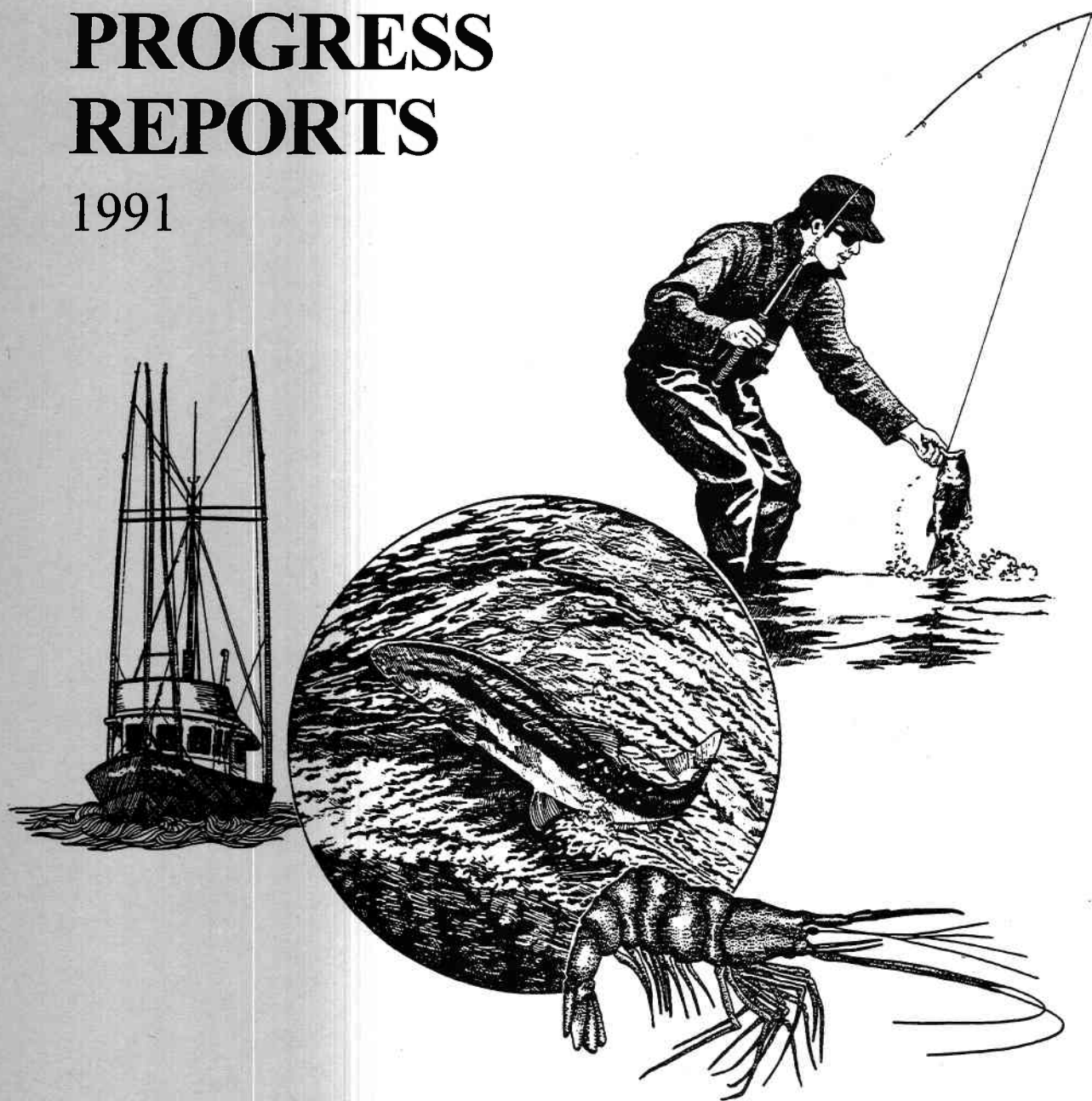


PROGRESS REPORTS

1991



FISH DIVISION

Oregon Department of Fish and Wildlife

Exploitation Rate Indicator Stock Monitoring; Catch
and Escapement of the North Oregon Coastal Fall
Chinook Salmon from Salmon River, Oregon, 1990

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Catch and Escapement of the North Oregon Coastal
Fall Chinook Salmon from Salmon River, Oregon, 1990.

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Objectives

1. Estimate the total number of salmonids and the number of coded-wire tagged fall chinook harvested in the fall recreational fishery in Salmon River, Lincoln County, Oregon, in 1990.
2. Estimate the total number of fall chinook salmon and the number of coded wire tagged chinook that escaped to natural spawning areas in the Salmon River, in 1990.
3. Determine the number of coded wire tagged fall chinook salmon and their origin captured and retained at the hatchery in 1990.
4. Compile estimates of recoveries of coded-wire tagged fall chinook from Salmon River hatchery harvested in the Pacific Ocean Fisheries, in 1990.
5. Revise spawner population estimates for 1986-1989 based on improved methods for accounting for the removal of tagged fish in the sport fishery.

Findings 1990

1. Recreational Fishery

We estimated that a total of 852 fall chinook salmon were harvested in the Salmon River recreational fishery in 1990. This catch was composed of an estimated 780 adults and 72 jacks and represents in-river harvest rate 34.3% of the total estimated ocean escapement of chinook salmon. The estimated freshwater harvest of coded-wire tagged chinook salmon from Salmon River Fish Hatchery was 286 adults, (1984-1987 broods), and 31 jacks (1988 brood).

2. Escapement to Natural Spawning Areas - 1990

We estimated that 1,525 fall chinook salmon were present on the spawning grounds in Salmon River in 1990. This estimate was partitioned into stratified estimates of 953 adult males, 446 adult females and 126 jack fall chinook salmon and represents spawning escapement rates of 61% and 63% of the total estimated ocean escapement of adults and jacks, respectively. The estimated upriver escapement of CWT chinook salmon from Salmon River Fish Hatchery was 391 adults and 84 jacks.

3. Hatchery Recovery

Salmon River Fish Hatchery retained 101 adult and 3 jack fall chinook salmon in 1990. Retention of chinook salmon by the hatchery accounted for 4 % and 2 % of the total estimated ocean escapement of adults and jacks, respectively. Hatchery personnel recovered 33 adult and 1 jack CWT chinook salmon from Salmon River Fish Hatchery.

4. Ocean Coded-wire Tag Recoveries

The Pacific States Marine Fisheries Commission reported estimated harvests of 599 adult and 6 jack coded-wire tagged Salmon River Hatchery chinook salmon in ocean fisheries in 1990. The majority of these tag recoveries occurred in SE Alaska commercial and sport fisheries - 225 recoveries; and North Central British Columbia commercial and sport fisheries - 185 recoveries. Additionally, other fishing areas reporting recoveries are as follows: West Coast Vancouver Island Troll fishery - 120 recoveries; Straits of Georgia, Johnstone Strait and Juan de Fuca Strait - 4 recoveries; PFMC area - 71 recoveries.

5. Revised Escapements to Natural Spawning Areas 1986-1989

Implementation of an improved population estimator led to revision of spawning populations estimates as follows: 1986 run year- 1,985 adult and 323 jack chinook; 1987 run year- 2,706 adult and 57 jack chinook; 1988 run year- 5,170 adult and 258 jack chinook; 1989 run year- 1,934 adult and 330 jack chinook.

INTRODUCTION

The Pacific Salmon Treaty between the United States and Canada created the Pacific Salmon Commission (PSC) to regulate mixed - stock fisheries that intercept salmon originating from both countries. Several technical committees were created to design and implement programs which provide information necessary to adhere to treaty principles and manage PSC fisheries in accordance with the treaty. One of the key conservation programs addressed in the treaty was the need to halt the decline in and increase the abundance of natural chinook salmon *Oncorhynchus tshawtscha* stocks. The goal of this program is to rebuild natural chinook stocks by 1998 up to escapement levels that will provide for long term sustained maximum yield. A program of fixed harvests (ceilings), were adopted for PSC fisheries by the parties in order to implement the rebuilding program. To monitor the effects of the rebuilding program the Chinook Technical Committee (CTC) required all parties to implement indicator stock projects to measure rates of exploitation and escapement of key natural stocks of chinook salmon under their jurisdiction.

In accordance with this program, the Ocean Salmon Management program of the Oregon Department of Fish and Wildlife developed projects in 1986 to monitor the catch and escapement of Oregon coastal stocks of naturally producing chinook salmon that contribute to fisheries under Treaty jurisdiction (Boechler and Jacobs, 1987). Salmon River Hatchery chinook are assumed to display patterns of distribution and harvest similar to Oregon's North Coast natural chinook populations that migrate into PSC fisheries. These populations are grouped together into the NOC stock aggregate for PSC harvest modeling purposes. Coded-microwire tagged (CWT) fall chinook salmon from Salmon River Hatchery are

used by the CTC to estimate the fishery index, exploitation rate, incidental fishing mortality, catch distribution and survival rate of this population aggregate. Concurrently, escapements of naturally occurring chinook in Oregon coastal rivers are monitored to measure if rebuilding is progressing at expected levels. This information is used by the CTC to evaluate the effectiveness of PSC management actions to achieve rebuilding and to recommend annual harvest management strategies that will meet rebuilding expectations.

Total ocean catch of CWT chinook salmon from Salmon River Fish Hatchery is estimated from data collected annually in port sampling programs throughout the Pacific Coast. These estimates are available through the Pacific States Marine Fisheries Commission, Portland, Oregon. Objectives of the Salmon River Indicator Stock project are: 1) tag and release at least 200,000 smolts representative of the far north migrating aggregate of stocks; 2) estimate the ocean escapement, including freshwater catch, brood stock collection and spawning escapement of CWT fall chinook salmon from Salmon River Fish Hatchery, and 3) report these data to the CTC for inclusion in the chinook harvest and rebuilding model and evaluation of PSC harvest management actions.

Chinook salmon returning to the Salmon River are either caught in the recreational fishery downstream of the hatchery, are captured at the hatchery, are caught in the recreational fishery upstream of the hatchery or spawn in the river basin above the hatchery. We estimated freshwater harvest by a statistical roving creel survey, recorded hatchery returns as they were recovered and estimated the number of chinook salmon that escaped to natural spawning areas using mark - recapture techniques and extensive spawning surveys. Additional objectives of this project are to analyze and calibrate the spawning fish surveys conducted for chinook salmon and collect any additional information on the fishery and spawning characteristics of these fish for state management purposes.

Currently, chinook salmon spawning surveys are used by the state only to assess long-term trends in escapement (Jacobs 1988). In compliance with PST monitoring, we need the ability to assess short-term changes in escapement relative to changes in ocean harvest patterns. Information from this project can provide a means to evaluate the interannual variation in stock abundance, reflecting marine survival conditions for north Oregon coastal natural chinook populations. The population estimate may provide a means to determine the accuracy of the coastal spawner survey statistic (peak fish per mile) and develop a procedure for estimating the total escapement of chinook salmon from spawning survey data.

This report presents results of the fifth year of freshwater run monitoring, and revisions of the spawner estimates obtained in 1986, 1987, 1988 and 1989. The objectives of this report are to (1) estimate the riverine catch and escapement of CWT fall chinook salmon that were released from Salmon River Fish Hatchery, (2)

compile estimates of CWT fall chinook salmon from Salmon River Fish Hatchery harvested in Pacific Ocean fisheries and (3) present additional results from the creel survey and spawning ground surveys conducted from 1990 that are important to the understanding of the biology and management of Oregon's coastal chinook salmon stocks.

METHODS

Methods used to estimate the ocean escapement of Salmon River fall chinook salmon from 1990 were previously described by Boechler and Jacobs (1987), with modifications described by Jacobs and Boechler (1988), Schindler et al. (1989), and Williams et al. (1993). A creel survey is conducted to estimate catch and a mark/recapture project is conducted to estimate the number of fish passing into the upper reaches of the river to spawn.

Expansion of sampled fish with coded micro-wire tags

To estimate the total number of chinook which contain a CWT, either caught or on the spawning grounds, a "standard ODFW expansion factor" is calculated using: 1) the fraction of the catch or the fraction of the escapement that were sampled; 2) ad-marked fish not processed (snouts not collected or snouts lost); and 3) microwire tags either lost or unreadable in processing. The following equation describes the calculation:

$$E = (N/T) * (A/S) * (W/D)$$

where:

E = expansion factor applied to each recovery of coded-wire tagged fish

N = estimated population size

T = number of fish sampled in both the catch or escapement

A = number of ad-marked fish observed in the sample

S = Number of snouts processed to locate CWT's

W = number of processed snouts with CWT's, and

D = number of CWT's decoded

Recoveries are typically recorded on the PSMFC data base using this expansion. However, this expansion does not account for ad-marked fish that have shed the CWT's. Because these are fish returning to their stream of origin, and contain few stray chinook, contribution analysis using results of CWT fish recovered in Salmon River should make adjustments to account for the "no tag" portion of the fish that were adipose marked. In-river CWT recoveries in this document are reported two ways : 1) using the standard expansion recorded as estimate A; and 2) apportioning the "no tag" recoveries proportionately among the decoded tag group and recorded as estimate B.

Mark/Recapture Population Estimate

The prior method developed for use on the Salmon River

assumes we can estimate the population size as it passes the hatchery based on the Chapman Version of the Petersen Estimate:

$$N = \frac{(M+1)(C+1)}{(R+1)}$$

where: N = Population of Chinook passing the hatchery
M = Number of Chinook Marked at hatchery and released
C = Number of Carcasses Sampled
R = Number of Marked Carcasses Sampled

Samples were stratified by gender and fork length to appropriately derive estimators based on the very differential recovery rates we obtain from sampling the spawning grounds for carcasses. The estimated catch was then subtracted from the estimated fish passing the hatchery to arrive at the number of spawners. A major problem with this method was that the number of anchor tagged fish (M) was actually diminished by the sport catch of anchor tagged fish, but was never adjusted in the prior estimates.

We have changed the method to now adjust the number of fish that were anchor tagged to account for any of these anchor tagged fish harvested after tagging, in the sport catch. During the creel survey the number of anchor tagged fish are counted and expanded for the sampling fraction. This number is then subtracted from the actual number that were anchor tagged and released, to derive the potential number that were available to escape and spawn as follows:

$$M_s = M_h - (R_2 + R_3)$$

where:

M_s = Number of Marked fish available to the spawning grounds;

M_h = Number of Marked fish released from Hatchery;

R_2 = Number of marked fish recovered in area 2 fishery;

R_3 = Number of marked fish recovered in area 3 fishery;

The adjusted marked number (M_s), is then used in the ratio estimator as follows:

$$N_s = \frac{(M_s + 1) * (C_s + 1)}{(R_s + 1)}$$

where:

N_s = Point estimate of chinook on spawning grounds;

R_s = Number of marked fish recovered on spawning grounds;

C_s = Number of fish examined on spawning grounds to look for tagged fish;

Accordingly it was necessary to revise prior years estimates as this adjustment effectively reduces the population estimate as the marked number is part of the numerator.

Stratification

Our general guidelines for stratification of recoveries on the spawning ground samples as set forth for previous years of the

study is: males stratified by four size groups (<60cm; 60-79.9cm; 80-99cm; and >99cm), and females by two size groups (<105cm and >149cm). However, the nature of the Petersen Formula used to estimate the population does not allow very precise estimates when tag recoveries are very low for a stratum. Ricker (1975) and Robson and Regier (1964) state that a fairly accurate estimate may be obtained with the general restriction that $M \times C$ (the marked population multiplied by the capture sample) should exceed four times the value of N (the population estimate). That is: that the number of recoveries should be at least 3 (for the Chapman version) or 4 (for the original Petersen version).

We have found, in the course of the study, that low recovery rates in one or more strata during a year left us with unacceptable variance and 95% confidence limits. Confidence intervals were still quite wide even for strata that exceeded the requisite 4 recoveries. Therefore, we do not stratify the samples whenever there is less than 5 tagged recoveries. For adult sized fish (>60cm) generally there are enough recoveries to place the sexes into separate strata. When dealing with small males or jacks (fish <60cm fork length), we did not combine them with older males as their recovery rate is much lower than for fish >60cm. Rather, when recoveries of tagged jacks are <5, we do not use the Petersen ratio for estimating the number of jacks on the spawning ground, but use the ratio of jacks to adults that entered the hatchery. We apply this ratio to the estimated number of adult chinook on the spawning grounds. For 1990, we used the hatchery entrance jack:adult ratio, and we stratified adult fish by sex only. For previous years revisions, we used the hatchery entrance ratio estimator for jacks in 1986 and in 1988, but were able to stratify the adults as described.

The number of anchor tagged fish in the catch has been relatively low (most fishing pressure and catch taking place below the hatchery), and hence the adjustment to total population minor. Spawning populations for previous years of the study have been revised to allow for exclusion of the floy-tagged portion of fish that are caught. The revision allows us to compare stock assessment between years more accurately.

Sampling Plan 1990

1. The creel survey ran from 15 August through 18 November, 1990.
2. The electric barrier on the weir was operated intermittently from 15 October to 5 November. During this time, the electric barrier was on five times an average of 37 hours each time with inactive periods between that averaged 78 hours. After 13 November, the barrier was active continuously through mid-December. This usage represents a high for the history of this study and was initiated by low expected run sizes and the desire of hatchery personnel to meet brood stock needs for chinook and coho *Oncorhynchus kisutch*.
3. Spawning ground surveys began on October 5, 1990 and terminated on December 19, 1990.

RESULTS

Recreational Riverine Fishery

Results of the creel survey conducted in 1990 are presented in Tables 1-4. Our sampling indicated that anglers caught 5 species of salmonids, the majority of which were chinook salmon. Anglers expended 45,058 total hours of effort to harvest 1,031 adult sized salmonids, and 641 jacks in Salmon River in 1990. Effort levels were slightly above 1986 levels, but ranked well behind 1987 - 1989 estimates. Catch rates in 1990 were about 57 hours per adult chinook. This was the same as the 1989 catch rate of 57 hours per adult chinook salmon, but was greater than the best success rate of 40 hours per adult chinook salmon in 1987. The poor catch rate may have been responsible for the reduction in effort in 1990. The recreational harvest of chinook salmon from Salmon River represented approximately 34% of the total number of chinook salmon entering Salmon River in 1990. The five year average harvest rate is 33% with a high of 39% in 1986 and a low of 27% in 1988. The percentage of ocean escapement harvested in Salmon River has remained relatively constant during the five years of the study while total populations, effort and catch per unit effort have fluctuated significantly.

Table 1. Estimated harvest (+/- 95% confidence intervals) of 5 species of salmonids^(a) between river mile 1.8 and 10.3 in the Salmon River recreational fishery 15 August to 18 November.

Species	Adults	Jacks ^(b)	Total
Chinook	780 +/-204	72 +/-51	852 +/-255
Coho	147 +/-91	569 +/-218	716 +/-309
Chum	2 +/-4	--	2 +/-4
Steelhead	9 +/-17	0	9 +/-17
Cutthroat	93 +/-61	--	93 +/-61

^a Chinook salmon: *Oncorhynchus tshawytscha*; Coho salmon: *O. kisutch*; Chum salmon: *O. keta*; Steelhead: *O. mykiss*; and Cutthroat: *O. clarkii*;
^b Jacks are fish < 605 mm fork length (except Cutthroat trout).

Table 2. Catch statistics by Area, Daytype or Angler Type strata for the Salmon River recreational fishery, 1990.

Stratum	-- All Salmonids --			----- Chinook -----		
	Total Effort	Total Catch	Catch Rate (hr/fish)	Total Adult	Catch Jacks	Catch Rate (A+J)
Area:						
Estuary	25,845	523	49	348	12	72
Otis bridge to Hatchery	14,763	902	16	289	54	43
Upriver of Hatchery	4,450	247	18	143	6	30
Day Type:						
Weekday	25,758	1,092	24	466	45	50
Weekend	19,300	579	33	314	27	57
Angler Type:						
Boat	13,302	335	40	251	12	51
Bank	31,756	1,337	24	529	60	54
Total	45,058	1,672	27	780	72	53
all salmonids include Chinook, Coho, Chum, Steelhead, and Cutthroat						

When we consider the angling success rate by angler type for all salmonids, predominantly chinook and coho, bank angler success (24 hours per fish) was better than for boat anglers (40 hours per fish). However, if we consider catch rate for just chinook salmon, the boat anglers were slightly more successful than bank anglers. Areas downstream of the hatchery were fished most intensely with the highest total numbers of fish being harvested from this area, but the success rate was greater for the area upstream of the hatchery. Weekday anglers had better success than weekend anglers.

Because the creel survey in the area upstream of the hatchery began after the onset of salmon angling in the area and because not all potential angling locations were accessible for the sampler, we believe our sampling underestimated the actual catch in this area. However, based on the duration of the angling season and the estimated angling effort in this area of the river, we believe the magnitude of this bias was not large and the majority of the chinook salmon that passed the hatchery escaped to spawning areas. Rainfall and flow levels of Salmon River this year were described as "average".

Overall, we sampled 32.6% of the chinook salmon that were caught in the 1990 Salmon River recreational fishery. Our sampling rates were 25.3% during weekdays and 41.2% during weekends.

Table 3. Estimates of Ad+CWT marked chinook from Oregon coastal Exploitation Rate Indicator Stock returning to freshwater in 1990 and caught in recreational fisheries in the home stream. See Appendix Table A-1 for derivation of expansion factors.

<u>Brood Year</u>	<u>Tag Code</u>	<u>Number Sport Recoveries</u>		
		<u>Observed</u>	<u>Estimated</u> <u>A</u>	<u>B</u>
Salmon River Hatchery Origin				
1984	073051	2	5	5
1984	073052	1	3	3
1985	073329	4	11	11
1985	073330	4	16	16
1986	073342	5	19	19
1986	074321	13	35	36
1986	074322	8	20	20
1986	074323	7	19	19
1986	074324	10	33	34
1987	074629	8	23	23
1987	074635	4	12	12
1987	074636	9	26	26
1987	074637	9	26	26
1987	074638	10	35	36
1988	075131	4	12	12
1988	075132	1	4	4
1988	075133	3	8	8
1988	075134	1	3	3
1988	075135	1	4	4
Snout Collected, no Tag present		3	0	0
TOTAL		106	314	317

Notes: Estimate B includes the 3 "no tag" fish apportioned according to the decoded tags.

Table 4. Weekly statistics of angler effort, catch and rate of catch in hours spent per fish landed, for all salmonids and for chinook salmon in the Salmon River recreational fishery, 1990.

Week	Total Anchler Hrs	Catch of All Salmonids		--- Chinook Catch ---		
		Total	Rate	Adult	Jacks	Rate
15 Aug-19 Aug	366	20	18	8	0	46
20 Aug-26 Aug	1,075	33	33	16	0	67
27 Aug-02 Sep	2,206	29	76	19	0	116
03 Sep-09 Sep	3,609	50	77	32	4	100
10 Sep-16 Sep	6,584	96	57	78	2	82
17 Sep-23 Sep	7,323	187	42	118	21	53
24 Sep-30 Sep	4,220	129	31	71	9	53
01 Oct-07 Oct	6,496	396	16	152	11	40
08 Oct-14 Oct	5,055	196	26	57	4	83
15 Oct-21 Oct (a)	3,453	220	16	108	11	29
22 Oct-28 Oct (a)	2,898	189	15	100	10	26
29 Oct-04 Nov (a)	1,042	84	12	10	0	104
05 Nov-11 Nov (a)	533	41	13	11	0	48
12 Nov-18 Nov (a)	<u>198</u>	<u>1</u>	<u>198</u>	<u>0</u>	<u>0</u>	
Total	45,058	1,672	27	780	72	53

(a) Includes only estimates from the recreational fishery in the area upstream from the hatchery (RM 4.9 to 10.3).

Escapement to Natural Spawning Areas

Results of the mark recapture study conducted in 1990 to estimate the spawning escapement of chinook salmon in Salmon River are presented in Tables 5 - 7.

Table 5. Estimated number of fall chinook salmon escaping to natural spawning areas in the Salmon River basin, 1990.

Stratum	Tagged (M)	Sampled (C)	Recaptured (R)	Recovery Rate (%)	Point Estimate (N)	95% CI
Jacks (a)	14	3	0	0	126	69-183
Males	47	138	6	12.8	953	309-1,597
Females	25	119	6	24.0	446	146-745
			Total Adult chinook		1,399	689-2,109

(a) Because less than 5 jacks were recovered they were estimated based on the ratio of jacks to adults that entered the hatchery, and applied to the adults estimated on the spawning grounds.

We estimated that 1,399 adults and 126 jack fall chinook escaped to natural spawning areas of the Salmon River in 1990. We found one of the 12 sampled carcasses with a single anchor tag. The rate of a single tag loss is therefore 1:12 and the rate of losing 2 tags would be $1/12 * 1/12$ or 1:144. Because we only tagged 86 fish we would not expect any of these to loose 2 tags. The 1990 spawning escapement represents the lowest escapement for the five years the study has been conducted. Chinook entered the trap throughout the run and in our estimation were a representative sample of the population escaping upstream of the hatchery. Jacks comprised 8.25% of the chinook salmon entering the hatchery in 1990.

Coded wire tagged recoveries were expanded based on the sample fraction derived from our spawning surveys, population estimates and adjusted for tags not present in snouts recovered (Table 6). The jack expansion factor was very large in part due to the few jacks seen on surveys, and may be biased high.

Table 6. Standard ODFW expansion factors for CWT chinook found on spawning surveys on Salmon River, Oregon, 1990. See Appendix Table A-4 for derivation of the expansion factors.

Fish Description	Expansion Factor
Males	
< 60 cm	42.00
> 60 cm	7.75
Females	3.87

Only 1 out of system stray was recovered on the spawning grounds, an age 4 chinook from the Oregon Aqua Foods salmon ranch in Yaquina Bay (Table 7). A total of 58 microwire tagged chinook were observed on the spawning grounds and 437 microwire tagged chinook were estimated from the sample fraction to have escaped to spawn in the river.

Table 7. Number of Ad+CWT marked chinook from Oregon Coastal exploitation rate indicator stock, returning to their home stream in 1990 and recovered on spawning grounds.

Brood Year	Tag Code	Number of Ad+CWT Chinook Recovered					
		-- Observed --		----- Estimated -----			
		Males	Females	<u>Males</u>		<u>Females</u>	
				<u>A</u>	<u>B</u>	<u>A</u>	<u>B</u>
1984	073051	0	1	0	0	4	4
1984	073052	0	2	0	0	8	8
1985	073329	1	2	8	8	8	8
1985	073330	1	3	8	8	12	13
1986	073342	5	6	39	40	23	24
1986	074321	3	5	23	24	19	20
1986	074322	3	1	23	24	4	4
1986	074323	4	1	31	32	4	4
1986	074324	6	1	47	48	4	4
1987	074629	1	3	42	42	12	12
1987	074635	1	0	8	8	0	0
1987	074636	2	2	16	16	8	8
1987	074637	3	0	23	24	0	0
1987	074638	0	1	0	0	4	4
1988	075135	1	0	42	42	0	0
Out system Origin							
1986	603860	1	0	8	8	0	0
No tag present =		6	3				
TOTAL		32	26	318	324	110	113

Note: Estimate B includes the 9 "no tag present" fish apportioned according to the decoded tags.

Temporal distribution of spawning fall chinook in 1990 followed the general pattern for an average water year. Live spawners peaked quickly during the weeks of October 22 and 29 and tapered off gradually through November with a few remaining into December. Live fish peaked somewhat later in the tributaries than on the mainstem. Peak counts on the mainstem occurred the week of October 29 - November 5. Live fish persisted on the tributaries longer than on the mainstem, being present in greater numbers from November 12 on and remaining some two weeks after fish had disappeared from the mainstem.

Spatial distribution of spawning chinook in 1990 followed distributions for previous average flow years. Approximately 67% of the chinook spawned in the mainstem with approximately 33% spawning in tributaries. This contrasts with distributions observed in 1987, where extended drought conditions resulted in less than 10% of the chinook spawning in tributaries.

Hatchery Broodstock Collection

The Salmon River Hatchery collects chinook returning to the Salmon River for broodstock. No gametes are transferred into the system from other river basins. Occasionally, stray chinook appear in the hatchery broodstock collection and may be spawned, only after reading CWT's are the strays discovered. Fish from the Trask River Hatchery and from the Oregon - Aqua Foods facility in Yaquina Bay have typically been found in this basin but in small numbers. As a consequence, the hatchery population has remained relatively pure Salmon River stock.

The hatchery collected 189 adult and 17 jack fall chinook salmon in 1990. This also represents a low for the history of the study. Only 88 adults and 14 jacks were released back to the river; 101 adults and 3 jacks were retained for broodstock purposes. Adipose + CWT marked chinook trapped for broodstock were all Salmon River Hatchery fish (Table 9). The 1990 escapement estimate was about 59% of the total number of chinook salmon that entered the river (Table 10).

Table 8. Salmon River Hatchery broodstock collection, 1990.

	<u>Male</u>	<u>Female</u>	<u>Jacks</u>	<u>Total</u>
Number Collected	105	84	17	206
Number Spawned	35	53	0	88
Number Prespawn Mortality	7	6	3	16
Number Released	63	25	14	102

Table 9. Number of Ad+CWT marked chinook returning to freshwater and taken at Salmon River Hatchery, 1990.

Brood Year	Tag Code	Number Observed		Number Estimated	
		Male	Female	Male	Female
1985	073329	0	3	0	3
1985	073330	1	1	1	1
1986	073342	4	1	4	1
1986	074321	1	1	1	1
1986	074322	3	2	3	2
1986	074323	1	1	1	1
1986	074324	1	4	1	5
1987	074635	1	0	1	0
1987	074636	1	0	1	0
1987	074637	5	0	5	0
1987	074638	1	0	1	0
	074658	1	0	1	0
1988	075135	1	1	1	1
	Snout collected "tag lost"				1
	Total	21	15	21	16

Note: Number "Observed" reported to PSMFC; "Estimate" apportions the "no tag" into the tag group.

Table 10. Disposition of the run of fall chinook salmon in Salmon River, 1990.

<u>Stratum</u>	Inriver Harvest		Natural Spawning		Hatchery Retention		<u>Total</u>
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>	
Adults	780	34.2	1,399	61.4	101	4.4	2,280
Jacks	72	35.8	126	62.7	3	1.5	187
Total	852	34.3	1,525	61.5	104	4.2	2,317

**Compilation of Coastwide Recovery of NOC
Exploitation Rate Indicator Stock**

Adipose + CWT chinook from the Salmon River Hatchery are captured in a variety of ocean fisheries. Additionally, this population is impacted by incidental mortality in directed and non-directed fisheries. Agencies in North America sample landed catch for adipose fin-marked fish and decode the CWT to reveal stock origin. Analysis of the landed catch of the Salmon River Ad+CWT fish shows that the majority of the 1990 ocean landed catch occurred in Southeast Alaska and Northern British Columbia (Table 11). No estimates of incidental mortality of chinook captured and released during non-retention periods is made in this analysis. Oregon derives little benefit from this stock in offshore fisheries but harvested about 38.5% of the total number of fish actually caught in 1990 in the terminal freshwater sport fishery. About 61.8% of the Ad+CWT fish recovered in 1990 were found in the home stream, while 35.6% of the total recovered Ad+CWT fish occurred on the spawning grounds.

Table 11. Estimated recovery of Ad+CWT Far North Oregon Coastal Exploitation Rate Indicator Stock Fall Chinook Salmon in 1990. SEAK = Southeast Alaska, NCBC = Northern and Central British Columbia, WCVI = West Coast Vancouver Island, GS = Georgia, Johnston and Juan de Fuca Straits, WA = Washington (Puget Sound and Coast), OR = Oregon Marine, and CA = California.

Brood Year (tag code)	Estimated Ocean Landed Recoveries				PFC Area				OCEAN TOTAL		Columbia River		Oregon Coastal Recoveries		Fresh Water Total		GRAND TOTAL
	SEAK	NCBC	WCVI	GS	WA	OR	CA	OCEAN TOTAL	Catch	Hatch	River Catch	Hatchery	Spawning Escapement	Fresh Water Total	GRAND TOTAL		
1984																	
07/30/51	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	4	9
07/30/52	0	8	0	0	0	0	0	8	0	0	0	0	0	3	0	8	11
1985																	
07/33/29	10	17	3	0	0	1	0	31	0	0	0	3	16	11	3	16	30
07/33/30	18	16	3	0	0	0	0	37	0	0	0	2	21	16	2	21	39
1986																	
07/33/42	44	22	19	0	0	11	0	105	0	0	0	5	64	19	5	64	88
07/43/21	22	19	3	0	2	3	0	53	0	0	0	2	44	36	2	44	82
07/43/22	6	13	12	0	2	10	0	47	0	0	0	5	28	20	5	28	53
07/43/23	30	28	11	0	0	6	0	80	0	0	0	2	36	19	2	36	57
07/43/24	14	5	5	0	0	0	0	28	0	0	0	6	52	34	6	52	92
1987																	
07/46/29	5	14	5	0	0	3	0	27	0	0	0	0	54	23	0	54	77
07/46/35	5	0	11	0	0	0	0	17	0	0	0	1	8	12	1	8	21
07/46/36	9	23	28	0	2	0	0	64	0	0	0	1	24	26	1	24	51
07/46/37	21	7	6	0	13	2	3	55	0	0	0	5	24	26	5	24	55
07/46/38	9	10	14	4	9	0	0	47	0	0	0	1	4	36	1	4	41
1988																	
07/51/31	0	0	0	0	2	0	0	2	0	0	0	0	0	12	0	0	12
07/51/32	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4
07/51/33	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	8
07/51/34	0	3	0	0	0	1	0	4	0	0	0	0	0	3	0	0	4
07/51/35	0	0	0	0	0	0	0	0	0	0	0	2	42	4	2	42	48
07/51/36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Notes: [a] Includes estimates derived from sampling rate expansion plus "selects" (observed number when no expansions were made).

Revised Escapements to Natural Spawning Areas 1986-1989

Adjusting the population estimates to account for those marked fish removed from the potential spawners by the sport catch resulted in changes in the number of spawners for 1986-89. Because the 1986 estimate was stratified by age only, unlike the subsequent years which are stratified by sex and size, we needed to restratified the estimates by sex and size for 1986. Field records were sufficient to resturcture the strata for 1986 and the Peterson estimates were calculated so they are analogous to estimates in subsequent years.

These revisions resulted in only small changes in the spawning population estimate of between -8.7% to +4.9%, but all estimates are now based on the same methods and are comparable (Table 12). Revised estimators are displayed in Appendix Tables C-1 to C-4.

Table 12. Revised and prior spawning population estimates of Fall Chinook Salmon in Salmon River, Lincoln County, Oregon, 1986-89.

<u>Year and Fish Type</u>	--- Total Spawner Estimates ---			<u>Percent Change</u>
	<u>New</u>	<u>Prior</u>	<u>Difference</u>	
1986				
Jack	323	322	+1	0.3%
Adult	1,984	2,170	-186	-8.6%
1987				
Jack	57	58	-1	-1.7%
Adult	2,706	2,896	-190	-6.6%
1988				
Jack	258	246	12	+4.9%
Adult	5,170	5,477	-307	-5.6%
1989				
Jack	333	330	+3	0.9%
Adult	1,935	1,886	+49	+2.6%

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APPENDIX A

Sampled chinook and catch or population estimates used to derive ODFW "standard" expansion factors for estimates of CWT fall chinook salmon in the Salmon River Basin, 1990.

Appendix Table A-1. Recoveries and expansion factors used to calculate the weekly estimates of CWT fall chinook caught in the Salmon River sport fishery, 1990.

$$\text{Expansion Factor} = (N/A)*(A/S)*(W/D)$$

Adults >60.5 cm		Statistical Week												
<u>Code</u>	<u>Category</u>	<u>33</u>	<u>34</u>	<u>35</u>	<u>36</u>	<u>37</u>	<u>38</u>	<u>39</u>	<u>40</u>	<u>41</u>	<u>42</u>	<u>43</u>	<u>44</u>	<u>45</u>
N	Est. Catch	8	16	19	32	78	118	71	152	57	108	100	10	11
T	Sampled	2	4	9	18	27	36	28	53	21	28	23	2	3
A	Ad-clips	1	4	4	8	8	14	7	25	9	7	8	1	0
	Snouts Taken	1	4	4	7	8	14	6	22	9	5	8	1	0
S	Processed	1	4	4	7	8	14	6	22	9	5	8	1	0
W	W/CWT	1	4	4	7	7	14	6	22	8	5	8	1	0
D	Decoded	1	4	4	7	7	14	6	22	8	5	8	1	0
Expansion Factor		4.0	4.0	2.11	2.03	2.89	3.28	2.96	3.26	2.71	5.40	4.35	5.0	3.67
Jacks <60.5 cm														
N	Est. Catch	0	0	0	4	2	21	9	11	4	11	10	0	0
T	Sampled	0	0	0	3	1	6	3	4	1	3	2	0	0
A	Ad-clips	0	0	0	0	0	5	0	1	1	1	1	0	0
	Snouts Taken	0	0	0	0	0	5	0	1	1	1	1	0	0
S	Processed	0	0	0	0	0	5	0	1	1	1	1	0	0
W	W/CWT	0	0	0	0	0	4	0	1	1	1	1	0	0
D	Decoded	0	0	0	0	0	4	0	1	1	1	1	0	0
Expansion Factor-		-	-	1.33	2.00	3.50	3.00	2.75	4.0	3.67	5.0	-	-	

Appendix Table A-2. Recoveries and expansion factors used to calculate the CWT fall chinook salmon sampled on the spawning grounds in Salmon River, 1990.

$$\text{Expansion Factor} = (N/T)*(A/S)*(W/D)$$

<u>Code</u>	<u>Category</u>	Numbers of Chinook Sampled or Estimated		<u>Females</u>
		<u>Males<60.5cm</u>	<u>Males> 60.5 cm</u>	
N	Pop. Estimate	126	953	446
T	Fish Sampled	3	138	119
A	Ad-clips Obs.	2	39	31
	Snouts Taken	2	38	30
S	Processed	2	37	30
W	W/CWT	2	4	27
D	Decoded	2	31	27
CWT Expansion Factor		42	7.75	3.87

APPENDIX B

Age composition of samples of spawned fall chinook salmon in the Salmon River Basin, 1990 as determined by scale analysis.

NOTE: Spawner carcass samples are biased toward larger fish and therefore older fish. As such, these measures are not representative of the age, or gender composition of the run.

Appendix Table B-1. Chinook age composition of non-adipose clipped carcasses as observed on spawning ground surveys in the Salmon River Basin, 1990.

Age	-- Male --		-- Female --		Unknown #	-- Total --	
	#	%	#	%		#	%
2	1	1.1	0	0	0	1	0.6
3	9	9.9	0	0	0	9	5.2
4	38	41.8	14	17.5	1	53	30.8
5	42	46.2	51	63.8	0	93	54.1
6	1	1.1	15	18.8	0	16	9.3

APPENDIX C

Revised estimates of the number of Fall Chinook Salmon on the spawning grounds in the Salmon River, Lincoln County, Oregon. Column codes are explained on page 6 in this report.

Appendix C-1. Run Year - 1986.

<u>Sex/ Length</u>	<u>M_h</u>	<u>R_{f2+3}</u>	<u>M_s</u>	<u>C_s</u>	<u>R_s</u>	<u>Recovery Rate</u>	<u>Population Estimate</u>
Jacks	45	0	45	118	2	4%	323 a
Male 60-80	116	2	114	74	11	10%	719
Male 80-100	80	0	80	134	18	23%	576
Male>100	12	0	12	34	5	42%	76
Female<105	74	4	70	175	21	30%	568
Female>105	7	0	7	45	7	100%	46

note: a) jack recovery less than minimum criteria of 5, therefore ratio of adults to jacks at hatchery entrance used to estimate population on spawning grounds. Sixty four jacks and 393 adults were counted into the hatchery .

Appendix C-2. Run Year - 1987.

<u>Sex/ Length</u>	<u>M_h</u>	<u>R_{f2+3}</u>	<u>M_s</u>	<u>C_s</u>	<u>R_s</u>	<u>Recovery Rate</u>	<u>Population Estimate</u>
Jacks	37	0	37	20	13	35%	57
Male 60-80	383	12	371	238	165	45%	536
Male 80-100	616	10	606	468	308	51%	921
Male>100	113	3	110	136	66	60%	227
Female<105	542	17	525	436	261	50%	877
Female>105	72	0	72	136	68	94%	145

Appendix C-3. Run Year - 1988.

<u>Sex/ Length</u>	<u>M_h</u>	<u>R_{f2+3}</u>	<u>M_s</u>	<u>C_s</u>	<u>R_s</u>	<u>Recovery Rate</u>	<u>Population Estimate</u>
Jacks	23	0	23	40	3	13%	258a
Male 60-80	54	0	54	67	18	33%	197
Male 80-100	289	0	289	478	107	37%	1,286
Male>100	95	0	95	209	34	36%	576
Female<105	622	3	619	1023	216	35%	2,926
Female>105	36	0	36	129	25	69%	185

notes: a) jack recovery less than minimum criteria of 5, therefore ratio of adults to jacks at hatchery entrance used to estimate population on spawning grounds. Seventy jacks and 1,403 adults were counted into the hatchery .

Appendix C-4. Run Year - 1989.

<u>Sex/ Length</u>	<u>M_h</u>	<u>R_{f2+3}</u>	<u>M_s</u>	<u>C_s</u>	<u>R_s</u>	<u>Recovery Rate</u>	<u>Population Estimate</u>
Jacks	105	0	105	27	8	8%	330
Male 60-80	92	0	92	65	25	27%	236
Male 80-100	107	3	104	117	35	34%	344
Male>100	75	0	75	124	37	49%	250
Female<105	310	0	310	365	115	37%	981
Female>105	32	0	32	111	29	91%	123

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