AGE COMPOSITION AND CODED WIRE TAG RECOVERIES OF SUMMER and FALL CHINOOK BROODSTOCK AT WELLS HATCHERY, 1993

Columbia River Laboratory Progress Report 94-29

Washington Department of Fish of Wildlife
Anadromous Fish Management
Columbia River Laboratory
16118 N.E. 219th St., P.O. Box 999
Battle Ground, Washington 98604

Larrie LaVoy
November 1994

INTRODUCTION

Maintaining genetic integrity of chinook salmon is guiding fish culture practices at the two new mitigation facilities in the upper Columbia River: Rock Island Fish Hatchery Complex funded by Chelan County Public Utility District and Methow Hatchery Complex funded by Douglas County Public Utility District. Production from these facilities are in addition to older programs for summer or fall chinook at Wells, Rocky Reach (Turtle Rock), and Priest Rapids hatcheries.

Generally, spring chinook populations have shown to be the most distinct with summer and fall migrating chinook electrophoretically indistinguishable from each other. The designation of summer and fall chinook upstream of Priest Rapids Dam is partly a label for management purposes rather than a reflection of differences in biological characteristics.

Since 1987, Wells Hatchery has curtailed broodstock collection for their summer chinook program in early fall (1 October in 1987, 15 September in 1988-90) to reduce the spawning of later timed chinook which have a higher contribution to fall net fisheries. The collection date cutoff between summer and fall chinook in 1991-93 was designated as 28 August which coincides with the separation date for counts at Wells Dam. The east ladder trap at Wells Dam became operational in 1991 with the objective of collecting broodstock for the Rock Island Hatchery Complex. Since most of the run passes the dam on the east side, the east ladder trap was more efficient and allowed the hatchery staff to collect the broodstock during a shorter period.

This report summarizes the age and coded wire tag (CWT) information on summer and fall chinook broodstock spawned at Wells Hatchery in 1993. Progeny will be used to meet the goals at Wells Hatchery (320,000 yearling and 484,000 subyearling summer chinook and 100,000 fingerling fall chinook) and in acclimation ponds on the Methow River at Carlton (400,000 yearling summer chinook) and on the Similkameen River near Oroville (576,000 yearling summer chinook).

METHODS

Chinook designated as summer run were collected from 29 June to 18 August. These fish were collected as swim-ins to Wells Hatchery or trapped at the east fish ladder at Wells Dam. Chinook were collected at the east ladder trap three

days per week. All chinook trapped at the ladder were retained for broodstock and, hence, were considered representative of the overall adult:jack and marked:unmarked populations. Chinook from the east ladder were tagged with a "hog-ring" type tag at the anterior base of the dorsal fin.

Collection of fall period chinook began on 2 October and were placed in a separate holding pond from summer chinook. Additional chinook which arrived during the spawning period were processed directly out of the swim-in trap as fall run fish. Some fall period chinook contained summer chinook CWTs. Most of these were spawned with the summer period broodstock. No chinook were collected from the east ladder in the fall.

Scales were collected on a sample of unmarked fish from the ladder trap and from the swim-ins. The sample rate on unmarked chinook collected during the summer was 1:4. The rate was 1:2 on unmarked chinook from the fall. Sampling occurred on five of six weekly spawning days, usually Wednesday. Spawning started on 13 October and ended on 17 November for both summer and fall period chinook.

All chinook processed, including pond mortalities, were examined for adipose clips. Snouts were taken from all adipose clipped chinook. Coded-wire tags were extracted from the snout and read immediately in order to isolate gametes from stray chinook. Collection site based on presence of a hog-ring (or scar from the hog-ring) was recorded for spawned chinook. Collection site for pond mortalities was not noted.

Scales were aged by John Sneva, Washington Department of Fish and Wildlife, Olympia, according to standard procedures.

RESULTS

A total of 1,252 chinook were kept for broodstock during the summer collection period from 29 June to 18 August 1993. Of this total, 822 chinook were trapped at the east ladder. During the fall period which started 2 October, 534 chinook were collected from the volunteer trap at Wells Hatchery. Hatchery "159" forms report an in-season estimated total of 1,258 summer chinook and 522 fall chinook.

An estimated 123 adipose clipped chinook voluntarily returned to Wells Hatchery during the summer period (9% of total) and 96 during the fall (18%). An estimated total of 142 adipose clipped chinook were collected at the east ladder (17%). These estimates vary slightly from those on

the in-season hatchery reports partly because the collection site was unknown for some summer period pond mortalities and because 24 CWT summer chinook arrived during the fall but were recorded on the summer period 159 forms.

Age composition

Age composition of the summer broodstock was similar between the swim-in chinook and those from the east ladder trap (Figure 1 and Table 1). Four-year old chinook dominated both collections, totalling 67% of the broodstock. Subyearling migrants comprised 41% of the swim-ins compared to 46% subyearlings for the ladder trapped chinook (Figure 2). Four-year old chinook released as yearlings were 20% females whereas yearling releases returning as five-year fish were 73% females. Three-year chinook were predominantly males as expected. Overall, there were 468 females and 791 males collected during the summer, for a female to male ratio of 1.00:1.69.

Age composition of the fall period broodstock showed a preponderance (70%) of four-year chinook also (Table 2). Subyearling migrants comprised 61% of the fall period chinook. Sex ratios by age class were similar to those during the summer period. There were 180 females and 354 males collected during the fall (1.00:1.97 ratio).

Stock composition

Of the 1,252 summer period chinook collected for broodstock, a total of 526 (42%) were hatchery summer chinook based on CWT expansions (Table 3). By subtraction, 726 chinook were natural origin fish. Hatchery programs contributed 157 Wells Hatchery stock summer chinook, 201 Similkameen summer chinook, 82 Carlton summer chinook, and 86 Dryden Pond/Wenatchee summer chinook. Only 5% of the hatchery origin chinook were from subyearling releases (1989 brood Wells Hatchery). With the exception of the Wenatchee summer chinook, no stray CWT chinook were collected during the summer.

Wenatchee summer chinook comprised 11% of the summer period swim-ins and 4% of the arrivals to the east ladder (Figure 3). Similkameen and Carlton pond chinook had similar contribution rates between swim-ins and arrivals at the east ladder. Similkameen Pond chinook comprised 18% of the summer period swim-ins and 15% of the arrivals to Wells Dam. Carlton Pond chinook contributed 6% of the swim-ins and 7% to Wells Dam.

Wells Hatchery summer period swim-ins were comprised of 150 (35%) natural origin chinook. Broodstock collected at

the east ladder contained 576 (70%) natural origin chinook. Both estimates were based on subtracting expanded hatchery CWTs from the total broodstock collected at each site.

Stock composition of chinook collected after 28 August was dominated by Turtle Rock fall chinook and secondly, Wells Hatchery summer chinook. Hatchery origin chinook contributed 283 (53%) of the 534 fall period broodstock. The hatchery component contained 126 Turtle Rock fall chinook, 70 Wells Hatchery summer chinook, 64 Priest Rapids fall chinook, 13 Similkameen summer chinook, and 9 Carlton summer chinook (Figure 4). One Hanford Reach fall chinook CWT was recovered.

Escapement past Wells Dam included 1,070 (30%) hatchery origin chinook of 3,574 counted at the dam during the summer period and 1,039 (86%) hatchery fish of 1,207 chinook counted in the fall. Therefore, hatchery origin chinook comprised 44% of the escapement past Wells Dam during the summer and fall period.

Survival rates as measured by returns to the Wells area in 1993 were estimated for the CWT groups. Highest survival to the area was 0.251% for 1989 brood Turtle Rock fall chinook and 0.247% for 1989 brood Similkameen summer chinook. These survivals are preliminary, based on single-year returns to the escapement area only.

DISCUSSION

In 1993, Similkameen and Carlton Pond chinook were as likely to voluntarily enter Wells Hatchery as to pass the east ladder based on contribution rates at each site. Dryden Pond summer chinook were more likely to voluntarily enter Wells Hatchery than the east ladder at Wells Dam.

Scale analysis and CWT expansion support the conclusion that natural origin chinook voluntarily enter Wells Hatchery and that Wells Hatchery chinook pass Wells Dam. This conclusion assumes that subyearling type scale patterns are almost exclusively natural origin chinook and that yearling patterns are predominantly hatchery origin. This assumption is valid during the summer period collections but deteriorates in the fall when subyearling fall chinook from Priest Rapids Hatchery enter the area. During the summer period, no subyearling type CWT chinook were collected at the east ladder and only 6% of the swim-ins were represented by subyearling CWT groups. Comparing the two types of analysis shows that summer period swim-ins were 35% natural origin by CWT expansion or 41% natural by subyearling scale patterns. East ladder chinook had a larger range of estimates between the two methods. Expansion of CWT recoveries indicated that east ladder chinook were 70%

natural origin compared to 46% natural by subyearling scale patterns.

Survival from Similkameen Pond surpassed that from Carlton Pond for age 4 chinook returning from the 1989 brood releases. Performance of the 1989 brood Similkameen release has been a pleasant surprise given the questionable health and challenging rearing conditions at Similkameen Pond in winter 1990-91. Initially it appears that 1990 brood survival for all of the hatchery summer chinook groups will be lower than that of the 1989 brood yearling releases. Reduced survival for the 1990 brood seems widespread across many stocks and regions.

Estimating the stock composition of chinook passing Wells Dam during the fall counting period is speculative. Since no chinook were intercepted at the dam, stock composition estimates were based on CWT analysis of fall period swim-ins to Wells Hatchery. The fall period swim-ins were a mixture of summer and fall chinook. Another complicating factor is that collections during the fall of 1993 began on 2 October nearly six weeks after summer collections were discontinued on 18 August.

RECOMMENDATIONS

1. Wells Hatchery production should emphasize the early returning portion of ocean-type chinook above Rocky Reach Dam; however, it is not necessary to totally exclude later arriving chinook from their program. The data shows a gradual influx beginning in September of "upriver-bright" fall chinook mingled with summer chinook and a large overlap of spawning timing between summer and fall CWT chinook. Managers might consider adopting a ceiling percentage of egg-takes from chinook arriving after August. For example, a lid of 25% gametes from fall period arrivals would match the percentages in the 1970's and early 1980's. Using a ceiling guideline would be a safeguard against repeating the actions that got us into the quagmire of labeling separate "summer" and "fall" chinook programs from one large homogenous population. This happened in the mid-1980's when we collected up to 60% of the broodstock from the run after August in order to meet program goals for summer chinook. The summer chinook from these late arriving parents were contributing in increasing numbers in traditional fall chinook fisheries and their use for representing "summer chinook" in fishery modeling was compromised.

2. Continue to use ladder trapped broodstock for Carlton

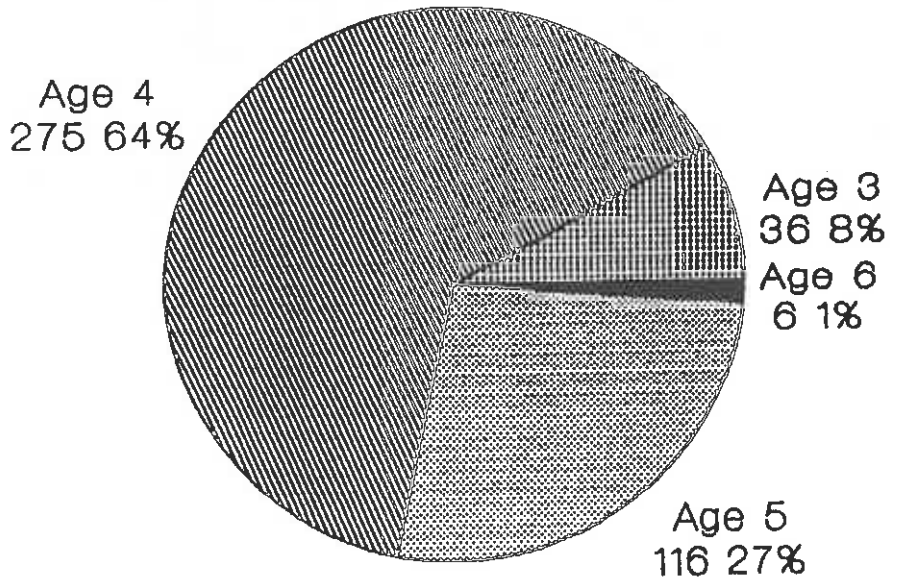
and Similkameen programs to reduce the potential for genetic influence from Wenatchee/Dryden Pond chinook.

3. Identify the collection site (volunteer or ladder trap) on the tag recovery form and on the mark sample form. This will provide the opportunity to expand tag recoveries from the ladder by a collection rate measured from the dam count. This sampling rate can be included in the PSMFC CWT database to document the estimate of escapement past the dam.

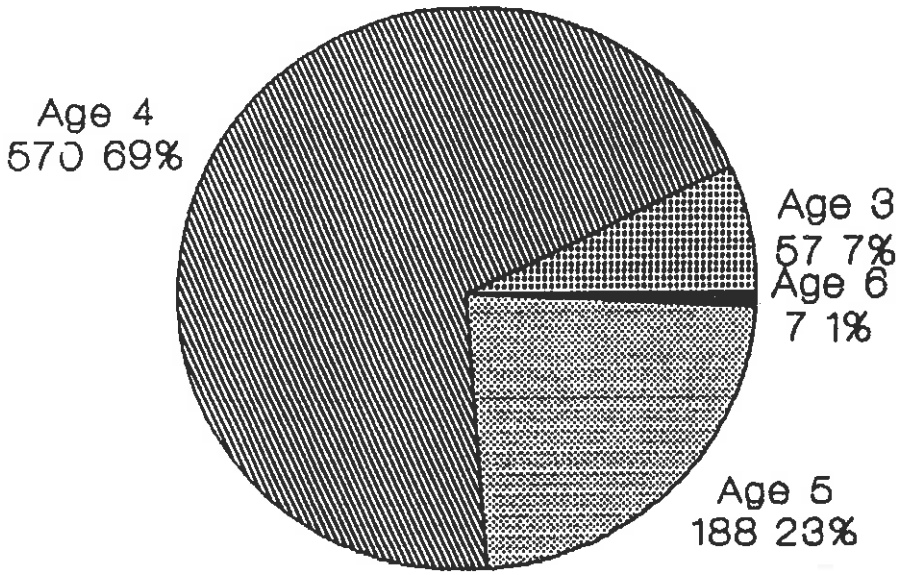
4. Scale samples and CWTs need to be collected from at least a portion of the broodstock arriving after August. The purpose of collecting some samples from the summer and fall arrivals is to facilitate run reconstruction with dam counts and to compare with past run sizes.

Figure 1.

AGE COMPOSITION WELLS AREA CHINOOK PRE-29 AUGUST 1993



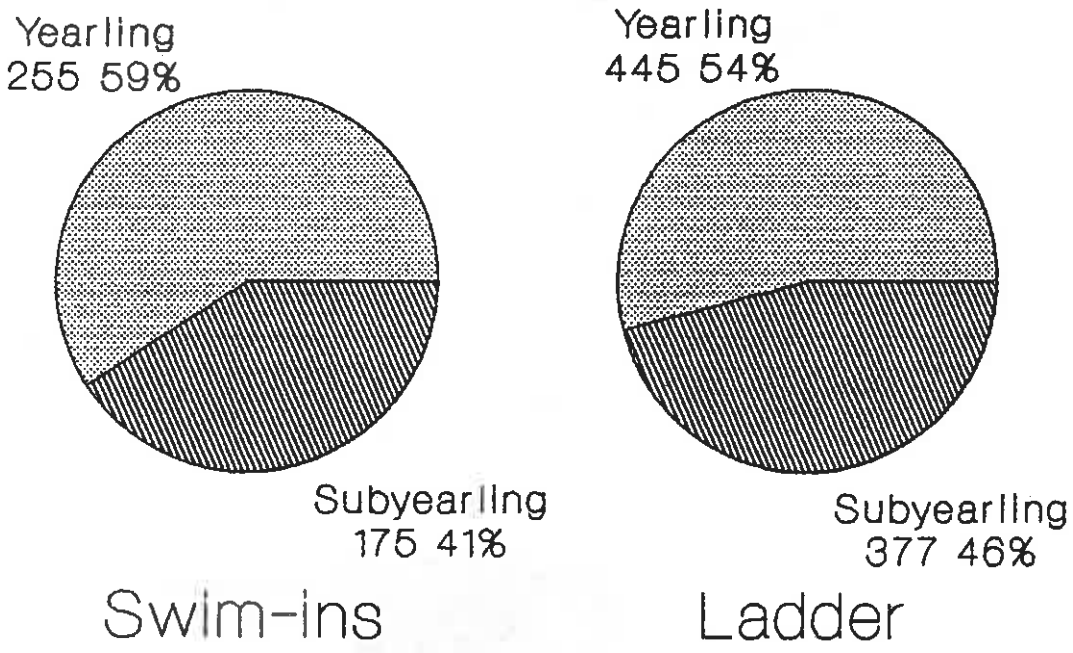
Swim-Ins



Ladder

Figure 2.

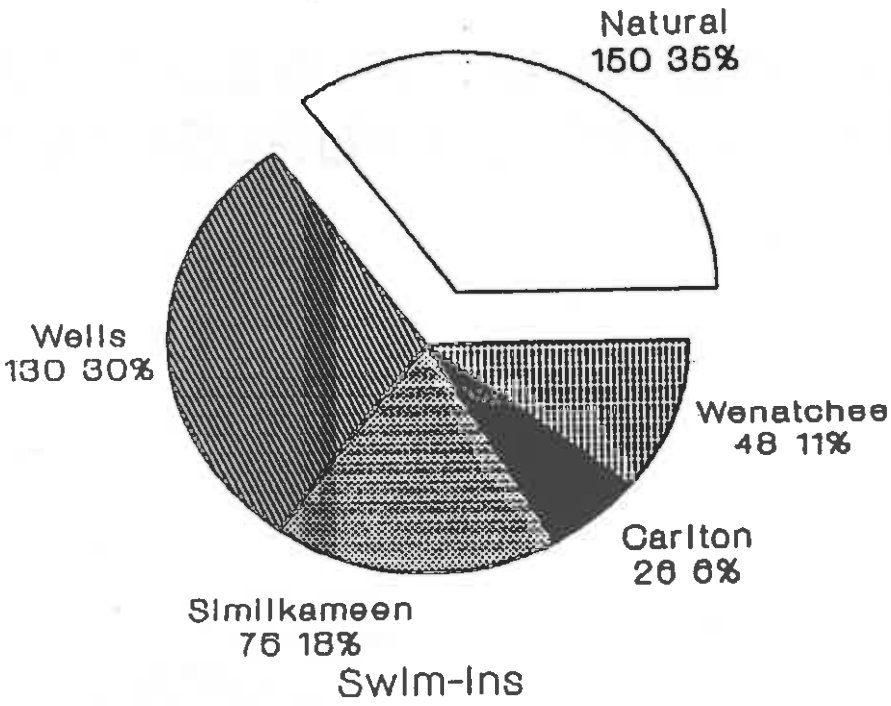
FRESHWATER AGE OF WELLS AREA CHINOOK PRE-29 AUGUST 1993

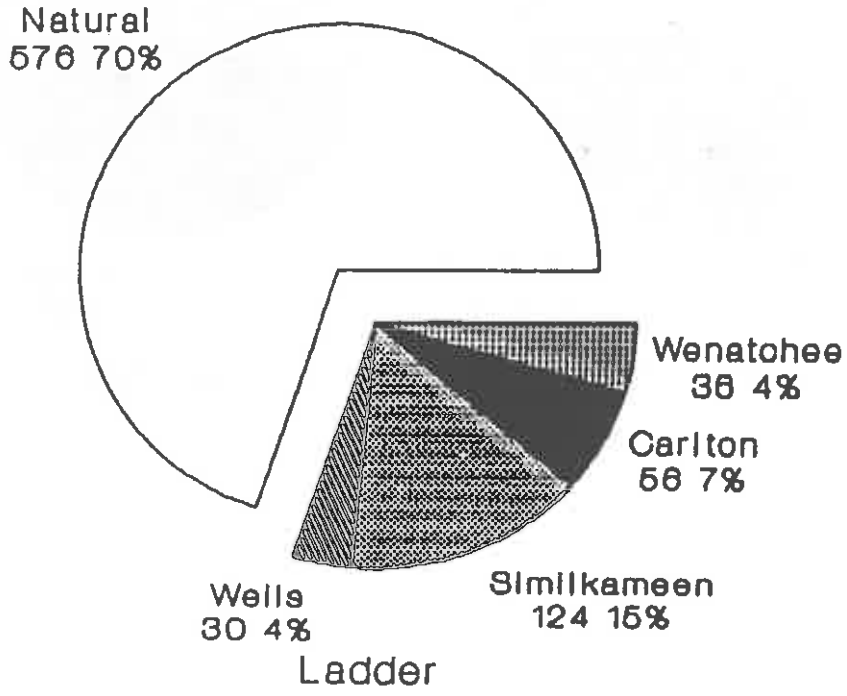


from scale analysis

Figure 3.

STOCK COMPOSITION OF WELLS AREA CHINOOK pre-29 AUGUST, 1993





from CWT expansion

Figure 4.

STOCK COMPOSITION OF WELLS AREA CHINOOK post-28 AUGUST, 1993

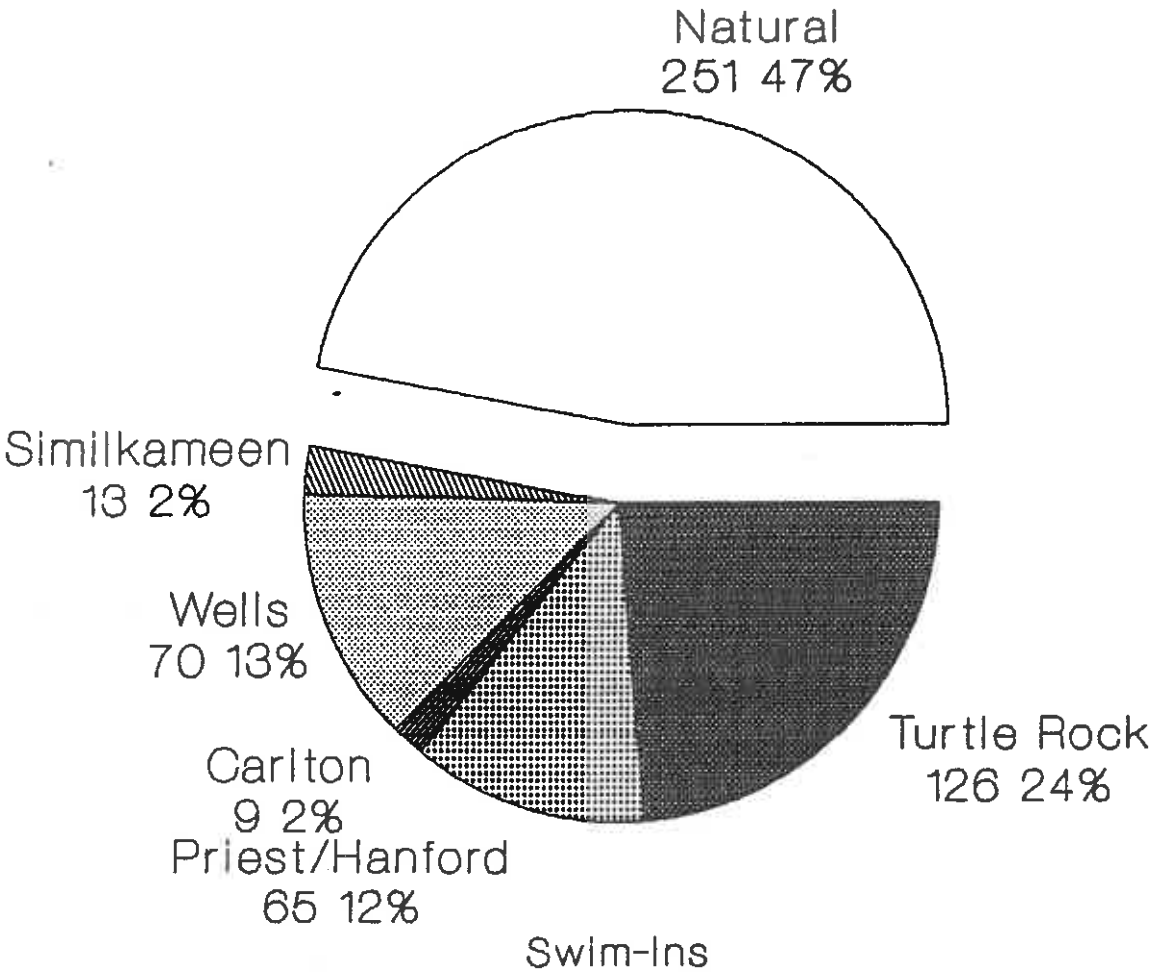


Table 1. Age and mark data from chinook broodstock collected before 29 August and spawned at Wells Hatchery in 1993.

ACTUAL SAMPLES (READABLE SCALES AND CWT) a/

TOTAL AGE b/

	Age 2		Age 3				Age 4				Age 5				Age 6				
	0.1		0.2		1.1		0.3		1.2		0.4		1.3		0.5		1.4		
Source	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Swim-ins:																			
unmarked	0	0	2	0	1	0	13	14	6	1	0	1	3	13	0	0	0	0	54
marked	0	0	0	0	10	0	1	2	51	8	0	0	9	15	0	0	0	5	101
Ladder																			
unmarked	0	0	4	1	2	0	22	11	15	10	3	10	3	11	0	0	0	1	93
marked	0	0	0	0	0	0	0	0	98	8	0	0	2	6	0	0	0	1	115

REPRESENTATIVE BIOLOGICAL PROFILE

TOTAL AGE b/

	Age 2		Age 3				Age 4				Age 5				Age 6				
	0.1		0.2		1.1		0.3		1.2		0.4		1.3		0.5		1.4		
Source	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Swim-ins																			
number	0	0	14	0	19	0	88	68	104	15	0	5	31	80	0	0	0	6	430
% by age	0.0	0.0	3.3	0.0	4.4	0.0	20.5	15.8	24.2	3.5	0.0	1.2	7.2	18.6	0.0	0.0	0.0	1.4	
Ladder																			
number	0	0	34	6	17	0	184	67	248	71	25	61	27	75	0	0	0	7	822
% by age	0.0	0.0	4.1	0.7	2.1	0.0	22.4	8.2	30.2	8.6	3.0	7.4	3.3	9.1	0.0	0.0	0.0	0.9	

a/ Excludes readable CWTs where collection site was unknown.

b/ Ages listed by number of freshwater annulus on left and ocean annulus on right.
Total age is 1 plus the number of annulus; eg. 1.3 is five year old yearling migrant.

Table 2. Age and mark data from chinook broodstock collected after 28 August at Wells Hatchery, 1993.

ACTUAL SAMPLES (READABLE SCALES AND CWT) a/

TOTAL AGE b/

	Age 2		Age 3				Age 4				Age 5				Age 6				
	0.1		0.2		1.1		0.3		1.2		0.4		1.3		0.5		1.4		
Source	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Swim-ins:																			
unmarked	0	0	10	0	0	0	28	46	16	2	3	13	4	8	0	0	1	0	131
marked	0	0	3	0	6	0	1	0	51	14	0	0	5	9	0	0	1	2	92

REPRESENTATIVE BIOLOGICAL PROFILE

TOTAL AGE b/

	Age 2		Age 3				Age 4				Age 5				Age 6				
	0.1		0.2		1.1		0.3		1.2		0.4		1.3		0.5		1.4		
Source	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	Total
Swim-ins																			
number	0	0	49	0	6	0	129	103	128	18	14	29	23	28	0	0	5	2	534
% by age	0.0	0.0	9.2	0.0	1.1	0.0	24.2	19.3	24.0	3.4	2.6	5.4	4.3	5.2	0.0	0.0	0.9	0.4	

a/ Excludes readable CWTs where collection site was unknown.

b/ Ages listed by number of freshwater annulus on left and ocean annulus on right.
Total age is 1 plus the number of annulus; eg. 1.3 is five year old yearling migrant.

Table 3. Contribution of hatchery origin chinook to Wells Dam and Wells Hatchery escapement in 1993.

Stock	Wells H. Volunteers		East Ladder Trap		Wells Dam Escapement			Wells area
	Pre-29 Aug	Post-28 Aug	Pre-29 Aug	Post-28 Aug	Pre-29 Aug	Post-28 Aug	Total	Surv. Rate
Wells H.								
1987 yearling	22	10	8	0	31	18	89	0.021%
1988 yearling	68	36	23	0	99	65	291	0.074%
1989 subyearling	24	16	0	0	0	0	40	0.003%
1990 yearling	16	6	0	0	0	0	22	0.006%
1990 subyearling	0	2	0	0	0	0	2	
Similkameen								
1989 yearling	69	13	123	0	540	125	870	0.247%
1990 yearling	7	0	0	0	0	0	7	0.001%
Carlton								
1989 yearling	23	9	54	0	242	117	445	0.106%
1990 yearling	3	0	0	0	0	0	3	0.001%
Wenatchee								
1989 yearling	45	0	38	0	158	0	241	0.033%
1990 yearling	3	0	0	0	0	0	3	0.002%
Priest FCh subyr.	0	64	0	0	0	240	304	0.005%
Turtle Rock								
1989 yearling	0	117	0	0	0	436	553	0.251%
1990 yearling	0	9	0	0	0	34	43	0.020%
Hanford FCh wild	0	1	0	0	0	4	5	0.003%
Total Hatchery	280	263	246	0	1070	1039	2918	
Total Natural	150 a/	251 a/	576 a/	0	2504	168	2672	
Total	430	534	822	0	3574 b/	1207 c/	5590	

Natural estimate by subtraction
/ Wells Dam count of 3404 adults and 170 jacks.
:/ Wells Dam count of 1048 adults and 159 jacks.

APPENDIX:

Worksheet 1. CWT expansions for pre-29 August collections with fall period add-ons.

CODED-WIRE TAG CODES RECOVERED IN WELLS SUMMER CHINOOK

Recoveries by Collection Site										#tagged	#rel.	Exp. rate	Expanded Recoveries			
Vol.	ladder	Fall	Unk.	AGENCY	D1	D2	RACE	STOCK	BY				Vol.	ladder	Fall	Unk.
24	8	10	3	63	2	62	summer	Wells 1	88	153645	391579	2.549	61	20	25	8
22	43	1	8	63	7	59	summer	Similkameen	89	116821	203795	1.745	38	75	2	14
12	17	1	6	63	56	13	summer	Similkameen	89	85304	148805	1.744	21	30	2	10
9	12	3	4	63	56	14	summer	Carlton	89	200670	235267	1.172	11	14	4	5
7	27	3	6	63	8	56	summer	Carlton	89	157567	184733	1.172	8	32	4	7
9	7	0	0	63	11	19	summer	Wenatchee	89	144905	720000	4.969	45	35	0	0
2	0	2	0	63	13	47	summer	Wells 0	89	99749	790925	7.929	16	0	16	0
1	0	0	0	63	13	52	summer	Wells 0	89	75600	519731	6.875	7	0	0	0
2	0	1	2	63	41	33	summer	Wells 1	90	122657	371369	3.028	6	0	3	6
3	0	0	0	63	43	37	summer	Wenatchee	90	119214	124440	1.044	3	0	0	0
3	0	0	2	63	44	17	summer	Similkameen	90	367207	540000	1.471	4	0	0	3
2	0	0	1	63	44	18	summer	Carlton	90	371483	391650	1.054	2	0	0	1
4	0	1	0	63	50	37	summer	Wells 1	87	61740	214949	3.482	14	0	3	0
1	1	2	1	63	50	38	summer	Wells 1	87	60818	214091	3.520	4	4	7	4
	115	24	33										240	210	65	48
												Lost tag adj.	228	217		
												Unk. collect adj.	249	246		
												Ladder rate (.1870) 822/(3404+822+170)		1316		
2	4	0	0	Lost tag												
4	6	0	0	No-tag												

1993 Hatchery Stock Composition of arrivals to Wells Dam
(based on eastern shore ladder CWT recoveries)

Wells 1+ 87'brd	39	0.9%
Wells 1+ 88'brd	122	2.8%
Similkameen 89'brd	663	15.1%
Carlton 1+ 89'brd	298	6.8%
Wenatchee 1+ 89'brd	194	4.4%
	1316	of 822+3404+170

APPENDIX:

Worksheet 2. CWT expansions for post 28 August chinook collections.

Recoveries by Collection Site	CWTs RECOVERED IN POST 28 AUGUST WELLS H. VOLUNTARY CHINOOK						#tagged	#rel.	Exp. rate	Expanded Recoveries
Fall	AGENCY	D1	D2	RACE	STOCK	BY				Fall
14	63	2	62	summer	Wells 1	88	153645	391579	2.549	36
6	63	7	59	summer	Similkameen	89	116821	203795	1.745	10
2	63	56	13	summer	Similkameen	89	85304	148805	1.744	3
3	63	56	14	summer	Carlton	89	200670	235267	1.172	4
4	63	8	56	summer	Carlton	89	157567	184733	1.172	5
0	63	11	19	summer	Wenatchee	89	144905	720000	4.969	0
2	63	13	47	summer	Wells 1	89	99749	790925	7.929	16
0	63	13	52	summer	Wells 1	89	75600	519731	6.875	0
2	63	41	33	summer	Wells 1	90	122657	371369	3.028	6
0	63	43	37	summer	Wenatchee	90	119214	124440	1.044	0
0	63	44	17	summer	Similkameen	90	367207	540000	1.471	0
0	63	44	18	summer	Carlton	90	371483	391650	1.054	0
1	63	50	37	summer	Wells 1	87	61740	214949	3.482	3
2	63	50	38	summer	Wells 1	87	60818	214091	3.520	7
48 a/	63	59	7	fall	Turtle Rk 1	89	90306	220400	2.441	117
1	63	59	13	summer	Wells 0	90	215672	329669	1.529	2
4	63	42	23	fall	Turtle Rk 1	90	90100	211000	2.342	9
2	63	7	32	fall	Priest R.H.	90	194530	6230590	32.029	64
1	63	7	55	fall	Hanford wild	89	144164	148398	1.029	1
92	Total									283
1	Lost Tag (assigned to Turtle Rock)									
4	No-tag									

a/ Includes the lost tag assigned to this code.