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11/30/91

AGE AND STOCK COMPOSITION OF FALL CHINOOK SALMON RETURNING TO WASHINGTON COLUMBIA RIVER HATCHERIES, 1990

Columbia River Laboratory Progress Report Number 91-11

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March, 1991

Introduction

Biological sampling at Columbia River hatcheries to estimate age and stock composition of fall chinook has been emphasized in recent years (Hymer, Kreitman, LeFleur, Norman, Roler). This report details age and stock composition of fall chinook returning to Washington Columbia River hatcheries downstream from McNary Dam. A separate paper, Columbia River Lab Progress Report 91-08 summarizes fall chinook age and stock composition returning to hatcheries upstream from McNary Dam. The data is primarily used to determine coded wire tag (CWT) expansion factors used in mixed stock fishery catch estimates, fall chinook run reconstruction, and run prediction. This information is incorporated into the Columbia River fall chinook harvest management data base.

Methods

Biological sampling was conducted throughout the run time and was concentrated on days when large numbers of fish were processed. The minimum sample size goal established by Bob Vreeland, National Marine Fisheries Service (Table 1) was used by the Battle Ground Laboratory. Fork length and gender were recorded and scale samples were collected using a systematic sampling procedure. All fish were mark sampled, fin clips noted, and snouts collected from adipose clipped (CWT) fish. Age was determined primarily from scale readings, but CWT analysis and fork length measurements were also incorporated. Although hatchery personnel sort returns into adults and jacks according to size, scale analysis often show small 3-year-olds and sometimes 4-year-olds in the "jack" category.

Scales were read by John Sneva - WDF Tumwater and the WDF Tag Recovery Lab dug and read the coded-wire tags. At federal hatcheries, sampling, scale and coded-wire tag reading, and age composition was handled by U.S. Fish and Wildlife Service (USF&WS).

Age composition was calculated from each week's sample to account for differential returns by age class. In weeks where no sampling occurred, proportions from an earlier/later week were used or an average of these were applied, provided those samples were representative of the fish that were not sampled.

Occasionally, scale readings did not coincide with true age based on CWT's. When appropriate, a scale reading error adjustment, specific to each hatchery, was applied to the age of the unmarked fish.

Stock composition in the escapement was determined from coded-wire tag recoveries. Usually, escapement returns were comprised of fish destined to return to that particular hatchery. In some cases, however, CWT and fin clip information indicated that stray fish or fish of a different race (spring or summer

chinook) were part of the escapement. Generally, adult escapement tag rates were used to extract stray stocks from each hatchery's returns. When adult escapement information was not available, juvenile release tag rates were applied.

Spring and fall chinook overlap for a few weeks at Cowlitz Hatchery. Tag rates were used to extract spring chinook from the fall chinook and vice versa.

Results

The 1990 pre-season forecast for Lower River Hatchery (LRH) fall chinook returns predicted a small Washington hatchery surplus but a larger shortfall for Oregon hatcheries. Staffs from both Washington and Oregon and the federal government developed supplemental broodstock capture programs to improve existing and establish new adult collection opportunities. The following is Washington's LRH broodstock collection efforts and results:

Grays Hatchery was supplemented with 148 snagged and 12 hoop-trapped fall chinook taken by Grays River Hatchery personnel and volunteers. In addition to the snagged and hoop-trapped fish, 497 fish returned voluntarily. Based on 1980-89 hatchery to natural spawn proportions, 88 fish that were snagged/hoop-trapped would not have voluntarily entered the hatchery.

Elokomin Hatchery was supplemented with 30 adult fall chinook seined from Mill Creek (Cowlitz Co.) by Elokomin Hatchery and Battle Ground Lab personnel. In addition, 1,511 fish were trapped by hatchery personnel at Foster Road Bridge rack, including 9 adults released upstream. The Mill Creek fish are not included in this report, but will be covered in a Progress Report for 1990 Washington natural spawn.

Near the end of the run at Abernathy Hatchery, Battle Ground Lab personnel seined 78 adult fall chinook just downstream from the hatchery and transported them to the holding pond. Voluntary returns totaled 1,695 fish.

The Toutle River Hatchery new adult rack, trapping and holding facility became operational in the fall of 1990. A total of 280 fall chinook were collected of which 19 adults and 24 jacks were put upstream to spawn naturally. The opening of the Toutle Hatchery marked the first hatchery collection and spawning since Mt. St. Helens eruption in 1980.

Improvements to the Modrow rack on the Kalama River greatly improved hatchery conversion based on 1988-89 hatchery to natural spawn proportion. An estimated 4,696 of the 6,183 fish trapped at the Modrow rack were the result of the improvements. Kalama Falls Hatchery escapement includes 198 adult males and 92 jacks put upstream from Kalama Falls to spawn naturally.

In addition to LRH broodstock supplementation, Washington hatcheries located upstream from Bonneville Dam also collected additional broodstock from mainstem dam fish ladders. Spring Creek Hatchery fall chinook escapement included 1,289 adult males, 2,007 females, and 100 jacks trapped at Bonneville Dam right ladder in addition to the 8,038 fish that returned voluntarily.

Lyons Ferry Hatchery escapement consisted of fall chinook trapped at Ice Harbor and Lower Granite Dam in addition to voluntary returns.

Fall chinook escapement to Priest Rapids Hatchery in 1990 was from fish trapped from Priest Rapids Dam left ladder and volunteers.

No fall chinook returns were reported at Klickitat Hatchery in 1990.

The 108 adult male and 318 female "brights" transferred from Bonneville Hatchery and spawned at Little White Salmon Hatchery are considered Oregon hatchery escapement and not covered in this report.

This report includes only two of the 101 adult and 7 jack fall chinook that returned to Lewis River Hatchery. The remaining fish were put upstream to spawn naturally.

At Cowlitz Hatchery, 27 spring chinook were spawned during the fall chinook time frame and no fall chinook were spawned during the spring chinook time frame in 1990.

Table 2 lists the final hatchery returns of adults and jacks as reported by WDF Salmon Culture Division and the U.S. Fish and Wildlife Service. Data for actual biological sample sizes collected by WDF and USF&WS are also included. In addition, Battle Ground Lab's mark sample summary for each WDF facility is noted. The total escapement of fall chinook in 1990 for Washington Columbia River stations was 42,945. The total biological sample size was 9,137 or slightly more than 21% of the return. Battle Ground Lab mark sampled 22,613 fall chinook or 52.7% of the total return; the remaining 20,332 fall chinook were mark sampled by either WDF hatchery or USF&WS staffs.

Table 3 is a summary of the age composition at each Washington Columbia River hatchery located downstream from McNary Dam. Overall, 4 year-olds were the dominant age class (42.0%) followed by 3 year-olds, (28.4%). Two year-old and five-year-old returns to Washington Columbia River hatcheries downstream from McNary Dam in 1990 were nearly equal.

Tables 4-11 list the weekly age composition by sex to Columbia River hatcheries in 1990. The weekly totals represent fish that were processed during that time frame and do not necessarily imply arrival time. A summary of the scale age error

adjustments made to some of the state hatchery age compositions is listed in the Appendix.

Table 12 lists the age composition by sex of fall chinook returning to Lewis River Hatchery and not put upstream in 1990.

Tables 13-16 list the age composition by sex to federal Columbia River hatcheries in 1990.

Tables 17-29 list the stock composition by age of the Washington Columbia River stations.

Table 30 is a summary of the total Lower River Hatchery (LRH) stock escapement at Washington Columbia River hatcheries. Returns to Cowlitz, Kalama (including Lower Kalama and Kalama Falls), and Washougal hatcheries comprised 79.6% of the total LRH return. Overall, LRH stock comprised over half (52.3%) of the total return of fall chinook to Washington Columbia River hatcheries in 1990. Two-year-old LRH returns in 1990 were more than double last years returns.

The total Lower River Wild (LRW) stock component at Washington lower Columbia River hatcheries is listed in Table 31. This stock is a natural spawning stock primarily produced in the North Lewis River.

Table 32 is a summary of the total escapement of Rogue River Bright fall chinook. This stock was introduced by Oregon in 1982 into Big Creek Hatchery and 1983 in the South Fork Klaskanine River.

Table 33 is a summary of total Bonneville Pool Hatchery (BPH) stock escapement at Columbia River hatcheries. The voluntary return to Spring Creek Hatchery was supplemented with fish trapped from Bonneville Dam right ladder. Three year-olds (43.4%) were the dominant age class, followed by two and four-year-olds (28.5% and 27.7% respectively). The BPH return in 1990 was over twice as large as last year. This year's two-year-old return was five times greater than 1989's two-year-old return.

The total Bonneville (Hatchery) Upriver Brights (BUB) stock escapement at Columbia River hatcheries located downstream of McNary Dam is included in Table 34. All BUBs originated from stock taken from Priest Rapids Hatchery or Bonneville Dam right ladder and were formerly called Bonneville Egg Bank (BEB) stock.

Table 35 is a summary of the total Pool Upriver Bright (PUB) stock returning to Washington Columbia River hatcheries located downstream from McNary Dam. PUBs are bright stock fall chinook released at various hatcheries and streams between McNary and Bonneville Dams.

Table 36 is a summary of the Upriver Bright stock straying to hatcheries downstream from McNary Dam.

Table 37 lists numbers of Bonneville summer chinook (stray) found at Washington Columbia River Hatcheries.

Tables 38-39 list Washington Columbia River Hatchery returns from 1981-90 for adult and jack fall chinook salmon.

Summary

The state's minimum sample size goal was achieved at all but the following four stations; Elokomin and Toutle hatcheries were 75% and 86% of the minimum goal, Cowlitz and Priest Rapids were 21-43 biological samples below the minimum goal for each hatchery. Under-sampling could be attributed to Cowlitz and Priest Rapids hatcheries spawning several times a week and Priest Rapids due to large numbers of fish sampled at Lyons Ferry Hatchery and Hanford Reach. The small numbers of fish held at Lewis River Hatchery (Lewis stock) were not sampled.

An overall biological sample rate of 21.3% at the Washington Columbia River hatcheries provided enough data to adequately profile the 1990 fall chinook run.

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Table 1. Minimum return sample sizes at fall chinook hatcheries, 1990.

Hatchery Return	Adjusted minimal Sample size 1/
100	100
200	198
300	273
500	391
750	499
1,000	580
1,250	642
1,500	691
2,500	816
5,000	944
7,500	996
10,000	1,024
15,000	1,054
20,000	1,070
25,000	1,080
30,000	1,086

1/ Sampling levels based on any age group being 30 percent of the total return +_ 10 percent at 95 percent confidence intervals.

Table 2. Washington Columbia River hatcheries fall chinook returns and sample size summary, 1990.

Station	Hatchery Return			Minimum Sample Goal Size Adults and Jacks		Actual Biological Sample Size Adults and Jacks		Battle Ground Lab Mark Sample Size Adults and Jacks 1/	
	Adults	Jacks	Total	Number	Percent	Number	Percent	Number	Percent
Grays 2/	629	28	657	459	70	591	90	591	90
Elokomin 3/	1,498	13	1,511	692	46	521	34	1,039	69
Cowlitz	6,357	473	6,830	982	14	961	14	4,887	72
Lower Kalama	1,899	161	2,060						
Kalama Falls 4/	3,980	143	4,123	969	16	1,437	23	4,593	74
Toutle 5/	253	27	280	258	92	221	79	221	79
Lewis (Lewis) 6/	2	0	2	2	100	0	0	0	0
Washougal	4,814	296	5,110	946	19	1,280	25	5,110	100
Lyons Ferry 7/	1,662	981	2,643	824	31	912	35	2,242	85
Priest Rapids 8/	3,479	451	3,930	889	23	846	22	3,930	100

1/ All fish were mark sampled, either by hatchery staff or Battle Ground Lab staff. This column reflects the portion the Battle Ground Lab mark sampled.

2/ Includes estimated 88 of the 148 snagged and 12 hoop trapped fish would not have voluntarily returned to Grays Hatchery based on 1980-89 Grays River hatchery/natural spawn escapement ratio.

3/ Does not include 30 adults seined from Mill Cr. (Cowlitz County) and spawned at Elokomin Hatchery. Elokomin escapement includes 9 adults put upstream from rack.

4/ Lower Kalama Hatchery and Kalama Falls Hatcheries are combined for sampling goals. Kalama Falls return includes 198 adult males and 92 jacks put upstream from Kalama Falls to spawn naturally.

5/ Include 19 adults and 24 jacks put upstream from Toutle Hatchery to spawn naturally.

6/ Does not include 99 adults and 7 jacks released upstream from Lewis Hatchery to spawn naturally.

7/ Includes fall chinook trapped at Ice Harbor and Lower Granite Dams and fish that voluntarily returned.

8/ Include Priest Rapids Hatchery voluntary returns and chinook trapped at Priest Rapids Dam left ladder.

Table 2. Washington Columbia River hatcheries fall chinook returns and sample size summaries, 1990 (cont.).

Station	Hatchery Return			Minimum Sample Goal Size Adults and Jacks		Actual Biological Sample Size Adults and Jacks		Battle Ground Lab Mark Sample Size Adults and Jacks 1/	
	Adults	Jacks	Total	Number	Percent	Number	Percent	Number	Percent
Sea Resources 9/	450	12	462	-----	-----	454	98	-----	-----
Abernathy 10,11/	1,298	475	1,773	-----	-----	463	26	-----	-----
Little White Salmon 10,12/ (brights)	1,730	400	2,130	-----	-----	716	34	-----	-----
Spring Creek 10,13/	8,121	3,313	11,434	-----	-----	727	6	-----	-----
Total	36,172	6,773	42,945	6,020	14.02	9,137	21.28	22,613	52.66

9/ Sea Resources Hatchery sampled by hatchery personnel.
10/ Abernathy, Little White Salmon, and Spring Creek Hatchery sampled by federal personnel.
11/ Includes 78 adults seined just downstream from hatchery and transported to holding pond.
12/ Does not include 108 adult male and 318 female brights transferred from Bonneville Hatchery and spawned at Little White Salmon Hatchery.
13/ Includes 1,289 adult males, 2,007 females, and 100 jacks trapped at Bonneville Dam right ladder and 8,038 chinook that voluntarily returned.

Table 3. Age composition of fall chinook returning to Washinton Columbia River Hatcheries located downstream from McNary Dam, 1990. 1/

Station	2's	3's	4's	5's	6's	Total
Grays						
Number	22	37	381	170	47	657
Proportion of return	0.034	0.056	0.580	0.259	0.071	1.000
Elokomin						
Number	21	266	939	270	15	1,511
Proportion of return	0.014	0.176	0.621	0.179	0.010	1.000
Toutle						
Number	27	31	220	2	0	280
Proportion of return	0.096	0.111	0.786	0.007	0.000	1.000
Cowlitz						
Number	393	1,501	3,735	981	220	6,830
Proportion of return	0.057	0.220	0.547	0.144	0.032	1.000
Lower Kalama						
Number	110	334	984	556	76	2,060
Proportion of return	0.053	0.162	0.478	0.270	0.037	1.000
Kalama Falls						
Number	90	321	2,142	1,334	236	4,123
Proportion of return	0.022	0.078	0.519	0.324	0.057	1.000
Lewis						
Number	0	0	0	2	0	2
Proportion of return	0.000	0.000	0.000	1.000	0.000	1.000
Washougal						
Number	293	1,712	2,209	788	108	5,110
Proportion of return	0.057	0.335	0.433	0.154	0.021	1.000
Sea Resources						
Number	17	78	332	34	1	462
Proportion of return	0.037	0.169	0.718	0.074	0.002	1.000

1/ Based on scale and CWT analysis, and not necessarily on adult/jack calls by hatchery staff.

Table 3. Age composition of fall chinook returning to Washington Columbia River Hatcheries located downstream from McNary Dam, 1990. 1/ (cont)

ation	2's	3's	4's	5's	6's	Total
Abernathy						
Number	424	863	466	20	0	1,773
Proportion of return	0.240	0.487	0.262	0.011	0.000	1.000
Little White Salmon (brights)						
Number	370	246	657	782	75	2,130
Proportion of return	0.174	0.115	0.309	0.367	0.035	1.000
Spring Creek (Bonn. Dam trapped)						
Number	662	1,561	1,150	23	0	3,396
Proportion of return	0.195	0.460	0.338	0.007	0.000	1.000
Spring Creek (swim-in tules)						
Number	2,565	3,360	2,057	56	0	8,038
Proportion of return	0.319	0.418	0.256	0.007	0.000	1.000
Total						
Number	4,994	10,310	15,272	5,018	778	36,372
Proportion of return	0.137	0.284	0.420	0.138	0.021	1.000

1/ Based on scale and CWT analysis, and not necessarily on adult/jack calls by hatchery staff.

Table 4. Weekly age composition by sex of fall chinook returning to Grays River Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
29-Sep	Male	1	1	8	8	17	17	0	0	0	0	26	26
	Female	0	0	1	1	21	21	8	8	0	0	30	30
06-Oct	Male	3	4	6	14	15	32	9	9	1	1	34	60
	Female	0	0	0	1	21	42	11	19	1	1	33	63
13-Oct	Male	5	9	7	21	20	52	8	17	4	5	44	104
	Female	0	0	3	4	31	73	36	55	2	3	72	135
20-Oct	Male	2	11	5	26	23	75	8	25	5	10	43	147
	Female	0	0	1	5	47	120	15	70	14	17	77	212
27-Oct	Male	0	11	0	26	45	120	14	39	2	12	61	208
	Female	0	0	0	5	36	156	23	93	5	22	64	276
03-Nov	Male	10	21	6	32	48	168	16	55	3	15	83	291
	Female	0	0	0	5	53	209	21	114	9	31	83	359
10-Nov	Male	1	22	0	32	2	170	0	55	0	15	3	294
	Female	0	0	0	5	2	211	1	115	1	32	4	363

Table 5. Weekly age composition by sex of fall chinook returning to Elokomin Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
15-Sep	Male	0	0	9	9	20	20	1	1	0	0	30	30
	Female	0	0	2	2	36	36	4	4	0	0	42	42
22-Sep	Male	3	3	51	60	118	138	7	8	0	0	179	209
	Female	0	0	12	14	194	230	21	25	2	2	229	271
29-Sep	Male	0	3	42	102	39	177	9	17	0	0	90	299
	Female	0	0	20	34	118	348	35	60	0	2	173	444
06-Oct	Male	10	13	47	149	55	232	5	22	0	0	117	416
	Female	0	0	7	41	57	405	14	74	0	2	78	522
13-Oct	Male	8	21	30	179	54	286	18	40	2	2	112	528
	Female	0	0	10	51	70	475	73	147	2	4	155	677
20-Oct	Male	0	21	15	194	38	324	37	77	2	4	92	620
	Female	0	0	11	62	61	536	25	172	2	6	99	776
27-Oct	Male	0	21	5	199	41	365	12	89	0	4	58	678
	Female	0	0	3	65	15	551	7	179	2	8	27	803
03-Nov	Male	0	21	0	199	16	381	0	89	3	7	19	697
	Female	0	0	2	67	7	558	2	181	0	8	11	814

Table 6. Weekly age composition by sex of fall chinook returning to the Toutle Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
29-Sep	Male	3	3	3	3	4	4	0	0	10	10
	Female	0	0	0	0	2	2	0	0	2	2
06-Oct	Male	0	3	2	5	2	6	0	0	4	14
	Female	0	0	0	0	5	7	0	0	5	7
13-Oct	Male	0	3	3	8	16	22	0	0	19	33
	Female	0	0	4	4	19	26	1	1	24	31
20-Oct	Male	2	5	10	18	49	71	0	0	61	94
	Female	0	0	1	5	50	76	1	2	52	83
27-oct	Male	20	25	7	25	23	94	0	0	50	144
	Female	0	0	0	5	24	100	0	2	24	107
03-Nov	Male	2	27	0	25	9	103	0	0	11	155
	Female	0	0	1	6	17	117	0	2	18	125

Table 7. Weekly age composition by sex of fall chinook returning to Cowlitz Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
08-Sep	Male	3	3	15	15	6	6	1	1	0	0	25	25
	Female	0	0	2	2	16	16	4	4	0	0	22	22
15-Sep	Male	0	3	1	16	1	7	0	1	0	0	2	27
	Female	0	0	0	2	1	17	1	5	0	0	2	24
22-Sep	Male	80	83	32	48	9	16	1	2	1	1	123	150
	Female	0	0	1	3	7	24	2	7	1	1	11	35
29-Sep	Male	0	83	1	49	1	17	0	2	0	1	2	152
	Female	0	0	1	4	6	30	2	9	0	1	9	44
06-Oct	Male	136	219	146	195	63	80	7	9	2	3	354	506
	Female	0	0	7	11	61	91	16	25	2	3	86	130
13-Oct	Male	88	307	102	297	150	230	73	82	21	24	434	940
	Female	0	0	10	21	154	245	88	113	16	19	268	398
20-Oct	Male	20	327	188	485	257	487	57	139	24	48	546	1,486
	Female	0	0	38	59	534	779	141	254	27	46	740	1,138
27-Oct	Male	46	373	294	779	425	912	70	209	27	75	862	2,348
	Female	0	0	52	111	835	1,614	236	490	47	93	1,170	2,308
03-Nov	Male	6	379	225	1,004	183	1,095	40	249	13	88	467	2,815
	Female	0	0	39	150	494	2,108	128	618	19	112	680	2,988
10-Nov	Male	14	393	158	1,162	143	1,238	20	269	7	95	342	3,157
	Female	0	0	55	205	195	2,303	62	680	9	121	321	3,309
17-Nov	Male	0	393	70	1,232	53	1,291	0	269	1	96	124	3,281
	Female	0	0	18	223	72	2,375	20	700	1	122	111	3,420
24-Nov	Male	0	393	35	1,267	27	1,318	0	269	1	97	63	3,344
	Female	0	0	10	233	40	2,415	11	711	1	123	62	3,482
01-Dec	Male	0	393	1	1,268	1	1,319	0	269	0	97	2	3,346
	Female	0	0	0	233	1	2,416	1	712	0	123	2	3,484

Table 8. Weekly age composition by sex of fall chinook returning to Lower Kalama Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
22-Sep	Male	0	0	38	38	77	77	71	71	0	0	186	186
	Female	0	0	0	0	36	36	30	30	0	0	66	66
29-Sep	Male	37	37	11	49	19	96	23	94	0	0	90	276
	Female	0	0	18	18	118	154	47	77	0	0	183	249
06-Oct	Male	6	43	20	69	37	133	27	121	0	0	90	366
	Female	0	0	15	33	118	272	75	152	3	3	211	460
13-Oct	Male	42	85	90	159	132	265	29	150	32	32	325	691
	Female	0	0	25	58	212	484	137	289	10	13	384	844
20-Oct	Male	10	95	19	178	18	283	9	159	0	32	56	747
	Female	0	0	6	64	51	535	42	331	12	25	111	955
27-Oct	Male	15	110	62	240	54	337	8	167	10	42	149	896
	Female	0	0	10	74	57	592	23	354	0	25	90	1,045
03-Nov	Male	0	110	15	255	25	362	5	172	0	42	45	941
	Female	0	0	0	74	18	610	23	377	9	34	50	1,095
10-Nov	Male	0	110	5	260	8	370	2	174	0	42	15	956
	Female	0	0	0	74	4	614	5	382	0	34	9	1,104

Table 9. Weekly age composition by sex of fall chinook returning to Kalama Falls Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
11-Aug	Male	2	2	1	1	6	6	3	3	1	1	13	13
	Female	0	0	0	0	1	1	0	0	0	0	1	1
18-Aug	Male	0	2	0	1	7	13	1	4	3	4	11	24
	Female	0	0	0	0	1	2	0	0	0	0	1	2
25-Aug	Male	0	2	2	3	10	23	5	9	1	5	18	42
	Female	0	0	0	0	0	2	0	0	0	0	0	2
01-Sep	Male	6	8	18	21	66	89	32	41	6	11	128	170
	Female	0	0	0	0	2	4	2	2	0	0	4	6
08-Sep	Male	12	20	9	30	14	103	3	44	4	15	42	212
	Female	0	0	2	2	12	16	7	9	1	1	22	28
15-Sep	Male	11	31	13	43	30	133	13	57	3	18	70	282
	Female	0	0	1	3	6	22	4	13	0	1	11	39
22-Sep	Male	2	33	2	45	11	144	3	60	3	21	21	303
	Female	0	0	2	5	19	41	11	24	1	2	33	72
29-Sep	Male	16	49	9	54	36	180	7	67	15	36	83	386
	Female	0	0	37	42	324	365	192	216	19	21	572	644
06-Oct	Male	0	49	13	67	68	248	30	97	0	36	111	497
	Female	0	0	22	64	339	704	265	481	54	75	680	1,324
13-Oct	Male	13	62	33	100	227	475	87	184	0	36	360	857
	Female	0	0	12	76	290	994	224	705	37	112	563	1,887
20-Oct	Male	3	65	30	130	94	569	54	238	0	36	181	1,038
	Female	0	0	3	79	109	1,103	38	743	27	139	177	2,064
27-Oct	Male	13	78	68	198	142	711	98	336	18	54	339	1,377
	Female	0	0	9	88	185	1,288	150	893	21	160	365	2,429
03-Nov	Male	3	81	22	220	71	782	41	377	7	61	144	1,521
	Female	0	0	0	88	38	1,326	42	935	6	166	86	2,515
10-Nov	Male	9	90	10	230	27	809	14	391	0	61	60	1,581
	Female	0	0	3	91	7	1,333	8	943	9	175	27	2,542

Table 10. Weekly age composition by sex of fall chinook returning to Washougal Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
29-Sep	Male	65	65	270	270	78	78	12	12	0	0	425	425
	Female	0	0	0	0	31	31	10	10	0	0	41	41
06-Oct	Male	62	127	443	713	176	254	30	42	0	0	711	1,136
	Female	0	0	17	17	184	215	16	26	0	0	217	258
13-Oct	Male	120	247	598	1,311	401	655	80	122	0	0	1,199	2,335
	Female	0	0	49	66	347	562	60	86	0	0	456	714
20-Oct	Male	17	264	167	1,478	213	868	80	202	4	4	481	2,816
	Female	0	0	56	122	400	962	177	263	76	76	709	1,423
27-Oct	Male	4	268	48	1,526	71	939	50	252	0	4	173	2,989
	Female	0	0	23	145	172	1,134	129	392	0	76	324	1,747
03-Nov	Male	4	272	25	1,551	45	984	47	299	0	4	121	3,110
	Female	0	0	7	152	72	1,206	77	469	26	102	182	1,929
10-Nov	Male	14	286	2	1,553	5	989	5	304	0	4	26	3,136
	Female	0	0	1	153	3	1,209	3	472	1	103	8	1,937
17-Nov	Male	7	293	5	1,558	8	997	9	313	0	4	29	3,165
	Female	0	0	1	154	3	1,212	3	475	1	104	8	1,945

Table 11. Weekly age composition by sex of fall chinook returning to Sea Resources Hatchery, 1990.

Week Ending	Sex	Number of 2's		Number of 3's		Number of 4's		Number of 5's		Number of 6's		Total	
		Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum	Weekly	Cum
15-Sep	Male	0	0	2	2	0	0	0	0	0	0	2	2
	Female	0	0	0	0	0	0	1	1	0	0	1	1
22-Sep	Male	0	0	0	2	0	0	0	0	0	0	0	2
	Female	0	0	0	0	1	1	0	1	0	0	1	2
29-Sep	Male	0	0	1	3	0	0	0	0	0	0	1	3
	Female	0	0	1	1	1	2	0	1	0	0	2	4
06-Oct	Male	0	0	4	7	6	6	2	2	0	0	12	15
	Female	0	0	0	1	4	6	3	4	0	0	7	11
13-Oct	Male	1	1	6	13	8	14	2	4	0	0	17	32
	Female	0	0	2	3	15	21	3	7	0	0	20	31
20-Oct	Male	8	9	10	23	10	24	5	9	0	0	33	65
	Female	0	0	3	6	42	63	10	17	1	1	56	87
27-Oct	Male	0	9	15	38	22	46	0	9	0	0	37	102
	Female	0	0	7	13	74	137	6	23	0	1	87	174
03-Nov	Male	2	11	8	46	18	64	1	10	0	0	29	131
	Female	0	0	1	14	33	170	1	24	0	1	35	209
10-Nov	Male	0	11	7	53	20	84	0	10	0	0	27	158
	Female	0	0	1	15	44	214	0	24	0	1	45	254
17-Nov	Male	0	11	5	58	9	93	0	10	0	0	14	172
	Female	0	0	0	15	22	236	0	24	0	1	22	276
24-Nov	Male	6	17	5	63	3	96	0	10	0	0	14	186
	Female	0	0	0	15	0	236	0	24	0	1	0	276

Table 12. Age composition by sex of fall chinook returning to Lewis Hatchery and not put upstream 1990.

Sex	Number of 2's	Number of 3's	Number of 4's	Number of 5's	Total
Male	0	0	0	0	0
Female	0	0	0	2	2

Table 13. Age composition by sex of fall chinook returning to Abernathy Hatchery,

Sex	Number of 2's	Number of 3's	Number of 4's	Number of 5's	Total
Male	415	465	202	8	1,090
Female	9	398	264	12	683

Table 14. Age composition by sex of upriver bright fall chinook returning to Little White Salmon Hatchery, 1990.

Sex	Number of 2's	Number of 3's	Number of 4's	Number of 5's	Number of 6's	Total
Male	370	209	220	255	38	1,092
Female	0	37	437	527	37	1,038

Table 15. Age composition by sex of fall chinook trapped from Bonneville Dam right ladder and spawned at Spring Creek Hatchery, 1990.

Sex	Number of 2's	Number of 3's	Number of 4's	Number of 5's	Number of 6's	Total
Ma	655	509	215	10	0	1,389
Female	7	1,052	935	13	0	2,007

Table 16. Age composition by sex of swim-in tule fall chinook returning to Spring Creek Hatchery, 1990.

Sex	Number of 2's	Number of 3's	Number of 4's	Number of 5's	Number of 6's	Total
Male	2,556	1,989	839	39	0	5,423
Female	9	1,371	1,218	17	0	2,615

Table 17. Stock composition of fall chinook returning to Grays River Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	22	37	381	170	47	657
Rogue River Brights	1	1	5	0	0	7
LRH Escapemenent	21	36	376	170	47	650

Table 18. Stock composition of fall chinook returning to Elokomin Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	21	266	939	270	15	1,511
Rogue River Brights	8	9	50	5	0	72
LRH Escapement	13	257	889	265	15	1,439

Table 19. Stock composition of fall chinook returning to the Toutle Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	27	31	220	2	0	280
Unresolved Discrepancy 1/	1	0	0	0	0	1
LRH Escapement	26	31	220	2	0	279

1/ Marked coho sampled as fall chinook; however, coded-wire tag was read and verified as coho.

Table 20. Stock composition of fall chinook returning to Cowlitz Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	393	1,501	3,735	981	220	6,830
Unresolved Discrepancy 1/	0	2	0	0	0	2
Cowlitz Spring Chinook	0	0	22	5	0	27
LRW Fall Chinook	0	0	44	54	0	98
Sub-Total	393	1,500	3,670	922	220	6,705
(From Spring Chinook Time Frame)	0	0	0	0	0	0
Total LRH Fall Chinook Escapement	393	1,499	3,669	922	220	6,703

1/ Marked coho sampled as fall chinook; however coded-wire tags were read and verified as coho.

Table 21. Stock composition of fall chinook returning to Lower Kalama Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	110	334	984	556	76	2,060
LRH Escapement	110	334	984	556	76	2,060

Table 22. Stock composition of fall chinook returning to Kalama Falls Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	90	321	2,142	1,334	236	4,123
Unresolved Discrepancy 1/	0	0	0	1	0	1
LRW Escapement	0	0	21	81	0	102
Rogue River Brights	0	0	2	0	0	2
LRH Escapement	90	321	2,119	1,252	236	4,018

1/ Marked coho sampled as fall chinook; however coded-wire tag was read and verified as coho.

Table 23. Stock composition of fall chinook returning to Lewis Hatchery and not put upstream, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	0	0	0	2	0	2
LRW Escapement	0	0	0	2	0	2

Table 24. Stock composition of fall chinook returning to Washougal Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	293	1,712	2,209	788	108	5,110
LRH Escapement	293	1,712	2,209	788	108	5,110

Table 25. Stock composition of fall chinook returning to Sea Resources Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	17	78	332	34	1	462
LRH Escapement	17	78	332	34	1	462

Table 26. Stock composition of fall chinook returning to Abernathy Hatchery, 1990.

	2's	3's	4's	5's	Total
Total Escapement	424	863	466	20	1,773
Rogue River Brights	1	21	29	2	53
LRH Escapement	423	842	437	18	1,720

Table 27. Stock composition of upriver bright fall chinook returning to Little White Salmon Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	370	246	657	782	75	2,130
URB Escapement	0	0	0	4	0	4
BUB (NMFS) Escapement	34	13	121	0	0	168
BUB Escapement	168	69	113	95	0	445
PUB Escapement	168	164	423	683	75	1,513

Table 28. Stock composition of fall chinook trapped from Bonnneville Dam right ladder and spawned at Spring Creek Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	662	1,561	1,150	23	0	3,396
LRH Escapement	0	0	22	6	0	28
Rogue River Bright	0	0	1	0	0	1
Bonn. summer chinook	0	0	12	0	0	12
BPH Escapement	662	1,561	1,115	17	0	3,355

Table 29. Stock composition of swim-in tule fall chinook returning to Spring Creek Hatchery, 1990.

	2's	3's	4's	5's	6's	Total
Total Escapement	2,565	3,360	2,057	56	0	8,038
BUB Escapement	0	0	33	15	0	48
PUB Escapement	0	0	2	7	0	9
URB Escapement	0	0	1	1	0	2
BPH Escapement	2,565	3,360	2,021	33	0	7,979

Table 30. Total LRH escapement to Washington Columbia River Hatcheries, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Grays River	21	36	376	170	47	650
Elokomin	13	257	889	265	15	1,439
Cowlitz	393	1,499	3,669	922	220	6,703
Lower Kalama	110	334	984	556	76	2,060
Kalama Falls	90	321	2,119	1,252	236	4,018
Toutle	26	31	220	2	0	279
Washougal	293	1,712	2,209	788	108	5,110
Sea Resources	17	78	332	34	1	462
Abernathy	423	842	437	18	0	1,720
Spring Creek (Bonn. Dam trapped)	0	0	22	6	0	28
Total	1,386	5,110	11,257	4,013	703	22,469

Table 31. Total LRW escapement to Washington Columbia River Hatcheries, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Cowlitz	0	0	44	54	0	98
Kalama Falls	0	0	21	81	0	102
Lewis (Lewis stock)	0	0	0	2	0	2
Total	0	0	65	137	0	202

Table 32. Total Rogue River Bright Stock escapement to Washington Columbia River Hatcheries, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Grays	1	1	5	0	0	7
Elokomin	8	9	50	5	0	72
Kalama Falls	0	0	2	0	0	2
Abernathy	1	21	29	2	0	53
Spring Creek (Bonn. Dam Trapped)	0	0	1	0	0	1
Total	10	31	87	7	0	135

Table 33. Total BPH escapement to Washington Columbia River Hatcheries, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Spring Creek (swim-in)	2,565	3,360	2,021	33	0	7,979
Spring Creek (Bonn. Dam trapped)	662	1,561	1,115	17	0	3,355
Total	3,227	4,921	3,136	50	0	11,334

Table 34. Total BUB escapement to Washington Columbia River Hatcheries located downstream from McNary Dam, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Spring Creek (swim-in)	0	0	33	15	0	48
Little White Salmon (brights)	202	82	234	95	0	613
Total	202	82	267	110	0	661

Table 35. Total PUB escapement to Washington Columbia River Hatcheries located downstream from McNary Dam, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Little White Salmon (brights)	168	164	423	683	75	1,513
Spring Creek (swim-in)	0	0	2	7	0	9
Total	168	164	425	690	75	1,522

Table 36. Total URB escapement to Washington Columbia River Hatcheries located downstream from McNary Dam, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Spring Creek (swim-in)	0	0	1	1	0	2
Little White Salmon	0	0	0	4	0	4
Total	0	0	1	5	0	6

Table 37. Total Bonneville summer chinook (stray) escapement to Washington Columbia River hatcheries, 1990.

Hatchery	2's	3's	4's	5's	6's	Total
Spring Creek (Bonn. Dam trapped)	0	0	12	0	0	12

able 38. Washington Columbia River Hatchery adult fall chinook returns 1981-90.

	Hatchery Return									
tation	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
rays	54	675	268	169	226	1,215	340	1,357	681	629
lokomin	633	2,059	2,690	1,708	1,809	1,515	4,811	4,705	3,677	1,498 1/
bernathy	1,450	2,065	1,950	557	1,974	439	1,752	1,335	1,417	1,298
owlitz	4,697	4,284	5,969	5,117	6,434	10,757	11,699	13,798	11,376	6,357
ower Kalama (tule)	1,519	760	650	1,347	1,291	2,495	2,407	658	1,307	1,899
ewis (Kalama stock)	0	0	0	0	0	0	0	0	152	0
alama Falls (tule)	4,233	812	3,866	3,894	3,445	3,672	4,307	3,438	2,280	3,980
peelyai 2/	633	0	0	130	414	0	0	0	0	0
ewis 2/	0	205	446	5	20	10	71	1	16	2
ashougal	3,659	2,565	3,996	1,957	2,298	10,402	5,704	5,219	6,719	4,814
ittle White Salmon (tule)	1,236	2,047	1,139	560	208	650	971	684	0	0
ittle White Salmon (brights)	0	0	0	68	412	1,541	2,724	1,937	1,647	1,730
pring Creek 3/	23,509	26,708	9,403	8,708	5,397	3,299	1,986	3,638	4,343	8,121
lickitat	280	314	147	137	8	202	41	0	0	0
yons Ferry 4/	0	0	0	698	595	457	3,267	1,403	1,880	1,662
ingold	0	177	154	0	0	1,430	1,190	0	0	0
riest Rapids 5/	1,594	2,613	3,042	6,388	11,957	14,865	18,171	9,966	6,496	3,479
ea Resources	6/	6/	6/	841	323	108	381	609	236	450

1/ Does not include 30 adult fall chinook seined from Mill Cr. and spawned at Elokomin Hatchery in 1990.
2/ Lewis River and Speelyai Hatcheries escapement does not include fall chinook put upstream to spawn naturally 1986-90.
3/ Includes fall chinook trapped from Bonneville Dam right ladder.
4/ Includes fall chinook trapped from Ice Harbor and Lower Granite Dams.
5/ Includes fall chinook trapped from Priest Rapids Dam left ladder.
6/ No immediate data available for Sea Resources Hatchery fall chinook escapement 1980-83.

able 39. Washington Columbia River Hatchery jack fall chinook returns 1981-90.

	Hatchery Return									
;tation	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
;rays	31	26	6	68	131	253	42	90	17	28
:lokomin	1	3	1	6	23	139	19	42	9	13
\bernathy	575	1,016	192	185	243	1,819	169	447	122	475
:owlitz	976	1,130	498	586	3,348	1,923	1,267	953	861	473
.ower Kalama (tule)	161	60	41	31	396	169	52	26	14	161
.ewis (Kalama stock)	0	0	0	0	0	0	0	0	1	0
(alama Falls (tule)	74	79	9	13	254	173	56	36	12	143
;peelyai 1/	113	0	0	213	322	0	0	0	0	0
.ewis 1/	0	178	151	6	41	28	37	1	1	0
Washougal	101	243	62	159	5,633	586	104	225	202	296
Little White Salmon (tule)	261	101	53	17	36	80	12	11	0	0
Little White Salmon (brights)	0	0	0	164	441	286	367	155	171	400
Spring Creek 2/	7,015	739	1,005	799	84	90	96	829	550	3,313
Klickitat	1	23	13	9	7	45	2	0	0	0
Lyons Ferry 3/	0	0	0	48	4,160	1,148	590	1,059	602	981
Ringold	0	14	50	0	0	710	2,131	0	0	0
Priest Rapids 4/	2,309	5,119	2,982	6,846	18,800	11,588	1,939	1,685	381	451
Sea Resources	5/	5/	5/	16	2	177	0	15	47	12

1/ Lewis River and Speelyai Hatcheries escapement does not include fall chinook put upstream to spawn naturally 1986-90.
2/ Includes fall chinook trapped from Bonneville Dam right ladder.
3/ Includes fall chinook trapped at Ice Harbor Dam and Lower Granite Dams.
4/ Includes fall chinook trapped from Priest Rapids Dam left ladder.
5/ No immediate data available for Sea Resources Hatchery fall chinook escapement 1980-83.

Appendix. A summary of scale age corrections applied to Washington Columbia River Hatcheries downstream from McNary Dam, 1990.

Hatchery	Scale age error adjustment
Grays River 1/	19.6% of the 5's were read as 4's 64.7% of the 6's were read as 5's
Elokomin 1/	21.9% of the 5's were read as 4's
Cowlitz	7.7% of the scales read as 4's were 5's 22.2% of the scales read as 5's were 6's
Lower Kalama 1,2/ Kalama Falls 1,2/	6.3% of the 4's were read as 5's 13.2% of the 5's were read as 4's 50.0% of the 6's were read as 5's
Washougal	31.4% of the 5's were read as 4's 0.9% of the 5's were read as 6's 11.1% of the 6's were read as 4's 77.8% of the 6's were read as 5's

1/ Rogue River Bright stock coded-wire tags and scale age readings were not used for scale age correction analysis.

2/ Lower Kalama and Kalama Falls coded-wire tag age versus scale age readings were combined to generate scale age corrections.