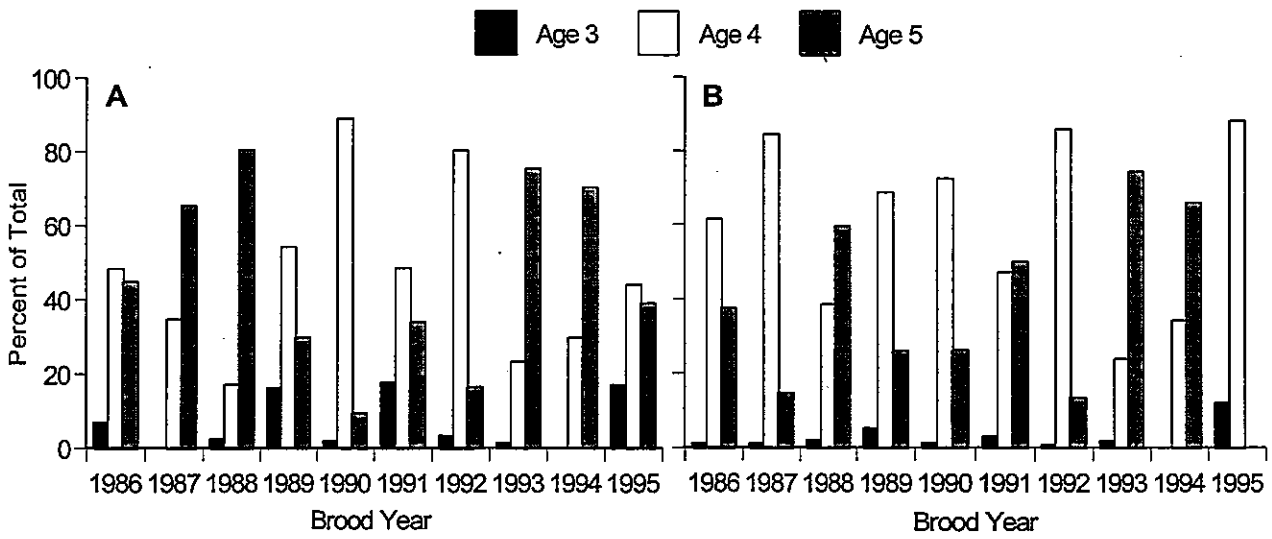

Figure 4. Percent age composition for A) Imnaha River and B) Grande Ronde River basin adult returns in 1986-1995.

Marked Fish Recoveries

All marked fish recovered during stream surveys were sampled and their snouts removed to be examined for the presence of a coded-wire-tag. Five marked carcasses were found in the Imnaha River, and three of those had coded-wire tags indicating they were part of a hatchery release in the Imnaha River (Table 2). The only marked fish found in the Grande Ronde Basin was a Lookingglass Hatchery release recovered in the Wenaha River. Intercepting Rapid River stock fish at Lower Granite Dam and trucking them to Lookingglass Fish Hatchery has had a significant impact on the numbers of strays found in the Grande Ronde Basin.

Typically, these recoveries are expressed as a percentage of total carcasses recovered. However, with extremely low sample sizes, percentages have a large error and should be used with caution.

Table 2. Marked carcass recoveries during spawning ground surveys in 1995.

Location	CWT code	Release site
Imnaha River	07-58-47	Imnaha Acclimation Pond (1990 Brood)
Imnaha River	07-15-39	Imnaha Acclimation Pond (1991 Brood)
Imnaha River	07-01-17	Imnaha Acclimation Pond (1992 Brood)
Imnaha River	No Tag	Unknown
Imnaha River	No Tag	Unknown
Wenaha River	07-15-48	Lookingglass Hatchery (1991 Brood)

Conclusions

Natural escapement and the corresponding information obtained from returning adults in 1995 was the lowest in the last decade for both the Imnaha and Grande Ronde basins (Figure 2). Though escapements were low, our intensive survey efforts yielded the most accurate monitoring information to continue the trend analysis for subsequent brood years. Adult returns were lower than normal throughout the region and not just in Northeast Oregon, indicating some larger scale impact on adult survival. If low escapement trends continue, survey effort must increase to permit adequate sample sizes for escapement and straying estimates. An evaluation of the current spawning ground survey database should be conducted to determine which sections should be added or deleted to provide the best design for estimating escapement and recovering carcasses.

References

Carmichael, R.C. and R.R. Boyce. 1986. U.S. v. Oregon, Grande Ronde River spring chinook production report. Oregon Department of Fish and Wildlife. Portland, OR.

Keefe, M.L., R.W. Carmichael, B.C. Jonasson, R.T. Messmer, and T.A. Whitesel. 1994. Investigations into the life history of spring chinook salmon in the Grande Ronde River Basin, Annual Report 1994. Bonneville Power Administration, Portland, OR.

Lofy, P.T and M.L. Mclean. 1995. Lower Snake River compensation Plan, Confederated Tribes of the Umatilla Indian Reservation, Evaluation Studies for 1 January to 31 December 1994. Pendleton, OR.

Nicholas, J.W. and L.A. Van Dyke. 1982. Straying of adult coho salmon to and from a private hatchery at Yaquina Bay, Oregon. Oregon Department of Fish and Wildlife, Information Report (Fish) 8240, Portland, OR.

Appendix 1. Index and extensive area surveys for spring chinook salmon in the Imnaha and Grande Ronde river basins, 1995

Basin, Stream, Section	Date	Miles	Redds			Live Fish				Dead Fish			
						On Redds		Off Redds					
			Occupied	Unoccupied	Total	Adults	Jacks	Adults	Jacks	M	F	J	U
GRANDE RONDE RIVER BASIN													
Bear Creek													
2 mile reach above G.S.	08/22	2.0	0	0	0	0	0	0	0	0	0	0	0
Guard Station to Bridge*	08/22	6.5	0	0	0	0	0	0	0	0	0	0	0
Bridge to Diversion	08/22	2.1	0	0	0	0	0	0	0	0	0	0	0
Total Bear Creek Drainage		**10.6**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Catherine Creek, NF													
Middle Fork to Mouth*	08/29	3.0	0	0	0	0	0	0	0	0	0	0	0
Catherine Creek, SF													
Road Barrier to start of Index Area	08/29	0.7	0	0	0	0	0	0	0	0	0	0	0
Index Area	08/29	2.0	0	0	0	0	0	0	0	0	0	0	0
Catherine Creek													
Forks to Badger Flat Road*	08/29	7.5	2	5	7	3	0	2	0	0	1	0	0
Badger Flat Road to 2nd Union City Bridge	08/29	7.0	0	0	0	0	0	0	0	0	0	0	0
Total Catherine Creek Drainage		**20.2**	**2**	**5**	**7**	**3**	**0**	**2**	**0**	**0**	**1**	**0**	**0**
Grande Ronde River													
Three Penny Claim to FS Boundary*	08/28	3.0	0	0	0	0	0	0	0	0	0	0	0
FS Boundary to Road 5125 Bridge*	09/05	5.5	0	5	5	0	0	0	0	0	1	0	0
Road 5125 Bridge to Starkey Bridge	08/28	13.7	0	0	0	0	0	0	0	0	0	0	0
Total Grande Ronde River Drainage		**22.2**	**0**	**5**	**5**	**0**	**0**	**0**	**0**	**0**	**1**	**0**	**0**
Hurricane Creek													
Gravel Pit to Mouth*	08/21	3.0	0	0	0	0	0	0	0	0	0	0	0
Indian Creek													
Lower 1.5 miles of Old Index Area	09/15	1.5	0	0	0	0	0	0	0	0	0	0	0
Lookingglass Creek**													
Summer Creek to L. Lookingglass Creek*	09/08	6.2	0	2	2	0	0	0	0	0	2	0	0
L. Lookingglass Creek to Mouth	09/12	3.8	0	1	1	0	0	2	0	1	0	0	0
Total Lookingglass Creek		10.0	0	3	3	0	0	2	0	1	2	0	0
Lookingglass Creek, Little**	09/12	4.0	0	0	0	0	0	0	0	0	0	0	0
Total Lookingglass Drainage		**14.0**	**0**	**3**	**3**	**0**	**0**	**2**	**0**	**1**	**2**	**0**	**0**

* Index area.

** Redd count on index date and total cumulative carcass recoveries from multiple surveys conducted by CTUIR biologists before and after index date.

Appendix 1. Continued.

Basin, Stream, Section	Date	Miles	Redds			Live Fish				Dead Fish			
						On Redds		Off Redds					
			Occupied	Unoccupied	Total	Adults	Jacks	Adults	Jacks	M	F	J	U
Lostine River													
Lapover Meadow to Williamson C.G.	08/23	5.0	0	0	0	0	0	0	0	0	0	0	0
Log Jam to Six-mile Bridge	08/23	2.0	0	0	0	0	0	0	0	0	0	0	0
Six-mile Bridge to OC Ranch Bridge*	08/23	3.0	3	3	6	4	0	0	0	0	0	0	0
OC Ranch Bridge to Westside Ditch	08/23	1.6	0	1	1	0	0	0	0	0	0	0	0
Westside Ditch to Lostine	08/23	4.0	0	0	0	0	0	0	0	0	0	0	0
Lostine to McLain's	08/23	2.7	0	0	0	0	0	0	0	0	0	0	0
McLain's to Mouth	08/23	2.7	0	0	0	0	0	0	0	0	0	0	0
Total Lostine River Drainage		**21.0**	3	4	7	4	0	0	0	0	0	0	0
Minam River**													
Elk Creek*	08/29		0	1	1	0	0	0	0	0	0	0	0
Rock Creek*	08/29		0	0	0	0	0	0	0	0	0	0	0
Camp 1*	08/29		0	0	0	0	0	0	0	0	0	0	0
Little Pot*	08/29		0	0	0	0	0	0	0	0	0	0	0
Splash Dam*	08/29		0	0	0	0	0	0	0	0	0	0	0
Salmon Hole to Bridge*	08/30		0	0	0	0	0	1	0	0	0	0	0
Red's Bridge to Pipeline*	08/30		0	4	4	0	0	0	0	0	0	0	0
Pipeline to Side Channel*	08/30		1	3	4	1	0	0	0	0	0	0	0
Land Ranch to Bluff*	08/30		1	0	1	1	0	0	0	1	0	0	0
Total Minam River		13.5	2	8	10	2	0	1	0	1	0	0	0
Little Minam River													
First Segment (falls to snag)	08/31	1.5	1	2	3	1	0	0	0	0	0	0	0
Middle Segment	08/31		1	1	2	1	0	0	0	0	0	0	0
Middle Segment to Mouth	08/31		0	0	0	0	0	0	0	0	0	0	0
Total Minam River Drainage		**17.8**	4	11	15	4	0	1	0	1	0	0	0
Sheep Creek													
Forks to Road 5182 Culvert	09/03	3.0	0	0	0	0	0	0	0	0	0	0	0
Road 5182 Culvert to Vey Meadow Bridge*	09/03	6.0	0	0	0	0	0	0	0	0	0	0	0
Total Sheep Creek Drainage		**9.0**	0	0	0	0	0	0	0	0	0	0	0
Wallowa River													
McClaran Lane Bridge to Hatchery Intake*	08/21	4.5	0	0	0	0	0	0	0	0	0	0	0

* Index area.

** Upper Minam River includes Elk Creek to Splash Dam, Lower Minam River includes Salmon Hole to Bluff.

Appendix 1. Continued.

Basin, Stream, Section	Date	Miles	Redds			Live Fish				Dead Fish			
						On Redds		Off Redds					
			Occupied	Unoccupied	Total	Adults	Jacks	Adults	Jacks	M	F	J	U
Wenaha River, NF													
Stateline to Forks	09/05	5.5	0	0	0	0	0	0	0	0	0	0	0
Wenaha River, SF													
Above Milk Creek	09/05	0.25	0	0	0	0	0	0	0	0	0	0	0
Milk Creek to Forks*	09/05	6.00	0	2	2	0	0	1	0	0	0	0	0
Wenaha River													
Forks to Crooked Creek	09/05-7	15.5	2	16	18	3	1	5	1	2	0	1	0
Total Wenaha River		27.25	2	18	20	3	1	6	1	2	0	1	0
Wenaha River Tributaries													
Milk Creek		0.25	0	0	0	0	0	0	0	0	0	0	0
Butte Creek	09/06	1.5	0	1	1	0	0	0	0	0	0	0	0
Total Wenaha River Drainage		29	2	19	21	3	1	6	1	2	0	1	0
GRANDE RONDE BASIN TOTAL		152.75	11	47	58	14	1	11	1	4	4	1	0
IMNAHA RIVER BASIN													
Imnaha River													
Blue Hole to Indian Crossing*	08/25	2.0	2	3	5	2	0	0	0	0	0	0	0
Indian Crossing to Mac's Mine*	08/25	7.7	6	4	10	9	2	0	0	0	0	0	0
Mac's Mine to Weir	08/25	4.5	0	1	1	0	0	0	0	2	1	0	0
Weir to Crazyman Creek	08/25	3.5	6	3	9	7	0	4	0	1	1	0	0
Crazyman Creek to Grouse Creek**	08/25	8.5	2	5	7	0	2	0	0	0	0	0	1
Grouse Creek to Freezeout Creek	08/25	6.0	0	0	0	0	0	0	0	0	1	0	0
Total Imnaha River Drainage		32.2	16	16	32	18	4	4	0	3	3	0	1
Lick Creek*	08/24	4.0	0	0	0	0	0	0	0	0	0	0	0
Big Sheep Creek													
Bridge to Echo Canyon*	08/24	4.0	0	0	0	0	0	0	0	0	0	0	0
Echo Canyon to Carrel Creek	08/24	6.0	0	0	0	0	0	0	0	0	0	0	0
Carrel Creek to Coyote Creek	08/24	3.0	0	0	0	0	0	0	0	0	0	0	0
Coyote Creek to Squaw Creek	08/24	5.0	0	0	0	0	0	0	0	0	0	0	0
Squaw Creek to Muley Creek	08/24	5.5	0	0	0	0	0	0	0	0	0	0	0
Total Big Sheep Creek Drainage		23.5	0	0	0	0	0	0	0	0	0	0	0
IMNAHA BASIN TOTAL		59.7	16	16	32	18	4	4	0	3	3	0	1

* Index area.

*** Previously was included as part of the index survey.

Appendix 2. Comparison of index area and extended area spring chinook salmon spawning ground surveys in some Imnaha and Grande Ronde river basin streams, 1995.

Basin, Stream	Date	Miles surveyed		Redds		Live Fish		Dead Fish		Percentage of redds in index area
		Inside index	Outside index	Inside index	Outside index	Inside index	Outside index	Inside index	Outside index	
GRANDE RONDE RIVER BASIN										
Bear Creek	Aug-22	6.5	4.1	0	0	0	0	0	0	0
Catherine Creek	Aug-29	7.5	12.7	7	0	5	0	1	0	100
Grande Ronde River	Sep-05	8.5	13.7	5	0	0	0	1	0	100
Lostine River	Aug-23	3.0	18.0	6	1	4	0	0	0	86
Sheep Creek	Sep-03	6.0	3.0	0	0	0	0	0	0	0
Wenaha River	Sep-05	6.0	23.0	2	19	1	10	0	3	10
IMNAHA RIVER BASIN										
Big Sheep Creek	Aug-24	4.0	19.5	0	0	0	0	0	0	0
Imnaha River	Aug-25	9.7	22.5	15	17	13	13	0	7	47

Appendix 3. Comparison of spawning ground counts conducted at the standard index survey time, and twice after the index survey on some sections of Imnaha and Grande Ronde river streams, 1995.

Basin, Stream, Section	Survey	Date	Miles	New Redds Observed			Live Fish Observed				Dead Fish Observed	
							On Redds		Off Redds			
				Occ	Unoc	Total	A	J	A	J	A	J
GRANDE RONDE BASIN												
Catherine Creek	Index	Aug-29	2.0	2	5	7	3	0	2	0	1	0
Bridge below forks to	Supp1	Sep-06	2.0	1	3	4	1	0	0	0	0	0
Highway Bridge	Supp2	Sep-13	2.0	0	3	3	0	0	0	0	4	0
Grande Ronde River	Index	Aug-28	3.0	0	0	0	0	0	0	0	0	0
Three Penny Claim to	Supp1	Sep-05	3.5	0	0	0	0	0	0	0	0	0
Forest Boundary	Supp2	Sep-12	3.5	0	0	0	0	0	0	0	0	0
Forest Boundary to	Index	Sep-05	5.5	0	5	5	0	0	0	0	1	0
Road 5125 Bridge	Supp1	Sep-12	5.5	0	1	1	0	0	0	0	0	0
Hurricane Creek	Index	Aug-21	3.0	0	0	0	0	0	0	0	0	0
Gravel Pit to	Supp1	Aug-30	1.3	0	0	0	0	0	0	0	0	0
McCorman Ranch Bridge	Supp2	Sep-06	1.3	0	0	0	0	0	0	0	0	0
Lookingglass Creek	Index	Sep-12	6.2	0	2	2	0	0	0	0	2	0
Weir to mouth	Supp1	Sep-27	2.3	1	1	2	2	0	0	0	1	0
Lostine River	Index	Aug-23	3.0	3	3	6	4	0	0	0	0	0
Six-mile Bridge to	Supp1	Aug-30	3.0	0	2	2	2	0	1	0	0	0
OC Ranch	Supp2	Sep-06	3.0	0	2	2	0	0	0	0	4	0
Minam River	Index	Aug-30	13.5	2	8	10	2	0	1	0	1	0
Red's Bridge to	Supp1	Sep-07	4.0	0	5	5	0	0	0	0	3	0
1 mile above L. Minam	Supp2	Sep-14	4.0	0	0	0	0	0	0	0	0	0
SF Wenaha River	Index	Sep-05	6.0	0	2	2	0	0	1	0	0	0
	Supp1	Sep-13	6.0	0	3	2	0	0	0	0	0	0
Wenaha River	Extensive	Sep-05	3.0	1	6	7	0	0	1	0	0	0
Forks down 3 miles*	Supp1	Sep-13	3.0	0	3	1	1	0	0	0	0	0
IMNAHA RIVER BASIN												
Imnaha River	Index	Aug-25	7.7	6	4	10	9	2	0	0	0	0
Indian Crossing to	Supp1	Sep-01	7.7	0	4	4	0	0	1	0	1	0
Mac's Mine	Supp2	Sep-07	7.7	0	5	5	0	0	0	0	3	0
Mac's Mine to	Index	Aug-25	4.5	0	1	1	0	0	0	0	3	0
Weir	Supp1	Sep-01	4.5	0	0	0	0	0	0	1	1	0
	Supp2	Sep-11	4.5	0	0	0	0	0	0	1	1	0
Weir to	Extensive	Aug-25	3.5	6		6	7	0	4	0	2	0
Crazyman Creek	Supp1	Sep-01	3.5	2	4	6	3	1	2	3	4	0
	Supp2	Sep-11	3.5	0	2	2	0	1	0	0	2	0

* This section is not part of the historical index survey.

Appendix 4. Spring chinook salmon spawning ground surveys conducted in Index areas in the Imnaha and Grande Ronde river basins, 1995.

Basin, Stream, Section	Date	Miles	Redds	Redds/ Mile	Live Fish A	Live Fish J	Dead Fish A	Dead Fish J
GRANDE RONDE RIVER BASIN								
Bear Creek	Aug-22	6.5	0	0.0	0	0	0	0
Catherine Creek, NF	Aug-29	3.0	0	0.0	0	0	0	0
Catherine Creek, SF	Aug-29	2.0	0	0.0	0	0	0	0
Catherine Creek	Aug-29	7.5	7	0.9	5	0	1	0
Grande Ronde River	Aug-28	8.5	5	0.6	0	0	1	0
Hurricane Creek	Aug-21	3.0	0	0.0	0	0	0	0
Indian Creek	Sep-15	1.5	0	0.0	0	0	0	0
Lookingglass Creek	Sep-08	6.2	2	0.3	0	0	2	0
Lostine River	Aug-23	3.0	6	2.0	4	0	0	0
Minam River	Aug-30	13.5	10	0.7	3	0	1	0
Sheep Creek	Sep-03	6.0	0	0.0	0	0	0	0
Wallowa River	Aug-21	4.5	0	0.0	0	0	0	0
Wenaha River	Sep-05	6.0	2	0.3	0	0	0	0
GRANDE RONDE BASIN TOTAL		71.2	32	0.4	12	0	5	0
IMNAHA RIVER BASIN								
Big Sheep Creek	Aug-24	4.0	0	0.0	0	0	0	0
Lick Creek	Aug-24	4.0	0	0.0	0	0	0	0
Imnaha River	Aug-25	9.7	15	1.5	11	2	0	0
IMNAHA BASIN TOTAL		17.7	15	1.5	11	2	0	0

Appendix 5. Summary of spring chinook salmon redds observed on spawning ground surveys in the Grande Ronde and Imnaha river basins, 1995.

Basin, Stream	Total miles surveyed	Total redds	Redds on index survey	Date	Redds on extensive survey*	Date	Redds on 1st supplemental survey**	Date	Redds on 2nd supplemental survey**	Date
GRANDE RONDE RIVER BASIN										
Bear Creek	10.6	0	0	Aug-22	0	Aug-22	--	--	--	--
Catherine Creek	20.2	14	7	Aug-29	0	Aug-22	4	Sep-06	3	Sep-13
Grande Ronde River	22.2	6	5	Aug-28	0	Aug-28	1	--	0	Sep-12
Hurricane Creek	3.0	0	0	Aug-21	0	Aug-21	0	Aug-30	0	Sep-06
Indian Creek	1.5	0	0	Sep-15	--	--	--	--	--	--
Lookingglass Creek	14.0	5	2	Sep-08	1	Sep-12	2	Sep-27	--	--
Lostine River	21.0	11	6	Aug-23	1	Aug-23	2	Aug-30	2	Sep-06
Minam River	17.8	20	13	Aug-30	2	Aug-29	5	Sep-07	0	Sep-14
Sheep Creek	9.0	0	0	Sep-03	0	Sep-03	--	--	--	--
Wallowa River	4.5	0	0	Aug-21	--	--	--	--	--	--
Wenaha River	29.0	24	2	Sep-05	19	ep-05-07	3	Sep-13	--	--
TOTAL	152.8	80	35		23		17		5	
IMNAHA RIVER BASIN										
Big Sheep Creek	23.5	0	0	Aug-24	0	Aug-24	--	--	--	--
Imnaha River	32.2	49	15	Aug-23	17	Aug-25	10	Sep-01	7	Sep-07
Lick Creek	4.0	0	0	Aug-24	--	--	--	--	--	--
TOTAL	59.7	49	15		17		10		7	

* Does not include redd counts in index areas.

** Includes only new redds.

Appendix 6. Summary of spring chinook salmon observed on spawning ground surveys in the Grande Ronde and Imnaha river basins, 1995.

Basin, Stream	Total miles surveyed	Fish on index survey			Fish on extensive survey*			Fish on first supplemental survey			Fish on second supplemental survey		
		Live	Dead	Date	Live	Dead	Date	Live	Dead	Date	Live	Dead	Date
GRANDE RONDE RIVER BASIN													
Bear Creek	10.6	0	0	22-Aug	0	0	22-Aug	--	--	--	--	--	--
Catherine Creek	20.2	5	1	29-Aug	0	0	29-Aug	1	0	6-Sep	0	4	13-Sep
Grande Ronde River	22.2	0	1	5-Sep	0	0	28-Aug	0	0	5-Sep	0	0	12-Sep
Hurricane Creek	3.0	0	0	21-Aug	--	--	--	0	0	30-Aug	0	0	6-Sep
Indian Creek	1.5	0	0	15-Sep	--	--	--	--	--	--	--	--	--
Lookingglass Creek	14.0	0	2	8-Sep	2	1	12-Sep	2	1	27-Sep	--	--	--
Lostine River	21.0	4	0	23-Aug	0	0	23-Aug	3	0	30-Aug	0	4	6-Sep
Minam River	17.8	4	1	30-Aug	1	0	29-Aug	0	3	7-Sep	0	0	14-Sep
Sheep Creek	9.0	0	0	3-Sep	0	0	3-Sep	--	--	--	--	--	--
Wallowa River	4.5	0	0	21-Aug	--	--	--	--	--	--	--	--	--
Wenaha River	29.0	1	0	5-Sep	10	3	5-Sep	1	0	13-Sep	--	--	--
TOTAL	152.8	14	5		13	4		7	4		0	8	
IMNAHA RIVER BASIN													
Big Sheep Creek	23.8	0	0	24-Aug	0	0	24-Aug	--	--	--	--	--	--
Imnaha River	32.2	13	0	25-Aug	13	7	25-Aug	11	6	1-Sep	2	6	7-Sep
Lick Creek	4.0	0	0	24-Aug	--	--	--	--	--	--	--	--	--
TOTAL	64.4	13	0		13	7		11	6		2	6	

* Does not include counts on index survey.

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