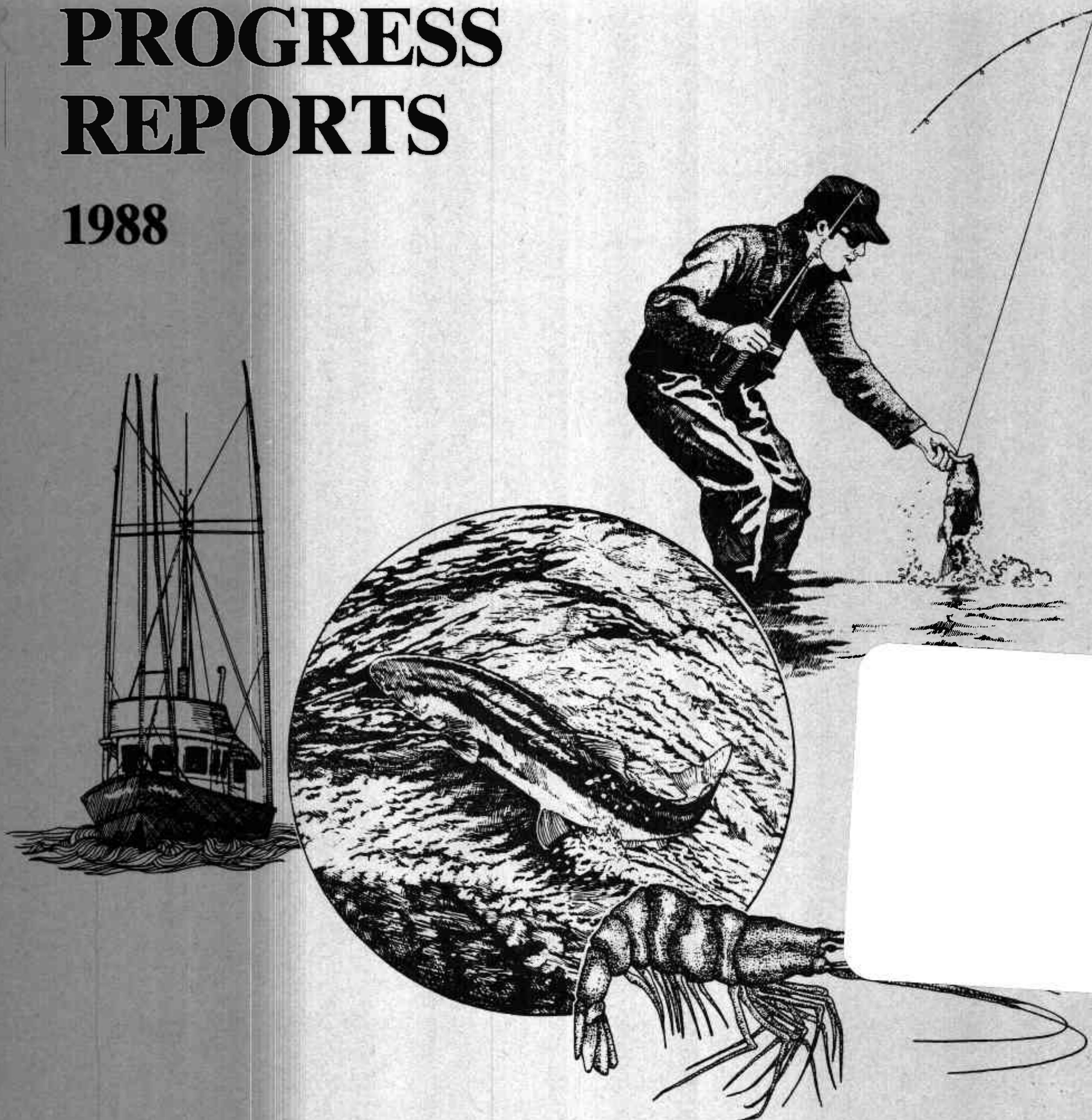
PROGRESS REPORTS

1988



FISH DIVISION

Oregon Department of Fish and Wildlife

Catch and Escapement of Fall Chinook Salmon from
Salmon River, Oregon, 1987

ANNUAL PROGRESS REPORT

MARINE RESOURCES PROGRAM
OREGON

PROJECT TITLE:	Catch and Escapement of Fall Chinook Salmon from Salmon River, Oregon, 1987
CONTRACT NUMBER:	NA-87-ABH-00017
PROJECT PERIOD:	15 June 1987 to 30 June 1988

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SUMMARY

Objectives

1. Estimate the total number of all salmonids and the number of coded-wire tagged (CWT) fall chinook salmon from Salmon River Fish Hatchery harvested in the Salmon River fall recreational fishery in 1987.

2. Estimate the total number of fall chinook salmon and the number of CWT fall chinook salmon from Salmon River Fish Hatchery that escaped to natural spawning areas in the Salmon River Basin in 1987.

3. Determine the number of CWT fall chinook salmon from Salmon River Fish Hatchery captured and retained at Salmon River Fish Hatchery in 1987.

4. Evaluate the adequacy of methods used in 1987 to estimate ocean escapement of fall chinook salmon to Salmon River.

5. Compile estimates of recoveries of CWT fall chinook salmon from Salmon River Fish Hatchery harvested in 1987 Pacific Ocean fisheries.

6. Estimate the age and sex composition of fall chinook salmon escaping to Salmon River in 1987.

7. Collect data for evaluating Oregon coastal chinook salmon spawning ground surveys.

8. Report other data derived from the creel survey and spawning ground surveys conducted in 1987 that are useful to the understanding and management of Oregon's coastal stocks of chinook salmon.

Accomplishments

All Objectives were accomplished.

Findings

Recreational Fishery

We estimated that 1,431 ± 113 fall chinook salmon were harvested in the Salmon River recreational fishery in 1987. This catch was composed of an estimated 1,383 adult, and 48 jack chinook salmon, and represents inriver harvest rates of 31% and 39% of the total estimated ocean escapement of adult and jack chinook salmon, respectively. The estimated harvest of CWT chinook salmon from Salmon River Fish Hatchery was 159 adults (1982-84 brood years) and 10 jacks (1985 brood year).

Escapement to Natural Spawning Areas

We estimated that 2,896 $\pm$ 118 fall chinook salmon migrated upstream of River Mile 4.3 in 1987. This estimate was partitioned into stratified estimates of 1,734 adult male, 1,091 adult female, and 62 jack fall chinook salmon, and represents spawning escapement rates of 61.6% and 50.4% 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 93 adults, and 0 jacks.

Hatchery Recovery

Salmon River Fish Hatchery retained 330 adult and 13 jack fall chinook salmon in 1987. Retention of chinook salmon by the hatchery accounted for 7.4% and 10.6% of the total estimated ocean escapement of adults and jacks, respectively. Hatchery personnel recovered and retained 220 adult and 9 jack CWT chinook salmon from Salmon River Fish Hatchery.

Ocean Coded-wire Tag Recoveries

The Pacific Marine Fisheries Commission estimated that 228 adult and one jack CWT Salmon River chinook salmon were harvested in ocean fisheries in 1987. The majority of these tag recoveries occurred in British Columbia (127 recoveries) and Alaska (79 recoveries) commercial fisheries.

INTRODUCTION

In accordance with the Pacific Salmon Treaty (PST) Act the Ocean Salmon Management Section of the Oregon Department of Fish and Wildlife developed a program in 1986 to monitor the catch and escapement of coastal stocks of chinook salmon *Oncorhynchus tshawytscha* that contribute to fisheries addressed by the PST (Boechler and Jacobs 1987). A goal of this program is to estimate the exploitation rate of north-migrating stocks of Oregon coastal fall chinook salmon. The approach used to accomplish this goal is to estimate the total catch and escapement of a representative portion (indicator stock) of these stocks. Coded-wire tagged (CWT) fall chinook salmon from Salmon River Fish Hatchery have been selected as this exploitation rate indicator stock.

Total ocean catch of CWT chinook salmon from Salmon River Fish Hatchery is estimated from data collected in port sampling programs throughout the Pacific coast. These estimates are available through the Pacific Marine Fisheries Commission, Portland, Oregon. Our objective is to estimate the ocean escapement of CWT fall chinook salmon from Salmon River Fish Hatchery and, from these escapement estimates and estimates of ocean catch, derive estimates of exploitation rate. Returning chinook salmon migrate up the Salmon River are (1) caught in the recreational fishery downstream from the hatchery, (2) captured at the hatchery, (3) caught in the recreational fishery upstream from the hatchery, or (4) attempt to naturally spawn in the river basin. We estimated freshwater harvest directly with a creel survey, recorded hatchery returns as they were recovered, and estimated the number of chinook salmon escaping to natural spawning areas using mark-recapture techniques and extensive spawning surveys.

An additional goal of this program is to analyze and calibrate the spawning fish surveys conducted for fall chinook salmon, and to present additional results derived from the creel survey and spawning ground surveys. Currently, fall chinook salmon spawning surveys conducted in ODFW are used 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 may provide means to evaluate the precision of these surveys and to develop a procedure for estimating the total escapement of fall chinook salmon from spawning survey data.

This report presents results of the second year of this study. Results obtained in 1986 were presented in Boechler and Jacobs (1987). The objectives of this report are to (1) assess the adequacy of methodologies used in 1987 to estimate the ocean escapement of fall chinook salmon to Salmon River, (2) present estimates of 1987 catch and escapement of fall chinook salmon from Salmon River, (3) document results of spawning surveys conducted in Salmon River in 1987 that will be used to evaluate coastal spawning escapement surveys and (4) present additional results derived from the creel survey and spawning ground surveys that are important to the understanding and management of Oregon's coastal chinook salmon stocks.

METHODS

The methods used to estimate ocean escapement of Salmon River fall chinook salmon in 1987 were previously described by Boechler and Jacobs (1987). Several modifications were enacted to improve the 1987 estimates. These modifications follow:

Recreational Fishery

1. The survey was conducted from 15 August through 22 November. From 19 September through 2 November, sampling effort was doubled with the addition of a second surveyor.

2. The creel survey encompassed the area from just downstream of the U. S. Highway 101 Bridge (RM 1.8) upstream to the State Highway 18 bridge (near the mouth of Widow Creek, RM 10.3). This change added 8.6 km to the area surveyed in 1986 and was enacted to provide a means to estimate the harvest of chinook salmon upstream from the hatchery.

3. The estimated number of adipose-clipped salmon harvested in the recreational fishery each week (by adults or jacks of each species) was calculated by multiplying the proportion of adipose-clipped fish in the sample by the total estimated catch of salmon as follows:

$$T_{jw} = T_w[(\sum_{k=1}^{m} Y_{kjw} / \sum_{k=1}^{m} Y_{kw})]$$

where

T_{jw} = the total catch of a given fish type with adipose clips in week w,

T_w = the total catch of a given fish type in week w,

Y_{kjw} = the number of fish sampled of a given type with adipose clips caught by angler k in week w,

Y_{kw} = the number of fish sampled of a given type caught by angler k in week, and

m = number of anglers interviewed in week w.

Estimates of variance were not calculated for the estimated catch of adipose-clipped fish.

4. Catch rate was sampled independently during each interview session. In 1986, anglers were re-interviewed if they were encountered during more than one interview session in the course of one shift. Each time an angler was interviewed his total hours of effort and total catch was recorded regardless of whether a portion of these data was already recorded earlier in the day. In 1987, we recorded only the effort and catch that occurred after the previous interview session for anglers that were interviewed repeatedly.

Escapement to Natural Spawning Areas

1. Because of low river flows, substantial numbers of fall chinook salmon spawned within a 0.8 km reach of Salmon River immediately downstream from the fish hatchery. The estimate of the natural spawning escapement in 1987 includes these fish, and therefore estimates the number of chinook salmon migrating upstream from River Mile 4.3. To include these fish recoveries of tagged and untagged fish in RM 4.4-4.8 were added to corresponding recoveries from other areas of the basin.

2. The population estimate was partitioned into length and sex strata to compensate for differential carcass recovery rates of different sizes and sexes of spawning chinook salmon. The number of fish tagged (M), tagged carcasses recovered (R), and carcasses sampled (C) were partitioned into 200 mm length intervals by sex, and the stratified population estimates were calculated according to Equation 11 in Boechler and Jacobs (1987).

3. To assess the validity of the assumption that tagged fish suffer the same natural mortality as untagged fish, we estimated the relative incidence of prespawning mortality in tagged and untagged chinook salmon. All female chinook salmon carcasses recovered on the spawning ground surveys were examined for signs of prespawning mortality (intact ovaries).

4. The electric barrier was not operated. Because of low flow in Salmon River in 1987, we were able to capture a large number of chinook salmon at the hatchery without operating the electric barrier.

Coded-wire Tag Recoveries

1. Expansion factors for CWT recoveries in the creel survey were calculated using equation 14 in Boechler and Jacobs (1987).

2. Expansion factors for CWT chinook salmon recovered on spawning ground surveys were stratified by 200 mm length intervals and by sex.

RESULTS

Recreational Fishery

Results of the creel survey conducted in 1987 are presented in Tables 1-3. Estimates of the age composition of chinook salmon harvested in the 1987 sport fishery are presented in **APPENDIX A**.

Table 1. The estimated harvest ± 95% confidence intervals, of salmonids in the Salmon River recreational fishery[a], 1987.

Species[b]	Adults	Jacks[c]	Total
Chinook salmon	1,383 ± 111	48 ± 22	1,431 ± 113
Coho salmon	95 ± 28	117 ± 33	212 ± 44
Chum salmon	12 ± 11	--	12 ± 11
Steelhead	10 ± 10	0	10 ± 10
Cutthroat trout	123 ± 50	--	123 ± 50

[a] *River mile 1.8-10.3, 15 August-22 November.*
[b] *Chinook salmon: Oncorhynchus tshawytscha, Coho salmon: O. kisutch, Chum salmon: O. keta, Steelhead: O. mykiss and Cutthroat trout: O. clarkii.*
[c] *Jacks are fish < 610 mm fork length (except Cutthroat).*

Table 2. Estimated angler effort, catch rate and total catch of fall chinook salmon in the Salmon River recreational fishery, 1987. RM = river mile.

Stratum	Effort (Angler-Hrs.)	Catch rate (Hrs./fish) Adults	Catch rate (Hrs./fish) Jacks	Total catch Adults	Total catch Jacks
Area:					
RM 1.8 to 4.3	46,752	39.6	1,854.2	1,133	25
RM 4.3 to 4.9	10,102	53.2	449.2	166	23
RM 4.9 to 10.3	1,364	16.9	0	84	0
Day-type:					
Weekday	34,677	39.2	1,102.8	833	31
Weekend/holiday	23,541	40.6	1,550.7	550	17
Angler-type:					
Boat	19,170	28.9	1,427.6	678	13
Bank	39,048	53.3	1,237.1	705	35
Total fishery	58,218	39.9	1,306.4	1,383	48

Table 3. Temporal distribution of angling effort, catch rate and total catch of fall chinook salmon in the Salmon River recreational fishery, 1987.

Statistical week	Effort (Angler-hrs)	Catch rate (Hrs/fish)		Total catch	
		Adults	Jacks	Adults	Jacks
10-16 Aug.[a]	219	91.0	--	2	0
17-23 Aug.	859	229.0	--	3	0
24-30 Aug.	1,180	59.4	297.0	18	4
31 Aug-6 Sep	1,238	43.6	--	26	0
7-13 Sep	2,925	23.1	971.0	106	3
14-20 Sep	6,751	38.9	919.7	165	5
21-27 Sep	9,150	38.6	672.3	224	14
28 Sep-4 Oct	8,462	39.3	4,994.0	197	2
5-11 Oct	6,743	49.7	1,689.5	130	3
12-18 Oct	5,583	40.0	3,356.0	125	3
19-25 Oct	5,646	50.5	3,230.0	125	3
26 Oct-1 Nov	3,578	37.0	563.8	89	7
2-8 Nov[b]	3,039	47.5	950.0	59	4
9-15 Nov[b]	2,106	20.2	--	103	0
16-22 Nov[a,b]	739	64.6	--	11	0
Average	4,405[c]	39.9	1,306.4	--	--
Total	8,218	--	--	1,383	48

[a] *Weekend only.*
[b] *Includes estimates from the recreational fishery in the area upstream from the hatchery (RM 4.9 to 10.3).*
[c] *Not including 10 Aug-16 Aug and 16 Nov-22 Nov.*

Escapement to Natural Spawning Areas

Results of the mark-recapture study conducted in 1987 to estimate the natural spawning escapement of chinook salmon are presented in Tables 4-9, Figures 1-4, and **APPENDIXES A** and **B**.

Table 4. Number of Salmon River fall chinook salmon tagged and recovered, by individual tag color, 1987.

		Number tagged			Tags recovered			Recovery rate (%)			
Tag color	Tagging period	Male	Female	Jack	Male	Female	Jack	Male	Female	Jack	Total
Dark blue	9-23 Oct	40	2	7	22	2	1	55.0	100.0	14.3	51.0
Pink	26-30 Oct	166	91	9	81	60	7	48.8	65.9	77.8	55.6
Green	2 Nov-6 Nov	617	313	16	350	194	5	56.7	62.0	31.3	58.0
Grey	9-13 Nov	207	142	5	90	61	1	43.5	43.0	20.0	42.9
Red	15-24 Nov	73	64	3	12	19	0	16.4	29.7	0.0	22.1
Yellow	27 Nov-3 Dec	6	2	0	1	0	0	16.7	0.0	0.0	12.5
Total		1,109	614	40	556	336	14	50.1	54.7	35.0	51.4

Table 5. Average time elapsed between marking and recapture of fall chinook salmon in the Salmon River mark-recapture study, 1987.

Tag color	Tagging period	Recovery period	Average elapsed time to recovery (days)
Dark blue	9-23 Oct	4-18 Nov	18.3
Pink	26-30 Oct	4-30 Nov	12.9
Green	2 Nov-6 Nov	4 Nov-23 Dec	14.4
Grey	9-13 Nov	10 Nov-6 Jan	18.6
Red	16-24 Nov	24 Nov-4 Jan	20.3
Yellow	27 Nov-3 Dec	16 Dec	17.0
Total			15.2

Table 6. Incidence of prespawning mortality observed in tagged and untagged female fall chinook salmon sampled on spawning ground surveys within the Salmon River basin, 1987. RM = river mile.

Survey area	Anchor-tagged		Untagged	
	Total sampled	Percent prespawning mortality	Total sampled	Percent prespawning mortality
Mainstem:				
RM 4.4-4.9	31	12.9	111	19.8
RM 4.9	11	9.1	1	--
RM 4.9-6.4	196	11.2	68	5.9
RM 6.4-8.8	51	7.8	14	14.3
RM 10.3-12.6	7	14.3	10	--
RM 12.6-13.7	2	--	1	--
RM 13.7-16.3	0	--	7	--
Total	298	10.7	212	13.2
Tributaries:				
Lower Bear Cr.	11	9.1	13	--
Middle Bear Cr.	0	--	1	--
Upper Bear Cr.	0	--	0	--
Slick Rock Cr.	12	8.3	7	--
Trout Cr.	1	100.0	1	--
Total	24	12.5	22	--
Basin Total	322	10.9	234	12.0

Table 7. Estimated number of fall chinook salmon escaping to natural spawning areas upstream from River Mile 4.3 in the Salmon River basin, 1987. The estimated escapement is stratified by length and sex.

Fork length interval (mm)	Tagged (M)	Sampled (C)	Recaptured (R)	Recovery Rate (%) (R/M x 100)	Point estimate (N)	95% confidence limits
Males:						
400-599	37	22	14	37.8	58	41-75
600-799	383	246	170	44.4	555	509-601
800-999	616	483	318	51.6	936	876-996
1000-1199	113	140	68	60.2	233	194-272
Total males	1,149	891	570	49.6	1,796[a]	1,708-1,884
Females:						
400-599	0	0	0	- -	0	- -
600-799	23	8	6	26.1	31	21-41
800-999	380	318	190	50.0	636	579-693
1000-1199	211	271	140	66.4	409	362-456
Total females	614	597	336	54.7	1,091[a]	1,014-1,168
Total	1,763	1,488	906	51.4	2,896[a]	2,778-3,014

[a] *Independent estimate based upon the total number of fish tagged, recovered,and sampled.*

Table 8. Disposition of run to the river for fall chinook salmon in Salmon River, 1987.

Stratum	Inriver harvest		Natural spawning		Hatchery retention		Total
	Number	%	Number	%	Number	%	
Adults	1,383	31.0	2,742	61.6	330	7.4	4,455
Jacks[a]	48	39.0	62	50.4	13	10.6	123
Total	1,431	31.2	2,812	61.3	343	7.5	4,586

[a] *Jacks are fish < 610 mm fork length.*

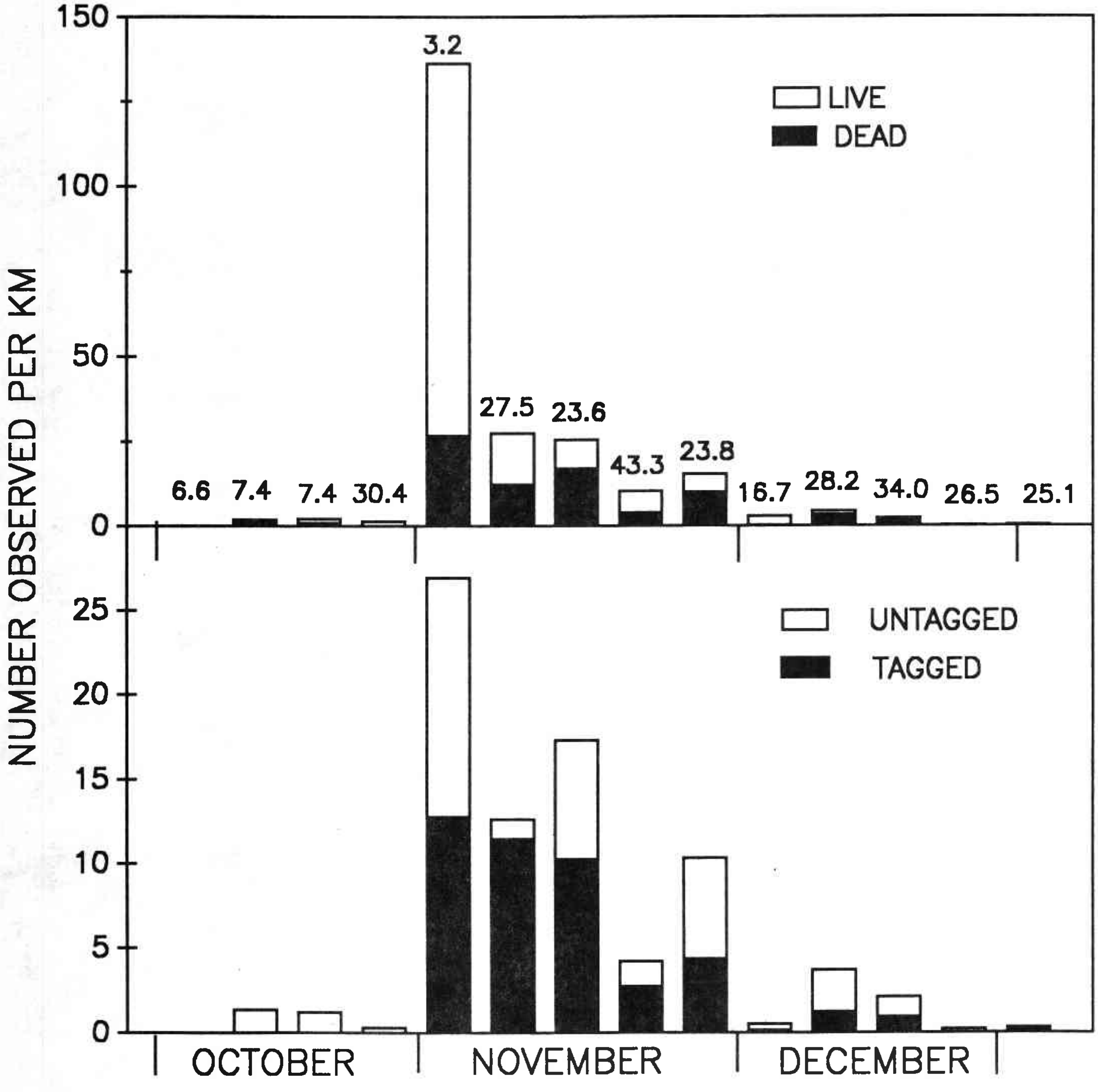

Figure 1. Temporal distribution of live and dead chinook salmon, and tagged and untagged chinook salmon carcasses observed on spawning ground surveys in the Salmon River basin, 1987. The total distance (kilometers) surveyed each week is presented at the top of the bars in the top half of the figure. Timing is based on Julian months.

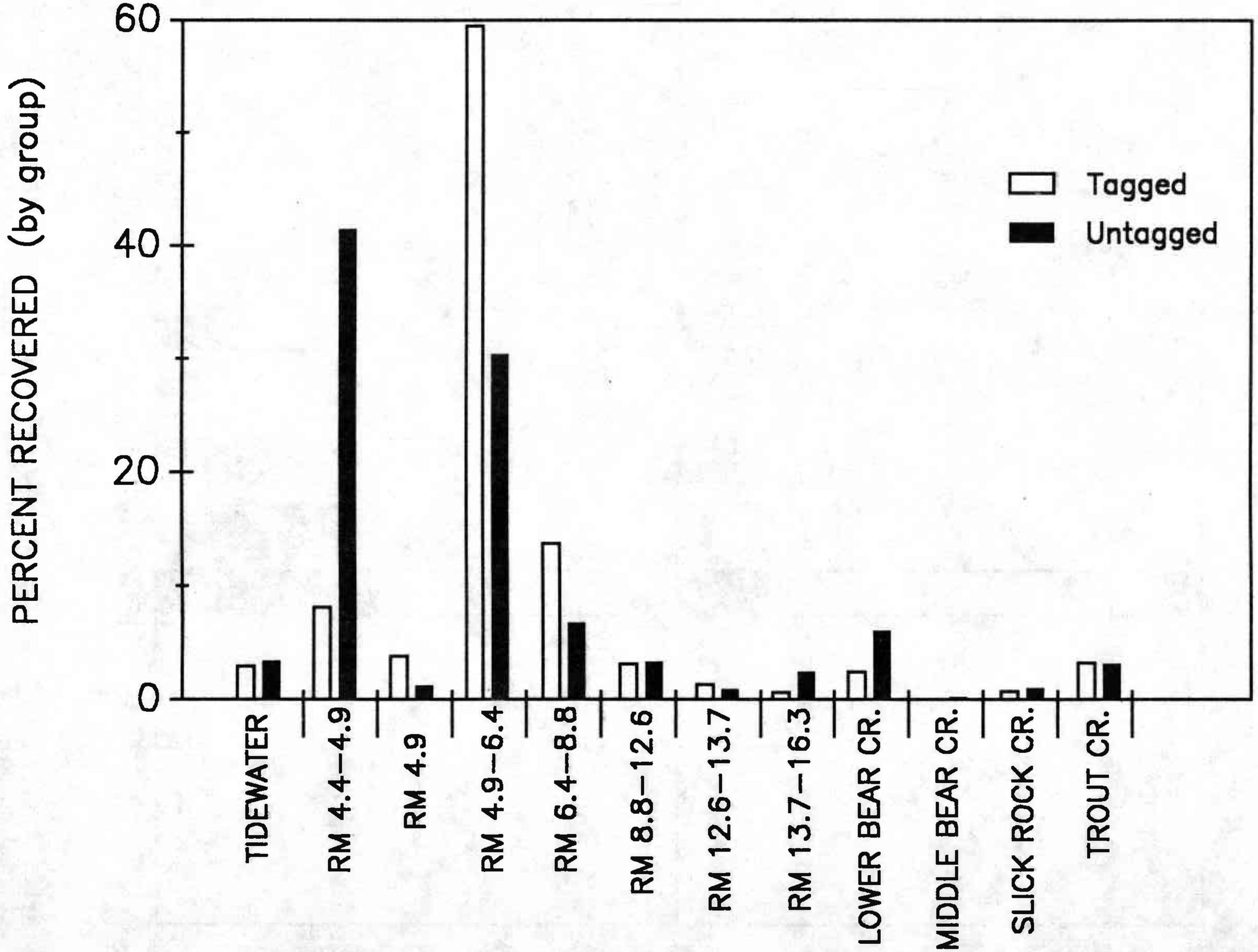

Figure 2. Spatial distribution of tagged and untagged chinook salmon carcasses recovered on spawning surveys in the Salmon River basin, 1987.

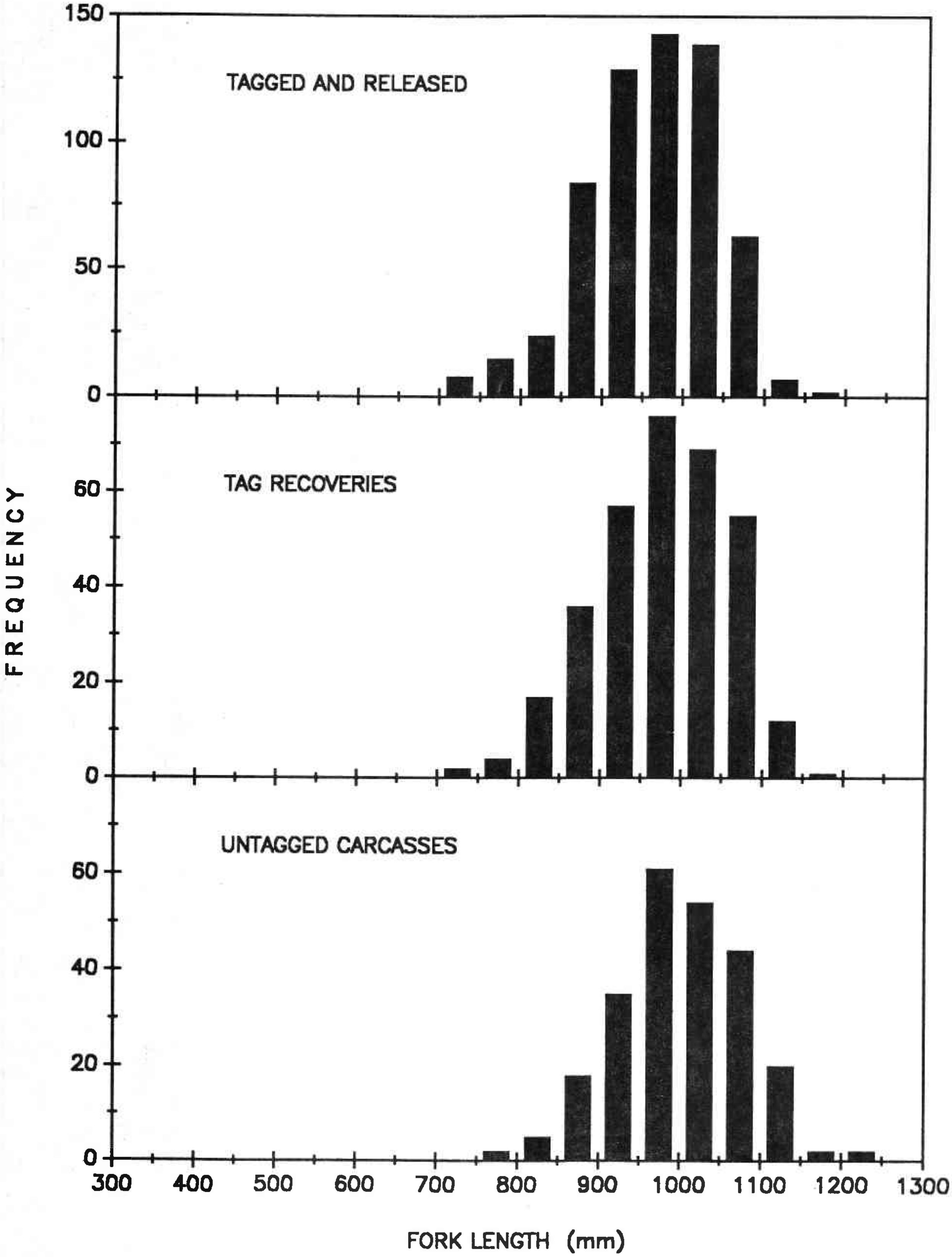

Figure 3. Size composition of female fall chinook salmon tagged and released, and recovered either tagged or untagged on spawning surveys in the Salmon River basin, 1987.

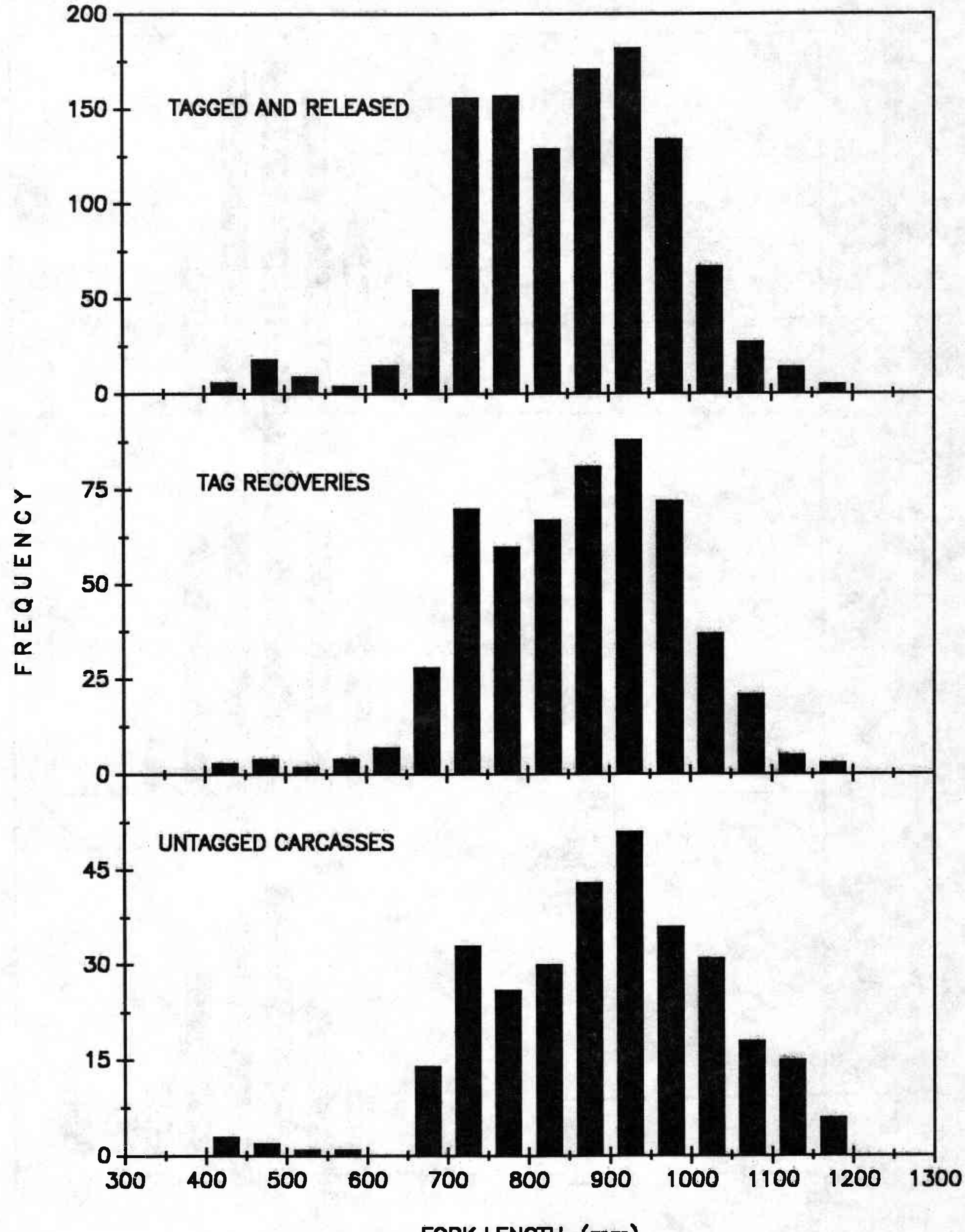

Figure 4. Size composition of male fall chinook salmon tagged and released, and recovered either tagged or untagged on spawning surveys in the Salmon River basin, 1987.

Coded-wire Tag Recoveries

Estimates of 1987 recoveries of CWT chinook salmon from Salmon River Fish Hatchery are presented in Table 9. Expansion factors used to calculate these estimates appear in **APPENDIX C**. Estimates of recoveries of CWT chinook salmon from Salmon River Fish Hatchery by individual brood year beginning with 1982 appear in **APPENDIX D**.

Table 9. Estimated harvest and escapement of Salmon River coded-wire tagged fall chinook salmon, 1987. AK = Alaska, BC = British Columbia, WA = Washington, OR = Oregon and CA = California.

Brood year (tag code)	Ocean harvest					Salmon River catch and escapement			
	AK	BC	WA	OR	CA	Inriver harvest	Hatchery recovery	Spawning escapement	Total
1982 (07 26 47)	41	55	0	3	0	65	60	27	250
1983 (07 27 26)	29	38	2	6	0	47	68	35	225
1984 (07 30 51)	2	16	0	5	0	21	48	20	111
1984 (07 30 52)	7	18	0	6	0	26	44	11	106
1985 (07 33 29)	0	0	0	1	0	5	7	0	14
1985 (07 33 30)	0	0	0	0	0	5	2	0	8

DISCUSSION

Recreational Fishery

Our sampling indicated that anglers expended 58,218 total hours of effort to harvest 1,431 fall chinook salmon in Salmon River in 1987. This harvest represented approximately 31% of the total number of chinook salmon that entered the Salmon River Basin in 1987. Most chinook salmon harvested in 1987 were caught by anglers that fished in Tidewater (RM 1.8-4.3). The high proportion of fish caught in this portion of the basin was due in part to extended low river flow in 1987 that restricted upstream movement of chinook salmon beyond areas influenced by tidal activity. The estimated 84 chinook salmon caught upstream from the hatchery (RM 4.9-10.3) represents a minimal estimate of harvest in this area of the river in 1987. Because the creel survey in this area of the river began after the start of salmon angling and because of inaccessibility of some angling locations, our sampling probably underestimated catch. However, we feel the magnitude of this bias was not large, and our estimate indicates that the vast majority of chinook salmon passing the hatchery escaped to spawn.

Sampling catch rate independently during each interview session provided a means for estimating rate of sampling by comparing the number of fish sampled to the total estimated catch. Overall we sampled 52% of chinook salmon that were caught in the 1987 Salmon River recreational fishery. Our estimated sampling rate, by daytype, was 40.5% on weekday days and 69.1% on weekend and holiday days. These rates of sampling were achieved with a survey that used two samplers during the most intensive portion of the angling season (19 September-2 November). Using only one sampler throughout the angling season would have resulted in an estimated 29.5% of the chinook salmon being sampled. This rate of sampling would have resulted in estimates of the catch of total and marked chinook salmon within 1.3% and 4.1%, respectively of those presented in Table 1. Because of the high level of precision among catch estimated by the two sampling rates, we will conduct the creel survey in 1988 using only one sampler.

Escapement to Natural Spawning Areas

We estimated that 2,896 fall chinook salmon migrated upstream from River Mile 4.3 in 1987. Approximately 20% of these fish did not pass above Salmon River Fish Hatchery and spawned in a 0.5 km stretch immediately downstream from the hatchery. Spawning downstream from the hatchery occurred because of persistent low river flow throughout October that hindered upstream movement. The 1987 escapement estimate composed approximately 61% of the total number of chinook salmon that entered the Salmon River. These results are similar to results in 1986 when we estimated that the natural spawning escapement was 2,492 fall chinook salmon (approximately 60% of the total ocean escapement), however, because of more typical river flow, essentially all natural spawning occurred upstream from the hatchery.

The methods used to estimate the natural spawning escapement of fall chinook salmon were modified slightly in 1987. The most important change involved partitioning the population estimate into length and sex strata to compensate for differential carcass recovery rates of different sizes and sexes of spawning chinook salmon. The new procedure provided escapement estimates based upon carcass size (length), and provided direct size-sex compensation for differential carcass recovery rates. In 1986, the compensation for differential recovery rates involved partitioning the estimates by age and sex, which was only an indirect compensation for carcass size.

The temporal spawning distribution of fall chinook salmon observed in 1987 was similar to that observed in 1986. In 1987, the peak count for spawning chinook salmon occurred during the first week of November (Figure 1). This peak occurred soon after the first rainfall of the season, and coincided with a very large release of anchor-tagged chinook salmon from the hatchery. In 1986, the peak count occurred during the second week of November. In 1987, approximately 85% of the chinook salmon spawned in the lower 14 km of the mainstem, with less than 10% spawning in tributaries (Figure 2). This contrasts the spatial distribution of spawning observed in 1986, when more normal river flow allowed spawning to occur throughout the basin.

Overall, methodologies used to estimate the spawning escapement of fall chinook salmon in 1987 appeared to be adequate despite several anomalies resulting from drought conditions that existed during the fall. Ricker (1975) lists several assumptions that must be met to justify the use of the Petersen formula in making an unbiased population estimate. A discussion of the relevance of these assumptions to our estimate in 1987 follows:

1. *Marked fish suffer the same natural mortality as unmarked fish.*

   We collected data to estimate the relative incidence of prespawning mortality in tagged and untagged chinook salmon to assess the assumption that tagged fish suffer the same natural mortality as untagged fish. A total of 556 female chinook salmon carcasses (322 tagged and 234 untagged) recovered on the spawning grounds were examined for signs of prespawning mortality (intact ovaries). The overall incidence of prespawning mortality was 10.9% for tagged, and 12.0% for untagged carcasses (Table 10). This difference was not significant ($P = 0.69$, X^2), so we conclude that the incidence of prespawning mortality in tagged fish is not significantly different than that which occurred naturally.

2. *Marked fish are as vulnerable to sampling as are unmarked fish.*

   This subject was previously discussed by Boechler and Jacobs (1987). These conclusions also apply to the 1987 estimate.

3. *Marked fish do not lose their mark.*

   The magnitude of tag loss was assessed by marking each fish with two tags. Surveyors recovering tagged carcasses noted the number of tags present. Of the 906 tagged carcasses recovered, we observed only 28 which had lost one tag. At this rate, assuming loss of each tag occurred independently, approximately 0.1% of the fish would have lost both tags. We felt that this tag loss rate was insignificant so no adjustment was made to the population estimate.

4. *Marked fish become randomly mixed with, and are representative of unmarked fish.*

   Generally, the sex composition of tagged carcasses recovered on the spawning grounds was very similar to that of untagged carcasses. The sex composition of the tagged carcasses was 61.4% males, 37.1% females, and 1.5% jacks. The sex composition of the untagged carcasses was 53.8% males, 44.8% females, and 1.4% jacks. Furthermore, the sum of the estimated population size of individual sex strata were within 2% of the overall population estimate (Table 7). Therefore we feel tagged fish were representative of the untagged with regard to sex composition.

   The size composition of tagged and untagged carcasses appear to be comparable. Relative length frequencies of tagged and untagged chinook salmon carcasses, for both males and females, were similar (Figures 3 and 4). Further, differences in size composition between marked and unmarked fish were not large enough to cause significant biases in the population estimate because sums of population estimates calculated from intermediates within 200 mm length strata differed by less than 1% and 2% of the overall population estimates for males and females, respectively (Table 7).

Generally, the temporal distribution of carcass recovery was similar among tagged and untagged chinook salmon with the exception that untagged carcasses were recovered somewhat later in the season than were tagged carcasses (Figure 1). Any resulting bias in the population estimate because of differences in the temporal distribution of carcass recovery was probably not large because 80% of the untagged carcasses were recovered during a period when little variation occurred in carcass recovery rates.

The spatial distribution of tagged carcasses differed from that of untagged carcasses and ($P < 0.001$, X^2; Figure 2). This difference was primarily due to low river flow hindering upstream movement, and resulted in a large proportion of unmarked carcasses spawning downstream from the hatchery. Because all fish were marked at the hatchery, marked fish almost exclusively spawned upstream from this point, and the only marked carcasses that were recovered downstream from the hatchery were carcasses that washed downriver during freshets and the few marked fish that dropped downstream after being tagged. Biases in the population estimate that resulted from this difference probably were not large because the majority of the remaining untagged carcass recoveries and nearly 70% of the tagged carcass recoveries: (1) occurred within 2.4 km of the location where untagged carcasses were recovered below the hatchery, and (2) occurred during a period when carcass recovery conditions (river flow and water visibility) were similar among these locations.

5. *All marks are recognized and reported on recovery.*

   This subject was previously discussed by Boechler and Jacobs (1987). These conclusions also apply to the 1987 estimate.

6. *Only a negligible amount of recruitment to the catchable population occurs during the time of sampling.*

   This subject was previously discussed by Boechler and Jacobs (1987). These conclusions also apply to the 1987 estimate.

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APPENDIX A

Age Composition of Scales Collected from Adult
Fall Chinook Salmon in the Salmon River Basin, 1987

Appendix Table A-1. Age composition of scales collected from fall chinook salmon harvested in the Salmon River sport fishery, 1987.

Age	Male		Female		Sex unknown	Total	
	Number	%	Number	%	(Number)	Number	%
2	12	5.1	0	--	0	12	2.9
3	68	28.9	4	2.3	0	72	17.6
4	109	46.4	53	30.6	1	163	39.9
5	41	17.5	107	61.9	0	148	36.2
6	5	2.1	9	5.2	0	14	3.4

Appendix Table A-2. Age composition of scales collected from untagged fall chinook salmon carcasses recovered on spawning ground surveys in the Salmon River Basin, 1987.

Age	Male		Female		Sex unknown	Total	
	Number	%	Number	%	(Number)	Number	%
2	6	1.9	0	--	0	6	1.1
3	90	29.1	3	1.3	1	94	17.3
4	135	43.6	67	28.6	0	202	37.1
5	73	23.6	138	59.0	0	211	38.8
6	5	1.6	26	11.1	0	31	5.7

APPENDIX B

Results of Spawning Ground Surveys Conducted
in the Salmon River Basin, 1987.

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 9 TIDEWATER

DISTANCE: .2 MILES (.3 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SPOT CHECK
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS:

LOCATION: T06S R10 SECTION W3 SPOT CHECK TIDEWATER AREA OF SALMON RIVER FROM MOUTH OF DEER CREEK #1 UPSTREAM APPROXIMATELY 0.2 MILES TO THE ANGLER ACCESS TRAIL AT THE HATCHERY

				WATER			ALL FISH			LIVE FISH		DEAD FISH					
DATE	FLOW	VIS	WTHR	TEMP	REDD	SPECIES	TOTAL	AD	JACK	AD	JACK	AD	MALE	FEMA	JACK	UNKN	COMMENTS
12/15/87	MOD.	2	OVER.			CHINOOK	49	49				49	16	13		20	SNOUT RECOVERED
						COHO	5	5				5		2		3	DEAD TAGGED FISH OBSERVED
12/18/87	MOD.	2	OVER.			CHINOOK	112	112				112	55	28		29	SNOUT RECOVERED
						COHO	8	6	2			6	3	1	2	2	DEAD TAGGED FISH OBSERVED

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 10 HATCHERY AREA

DISTANCE: .5 MILES (.8 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:
1986 PEAK COUNTS: 60 ADULTS (11/ 5/86)
7 JACKS (11/10/86)

LOCATION: T6S R10W SECTION 29 SURVEY FROM THE ANGLER ACCESS TRAIL AT THE DOWNSTREAM END OF THE HATCHERY PROPERTY, UPSTREAM 0.5 MILES TO THE HATCHERY WEIR.

							ALL FISH			LIVE FISH		DEAD FISH					
DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	TOTAL	AD	JACK	AD	JACK	AD	MALE	FEMA	JACK	UNKN	COMMENTS
10/13/87	LOW	1	CLEAR		4	CHINOOK	12	10	2	2	1	8	4	4	1		STREAM LOW
						COHO	15	9	6	6	4	3	1	1	2	1	PREDATION
																	SNOUT RECOVERED
10/20/87	LOW	1	FOGGY		13	CHINOOK	18	17	1	5		12	6	6	1		STREAM LOW
						COHO	21	15	6	10	5	5	2	1	1	2	
10/26/87	LOW	1	CLEAR		21	CHINOOK	22	22		10		12	5	7			STREAM LOW
						COHO	17	7	10	5	9	2	2		1		DEAD TAGGED FISH OBSERVED
11/ 4/87	LOW	1	CLEAR		71	CHINOOK	169	165	4	119	3	46	23	22	1	1	DARK IN POOLS
						COHO	24	19	5	15	5	4	2	2			SNOUT RECOVERED
						CHUM	1	1		1							STREAM LOW
11/12/87	LOW	2	RAIN			CHINOOK	227	218	9	32	2	186	87	94	7	5	SNOUT RECOVERED
						COHO	17	8	9	1	6	7	2	5	3		DEAD TAGGED FISH OBSERVED
						CHUM	14	14		5		9	5	4			
11/17/87	LOW	2	CLEAR			CHINOOK	172	169	3	15	1	154	64	69	2	21	SNOUT RECOVERED
						COHO	10	7	3	2		5	1	4	3		DEAD TAGGED FISH OBSERVED
						CHUM	10	10		2		8	5	3			
						STEELHEAD	1										
11/24/87	MOD.	3	RAIN			CHINOOK	43	43		4		39	13	19		7	SNOUT RECOVERED
						COHO	1	1		1							DEAD TAGGED FISH OBSERVED
						CHUM	2	2		1		1		1			
11/30/87	LOW	2	OVER.			CHINOOK	101	101		2		99	43	43		13	SNOUT RECOVERED
						COHO	3	3				3		3			DEAD TAGGED FISH OBSERVED
						CHUM	6	6				6	3	3			
						STEELHEAD	2										
12/14/87	MOD.	2	OVER.			CHINOOK	6	6				6	1	3		2	PARTIAL COUNT
						COHO	1	1				1	1				
12/17/87	MOD.	1	CLEAR			CHINOOK	46	46				46	24	12		10	DARK IN POOLS
						COHO	4	2	2	1		1	1		2		
12/28/87	LOW	1	OVER.			CHINOOK	20	20				20	5	3		12	
						COHO	1		1						1		

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 12 PANTHER CR TO SLICK ROCK CR

DISTANCE: 2.4 MILES (3.9 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SPOT CHECK
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 49 ADULTS (11/13/86)
4 JACKS (11/13/86)

LOCATION: T7S R10W SECTION 4 SURVEY FROM THE MOUTH OF PANTHER CREEK, UPSTREAM 2.4 MILES TO THE MOUTH OF SLICK ROCK CREEK (RIVER MILES 6.4 TO 8.8).

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
11/ 6/87	LOW	1	OVER.		20	CHINOOK	139	137	2	113	2	24	13	11			DARK IN POOLS
																	STREAM LOW
																	LIVE TAGGED FISH OBSERVED
11/18/87	LOW	1	CLEAR		20	CHINOOK	121	119	2	43		76	39	33	2	4	DARK IN POOLS
						COHO	2	1	1			1	1		1		SNOUT RECOVERED
																	DEAD TAGGED FISH OBSERVED
11/24/87	MOD.	2	RAIN			CHINOOK	67	66	1	7		59	32	20	1	7	SNOUT RECOVERED
						COHO	2	1	1			1		1	1		DEAD TAGGED FISH OBSERVED
12/16/87	MOD.	1	OVER.			CHINOOK	50	50				50	26	13		11	DARK IN POOLS
						COHO	8	5	3			5	4	1	3		SNOUT RECOVERED
12/23/87	MOD.	1	CLEAR			CHINOOK	25	25				25	11	6		8	
						COHO	4	4				4	4				
						STEELHEAD	2										
1/ 6/88	LOW	1	OVER.			CHINOOK	11	11				11	4	5		2	
						COHO	2	2				2	2				

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 15 LITTLE SALMON TO TRIB 6

DISTANCE: .6 MILES (1.0 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:
1986 PEAK COUNTS: 4 ADULTS (11/ 4/86)
0 JACKS ( )

LOCATION: T6S R9W SECTION 15 SURVEY FROM THE MOUTH OF LITTLE SALMON RIVER, UPSTREAM 0.6 MILE TO THE MOUTH OF TRIBUTARY 6 (RIVER MILES 16.3 TO 16.9).

							ALL FISH			LIVE FISH		DEAD FISH					
DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	TOTAL	AD	JACK	AD	JACK	AD	MALE	FEMA	JACK	UNKN	COMMENTS
11/27/87	LOW	1	CLEAR			COHO	4	1	3		2	1			1	1	
12/ 4/87	MOD.	2	OVER.														
12/17/87	LOW	1	CLEAR														
1/ 2/88	LOW	1	OVER.			STEELHEAD	1										
1/ 5/88.	LOW	1	OVER.			STEELHEAD	1										

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 17 PRAIRIE TO LITTLE SALMON

DISTANCE: 2.6 MILES (4.2 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 81 ADULTS (11/ 5/86)
11 JACKS (11/ 5/86)

LOCATION: T6S R9W SECTION 20 SALMON RIVER FROM PRAIRIE CREEK TO LITTLE SALMON RIVER

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/ 7/87	LOW	1	OVER.														DARK IN POOLS STREAM LOW
10/13/87	LOW	1	CLEAR														STREAM LOW
10/20/87	LOW	1	CLEAR														STREAM LOW
10/27/87	LOW	1	CLEAR														STREAM LOW
11/ 5/87	LOW	1	CLEAR		5	CHINOOK	1	1		1							DARK IN POOLS
						COHO	11	9	2	9	2						STREAM LOW
11/13/87	LOW	2	RAIN			CHINOOK	2	2		1		1	1				DARK IN POOLS
11/19/87	LOW	1	CLEAR		14	CHINOOK	39	39		31		8	8				DARK IN POOLS
						COHO	13	8	5	7	4	1		1	1		DEAD TAGGED FISH OBSERVED
11/25/87	LOW	1	CLEAR		6	CHINOOK	28	28		19		9	4	4		1	
						COHO	13	9	4	9	3				1		
12/ 2/87	MOD.	2	RAIN		10	CHINOOK	13	13		9		4	1	2		1	
						COHO	5	3	2	3					2		
12/ 8/87	MOD.	2	OVER.		2	CHINOOK	5	5		4		1		1			
						COHO	4	2	2	1	1	1			1	1	
12/15/87	MOD.	1	OVER.			CHINOOK	5	5		1		4	1	2		1	DARK IN POOLS
						COHO	2	2		2							
12/21/87	MOD.	1	OVER.			CHINOOK	5	5				5	1	2		2	DARK IN POOLS
12/28/87	LOW	1	CLEAR														
1/ 4/88	LOW	1	OVER.			STEELHEAD	7										
1/22/88	MOD.	1	OVER.		1												DARK IN POOLS

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 18 HATCHERY TO PANTHER CREEK

DISTANCE: 1.5 MILES (2.4 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:
1986 PEAK COUNTS: 61 ADULTS (11/ 5/86)
8 JACKS (11/12/86)

LOCATION: T6S R10W SECTION 29 SURVEY FROM THE HATCHERY UPSTREAM TO THE MOUTH OF PANTHER CREEK.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/ 6/87	LOW	1	CLEAR		2	COHO	11	7	4	7	4						DARK IN POOLS
																	STREAM LOW
10/13/87	LOW	1	CLEAR		2	CHINOOK	1	1				1		1			DARK IN POOLS
						COHO	1		1		1						STREAM LOW
																	SNOUT RECOVERED
10/20/87	LOW	1	CLEAR		4	CHINOOK	2	1	1	1	1						DARK IN POOLS
						COHO	3	3		2		1				1	STREAM LOW
																	PREDATION.
10/26/87	LOW	1	CLEAR		3	CHINOOK	25	22	3	20	3	2	1	1			DARK IN POOLS
						COHO	13	1	12	1	11				1		STREAM LOW
																	DEAD TAGGED FISH OBSERVED
11/ 4/87	LOW	1	CLEAR		50	CHINOOK	271	266	5	223	5	43	25	17		1	SNOUT RECOVERED
						STEELHEAD	1										DARK IN POOLS
																	LIVE TAGGED FISH OBSERVED
11/11/87	LOW	1	RAIN		90	CHINOOK	600	592	8	249	3	343	191	149	5	3	SNOUT RECOVERED
						COHO	70	5	65	3	63	2	1	1	2		LIVE TAGGED FISH OBSERVED
						CHUM	2	2				2	1	1			
11/18/87	LOW	1	CLEAR		43	CHINOOK	323	323		71		252	162	90			DARK IN POOLS
						COHO	16	16		13		3	2	1			SNOUT RECOVERED
																	DEAD TAGGED FISH OBSERVED
11/24/87	MOD.	3	RAIN			CHINOOK	134	134		36		98	63	34		1	SNOUT RECOVERED
						COHO	3		3						3		DEAD TAGGED FISH OBSERVED
						CHUM	1	1				1	1				
11/30/87	LOW	2	RAIN		82	CHINOOK	372	370	2	55		315	194	108	2	13	SNOUT RECOVERED
						COHO	6	1	5			1	1		5		DEAD TAGGED FISH OBSERVED
						CHUM	1	1				1				1	
12/14/87	MOD.	2	RAIN			CHINOOK	54	53	1			53	8	30	1	15	NO NEW SPAWNING FISH OBSERVED
						COHO	4	2	2		1	2	1	1	1		
12/21/87	MOD.	2	OVER.			CHINOOK	26	26				26	9	8		9	
						COHO	3		3						3		
						CHUM	1	1				1	1				
12/28/87	LOW	1	OVER.			CHINOOK	16	16				16	4	4		8	
						COHO	2	1	1	1					1		
1/ 4/88	LOW	1	OVER.		2	CHINOOK	17	17				17	5	6		6	DEAD TAGGED FISH OBSERVED
						COHO	3	1	2			1	1		2		
						STEELHEAD	5										

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 19 WIDOW CR. TO DEER CR. NO. 2

DISTANCE: 2.3 MILES (3.7 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:
1986 PEAK COUNTS: 15 ADULTS (11/ 6/86)
3 JACKS (11/ 6/86)

LOCATION: T6S R10W SECTION 25 SURVEY FROM THE MOUTH OF WIDOW CREEK UPSTREAM 2.3 MILES TO THE MOUTH OF DEER CREEK NO. 2.

							ALL FISH			LIVE FISH		DEAD FISH					
DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	TOTAL	AD	JACK	AD	JACK	AD	MALE	FEMA	JACK	UNKN	COMMENTS
11/ 5/87	LOW	1	CLEAR		8	CHINOOK	32	30	2	30	2						DARK IN POOLS
						COHO	3		3		3						STREAM LOW
																	LIVE TAGGED FISH OBSERVED
11/19/87	LOW	1	CLEAR		6	CHINOOK	32	32		4		28	17	9		2	DEAD TAGGED FISH OBSERVED
						COHO	4	2	2	2	2						
11/25/87	MOD.	2	CLEAR		2	CHINOOK	37	37		6		31	17	7		7	DEAD TAGGED FISH OBSERVED
						COHO	1	1				1	1				
12/15/87	MOD.	1	OVER.			CHINOOK	11	11				11	3	6		2	DARK IN POOLS
						COHO	2		2						2		
12/23/87	MOD.	1	OVER.			CHINOOK	7	7				7	3	1		3	DARK IN POOLS
						COHO	1		1		1						
12/30/87	LOW	1	SNOW			CHINOOK	1	1				1	1				

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 20 DEER CR. NO. 2 TO PRAIRIE CR.

DISTANCE: 1.1 MILES (1.8 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 46 ADULTS (11/ 6/86)
1 JACKS (11/ 6/86)

LOCATION: T6S R9W SECTION 29 SURVEY FROM THE MOUTH OF DEER CREEK NO. 2 UPSTREAM 1.1 MILES TO THE MOUTH OF PRAIRIE CREEK.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
11/ 5/87	LOW	1	CLEAR		2	CHINOOK	6	6		6							DARK IN POOLS
						COHO	6	4	2	4	2						STREAM LOW
																	LIVE TAGGED FISH OBSERVED
11/19/87	LOW	1	OVER.		6	CHINOOK	33	33		30		3	2	1			SNOUT RECOVERED
						COHO	2		2						2		DEAD TAGGED FISH OBSERVED
11/25/87	LOW	1	CLEAR		5	CHINOOK	23	23		20		3	3				DEAD TAGGED FISH OBSERVED
						COHO	1	1		1							
12/ 2/87	MOD.	2	RAIN			CHINOOK	17	17		5		12	7	5			DEAD TAGGED FISH OBSERVED
						COHO	1	1				1	1				
12/15/87	MOD.	1	OVER.			CHINOOK	2	2				2	2				DARK IN POOLS
						COHO	2	2		1		1		1			
12/21/87	MOD.	2	OVER.			CHINOOK	1	1		1							
						COHO	5	5				5	2	1		2	
12/30/87	LOW	1	SNOW			CHINOOK	1	1				1				1	

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 32 SALMON CREEK (2)

DISTANCE: 1.5 MILES (2.4 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 6 ADULTS (11/ 6/86)
0 JACKS ( )

LOCATION: T6S R10W SECTION 30 SURVEY FROM THE THREE ROCKS ROAD UPSTREAM 1.5 MILES TO THE CONFLUENCE WITH TELEPHONE CREEK.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/23/87	LOW	1	OVER.														STREAM LOW
10/30/87	LOW	1	CLEAR														STREAM LOW
11/ 9/87	LOW	1	OVER.			CHUM	1	1		1							STREAM LOW
11/17/87	LOW	1	CLEAR		3	COHO	5		5		4				1		
						CHUM	1	1				1		1			
11/23/87	LOW	1	OVER.		1	COHO	3	1	2	1	1				1		
12/ 2/87	LOW	2	RAIN		2	COHO	6	3	3	3	3						
12/ 7/87	MOD.	2	OVER.		5	CHINOOK	3	3		3							TAG RECOVERED
						COHO	10	5	5	4	5	1	1				
						CHUM	2	2				2	1	1			
12/17/87	LOW	1	CLEAR		2	COHO	9	3	6	3	5				1		
12/22/87	MOD.	1	RAIN		1	COHO	8	3	5	2	4	1	1		1		
12/28/87	LOW	1	OVER.		2	CHINOOK	1	1				1				1	
						COHO	4	2	2			2	1		2	1	
1/ 4/88	LOW	1	OVER.		3	CHINOOK	1	1				1				1	DARK IN POOLS
						COHO	3	3				3	1			2	
1/11/88	MOD.	2	OVER.		1	COHO	1	1		1							
1/20/88	MOD.	1	CLEAR			COHO	1	1		1							DARK IN POOLS
1/26/88	LOW	1	CLEAR		2												

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 33 LOWER SALMON CREEK

DISTANCE: .5 MILES (.8 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SPOT CHECK
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 0 ADULTS ( )
0 JACKS ( )

LOCATION: T6S R10W SECTION 30 SURVEY FROM THE MOUTH UPSTREAM 0.5 MILES TO THREE ROCKS ROAD

				WATER			ALL FISH			LIVE FISH		DEAD FISH					
DATE	FLOW	VIS	WTHR	TEMP	REDD	SPECIES	TOTAL	AD	JACK	AD	JACK	AD	MALE	FEMA	JACK	UNKN	COMMENTS
11/20/87	LOW	1	CLEAR		5	COHO	4	1	3	1	1				2		

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 41 DEER CREEK NO. 1

DISTANCE: 1.4 MILES (2.3 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 2 ADULTS (11/12/86)
0 JACKS ( )

LOCATION: T6S R10W SECTION 30 SURVEY FROM THE MOUTH, UPSTREAM 1.4 MILES TO A SIX FOOT WATERFALL.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/21/87	LOW	1	OVER.														STREAM LOW
10/30/87	LOW	1	CLEAR														STREAM LOW DARK IN POOLS
11/ 9/87	LOW	1	OVER.														STREAM LOW DARK IN POOLS
11/17/87	LOW	1	CLEAR		1												
11/23/87	LOW	1.	OVER.			COHO	6	2	4	2	3				1		
12/ 2/87	LOW	2	RAIN		1	CHINOOK	1	1		1							LIVE TAGGED FISH OBSERVED
						COHO	12	6	6	5	6	1		1			
12/ 8/87	MOD.	2	OVER.			COHO	14	5	9	4	6	1	1		3		
12/17/87	LOW	1	CLEAR		1	COHO	3	1	2			1		1	2		
12/22/87	MOD.	1	RAIN			COHO	3		3						3		
12/29/87	LOW	1	CLEAR			COHO	3	1	2		1	1		1	1		
1/ 5/88	LOW	1	OVER.		1												
1/12/88	MOD.	1	OVER.			COHO	1	1				1	1				DARK IN POOLS
1/20/88	MOD.	1	CLEAR		3												DARK IN POOLS
1/26/88	LOW	1	OVER.		5	STEELHEAD	2										

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 71 BEAR CREEK (LOWER)

DISTANCE: 2.0 MILES (3.2 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:
1986 PEAK COUNTS: 64 ADULTS (11/11/86)
18 JACKS (11/11/86)

LOCATION: T7S R10W SECTION 3 SURVEY FROM THE MOUTH, UPSTREAM 2.0 MILES TO A POINT 0.5 MILE ABOVE BEAR CREEK ROAD BRIDGE.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/23/87	LOW	1	OVER.														STREAM LOW
10/28/87	LOW	1	CLEAR														STREAM LOW
11/ 6/87	LOW	1	OVER.		11	CHINOOK	3	3		2		1	1				STREAM LOW
						COHO	5	2	3	2	3						PREDATION
																	LIVE TAGGED FISH OBSERVED
11/13/87	LOW	1	OVER.		2	CHINOOK	14	13	1	12	1	1		1			DARK IN POOLS
						COHO	9	5	4	5	3				1		LIVE TAGGED FISH OBSERVED
																	DEAD TAGGED FISH OBSERVED
11/19/87	LOW	1	CLEAR		22	CHINOOK	32	32		23		9	3	6			DEAD TAGGED FISH OBSERVED
						COHO	11	6	5	5	3	1			2	1	
						CHUM	2	2		1		1		1			
11/25/87	LOW	1	CLEAR		26	CHINOOK	32	32		10		22	9	10		3	DEAD TAGGED FISH OBSERVED
						COHO	35	14	21	11	10	3	1	2	3		
						CHUM	3	3		2		1		1			
12/ 2/87	MOD.	1	RAIN		21	CHINOOK	42	41	1	29	1	12	5	5		2	DARK IN POOLS
						COHO	18	5	13	4	9	1		1	4		
12/ 8/87	MOD.	2	RAIN		8	CHINOOK	29	29		20		9	4	4		1	
						COHO	13	8	5	5	5	3	1	2			
12/16/87	MOD.	1	CLEAR		9	CHINOOK	30	30		13		17	13	4			LIVE TAGGED FISH OBSERVED
						COHO	9	5	4	1		4	3	1	4		SNOUT RECOVERED
						STEELHEAD	1										
12/22/87	MOD.	1	RAIN			CHINOOK	20	20		6		14	8	6			DARK IN POOLS
						COHO	7	3	4	1	1	2	1	1	3		
12/29/87	LOW	1	OVER.		5	CHINOOK	12	12				12	4	7		1	
						COHO	4	3	1			3	1		1	2	
1/ 5/88	LOW	1	OVER.		1	CHINOOK	7	7				7	3	3		1	
						COHO	1		1						1		
1/12/88	MOD.	2	OVER.		1	CHINOOK	1	1				1		1			
						COHO	1	1		1							
						STEELHEAD	7										
1/21/88	MOD.	2	CLEAR			STEELHEAD	7										
1/28/88	LOW	2	RAIN		3	STEELHEAD	4										

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 77 BEAR CREEK (MIDDLE)

DISTANCE: 1.4 MILES (2.3 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 8 ADULTS (12/ 9/86)
0 JACKS ( )

LOCATION: T7S R10W SECTION 4 BEGIN AT THE ALUMINUM MARKER 0.5 MILES ABOVE THE BEAR CREEK ROAD BRIDGE AND SURVEY UPSTREAM 1.4 MILES TO THE BRIDGE ON TROUT CREEK RD.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/23/87	LOW	1	OVER.														STREAM LOW
10/30/87	LOW	1	CLEAR														STREAM LOW
11/ 9/87	LOW	1	RAIN														STREAM LOW
11/17/87	LOW	1	CLEAR		2	COHO	6	1	5	1	2				3		
11/23/87	LOW	1	OVER.		4	COHO	9	1	8	1	6				2		
12/ 1/87	MOD.	2	OVER.														
12/ 7/87	MOD.	2	OVER.		6	CHINOOK	7	7		7							LIVE TAGGED FISH OBSERVED
						COHO	6	3	3	3	1				2		
12/16/87	MOD.	1	CLEAR		1	COHO	5	4	1	3		1	1		1		
12/22/87	LOW	1	RAIN		1	CHINOOK	1	1				1		1			
12/29/87	LOW	1	OVER.														
1/ 5/88	LOW	1	OVER.														
1/12/88	MOD.	1	OVER.			CHINOOK	1	1				1				1	
						COHO	1	1				1	1				
						STEELHEAD	2										
1/21/88	MOD.	1	CLEAR		1	COHO	1	1		1							
						STEELHEAD	3										
1/28/88	LOW	1	RAIN		1	COHO	2	2				2		1		1	DARK IN POOLS
						STEELHEAD	2										

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 81 SLICK ROCK CREEK

DISTANCE: 1.3 MILES (2.1 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SPOT CHECK
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 14 ADULTS (11/14/86)
0 JACKS ( )

LOCATION: T6S R10W SECTION 35 SURVEY FROM THE MOUTH, UPSTREAM 1.3 MILES TO THE MOUTH OF TROUT CREEK

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
11/20/87	LOW	1	OVER.		15	CHINOOK	53	52	1	38	1	14	9	5			LIVE TAGGED FISH OBSERVED
						COHO	3	1	2	1	1				1		TAG RECOVERED
11/27/87	LOW	1	CLEAR		11	CHINOOK	51	50	1	15	1	35	19	14		2	SNOUT RECOVERED
						COHO	1		1		1						
12/15/87	MOD.	1	SNOW		3	CHINOOK	7	7		3		4	2	2			
						COHO	2	1	1			1	1		1		
12/21/87	MOD.	1	OVER.			CHINOOK	8	8				8	2	5		1	
						COHO	1	1				1	1				
12/28/87	LOW	1	CLEAR			CHINOOK	2	2				2	2				
						COHO	1	1				1	1				
1/ 6/88	LOW	1	OVER.			CHINOOK	3	3				3		3			
						COHO	2	2				2	1			1	

SPAWNING FISH SURVEY SUMMARY
(1987 SPAWNING YEAR)

DISTRICT: 3 LINCOLN
BASIN: 16 SALMON RIVER
SUBBASIN: 1 MAIN STEM AND BAY
SURVEY: 91 TROUT CREEK

DISTANCE: 1.2 MILES (1.9 KM)
TARGET SPECIES: CHINOOK
SURVEY TYPE: SUPPLEMENTAL SURVEY
HATCHERY INFLUENCED

BASE COUNT:

1986 PEAK COUNTS: 20 ADULTS (11/13/86)
1 JACKS (11/13/86)

LOCATION: T7S R10W SECTION 1 SURVEY FROM THE MOUTH UPSTREAM 1.2 MILES TO A FOUR-STEP FALLS IN A NARROW CANYON.

DATE	FLOW	VIS	WTHR	WATER TEMP	REDD	SPECIES	ALL FISH TOTAL	ALL FISH AD	ALL FISH JACK	LIVE FISH AD	LIVE FISH JACK	DEAD FISH AD	DEAD FISH MALE	DEAD FISH FEMA	DEAD FISH JACK	DEAD FISH UNKN	COMMENTS
10/22/87	LOW	1	CLEAR														STREAM LOW
10/28/87	LOW	1	CLEAR														STREAM LOW
11/ 6/87	LOW	1	OVER.														STREAM LOW
11/16/87	LOW	1	OVER.		7	CHINOOK	32	30	2	27	2	3	2	1			DEAD TAGGED FISH OBSERVED
						COHO	3	2	1	2	1						
11/23/87	LOW	1	OVER.		9	CHINOOK	43	42	1	38	1	4	4				
						COHO	12	7	5	7	5						
12/ 2/87	MOD.	2	RAIN		4	CHINOOK	11	11		3		8	5			3	
						COHO	6	4	2	4	2						
12/ 8/87	MOD.	2	RAIN		3	CHINOOK	8	8		6		2	1			1	
						COHO	4	4		3		1		1			
12/15/87	MOD.	1	OVER.			CHINOOK	1	1		1							
						COHO	4	3	1		1	3	1	2			
12/21/87	MOD.	1	OVER.			COHO	4	4		2		2	2				
12/28/87	LOW	1	CLEAR			CHINOOK	1	1				1				1	
1/ 4/88	LOW	1	OVER.			CHINOOK	1	1				1		1			
1/12/88	MOD.	2	OVER.														
1/21/88	MOD.	1	CLEAR			STEELHEAD	2										
1/28/88	LOW	1	RAIN			STEELHEAD	3										DARK IN POOLS

APPENDIX C

Data and Expansion Factors used to Calculate Estimates of Coded-wire Tagged Fall Chinook Salmon in the Salmon River Basin, 1987.

Appendix Table C-1. Data and expansion factors used to calculate the weekly estimates of coded-wire tagged fall chinook salmon caught in the Salmon River recreational fishery, 1987.

	Statistical Week[a]														
CWT expansion component	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
ADULTS:															
Estimated catch (N)	2	3	18	26	106	165	224	197	130	125	125	89	59	103	11
Fish sampled (T)	1	1	5	9	40	69	117	122	67	84	59	60	17	40	5
Ad-clips observed (A)	0	0	3	2	5	9	9	20	8	11	9	7	0	2	0
Snouts recovered[b]	0	0	2	4	5	6	8	19	9	11	10	6	0	2	0
Snouts processed (S)	0	0	2	4	5	6	8	19	9	11	10	6	0	2	0
Snouts with CWTs (W)	0	0	2	4	4	5	8	18	7	11	10	6	0	2	0
Snouts without CWTs	0	0	0	0	1	1	0	1	2	0	0	0	0	0	0
CWTs decoded (D)	0	0	2	4	4	5	8	18	7	11	10	6	0	2	0
CWT expansion factor (E)	--	--	5.40	1.44	2.65	3.59	2.15	1.70	1.72	1.49	1.91	1.73	--	2.58	-
JACKS:															
Estimated catch (N)	0	0	4	0	3	5	14	2	3	3	3	7	4	0	0
Fish sampled (T)	0	0	1	0	1	3	6	1	2	1	1	3	1	0	0
Ad-clips observed (A)	0	0	0	0	0	1	2	0	1	0	0	2	0	0	0
Snouts recovered[b]	0	0	0	0	0	0	2	0	1	0	0	2	0	0	0
Snouts processed (S)	0	0	0	0	0	0	2	0	1	0	0	2	0	0	0
Snouts with CWTs (W)	0	0	0	0	0	0	2	0	1	0	0	2	0	0	0
Snouts without CWTs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWTs decoded (D)	0	0	0	0	0	0	2	0	1	0	0	2	0	0	0
CWT expansion factor (E)	--	--	--	--	--	--	2.33	--	1.50	--	--	2.33	--	--	--

[a] *Monday through Sunday.*
[b] *Includes voluntary angler recoveries.*

Appendix Table C-2. Data and expansion factors used to estimate the number of coded-wire tagged fall chinook salmon that migrated upstream from River Mile 4.3, 1987.

	Length stratum (fork length,mm)							
	Males				Females			
CWT expansion components	400-599	600-799	800-999	1,000-1,199	400-599	600-799	800-999	1,000-1,199
Population estimate (N)	58	555	936	233	0	31	636	409
Fish sampled (T)	22	246	483	140	0	8	318	271
Ad-clips observed (A)	1	12	17	3	0	0	10	9
Snouts recovered	1	12	17	3	0	0	10	9
Snouts processed (S)	1	12	17	3	0	0	10	9
Snouts with CWTs (W)	1	12	17	3	0	0	9	8
Snouts without CWTs	0	0	0	0	0	0	1	1
CWTs decoded (D)	1	12	17	3	0	0	9	8
CWT expansion factor (E)	2.64	2.26	1.94	1.66	--	--	2.00	1.51

APPENDIX D

Estimates of recoveries of Coded-wire Tagged Fall Chinook salmon Released from Salmon River Fish Hatchery Summarized by Brood Year

Appendix Table D-1. Estimated recoveries of CWT chinook salmon released from Salmon River Fish Hatchery summarized by brood year, 1982-85. AK = Alaska, BC = British Columbia, WA = Washington, OR = Oregon and CA = California.

			Ocean recoveries											Inriver recoveries				
			Commercial					Recreational										
Tag code	Brood year	Recovery year	AK	BC	WA	OR	CA	AK	BC	WA	OR	CA	Total	Recreational harvest	Hatchery recoveries	Spawning escapement	Total	Grand total
07-26-47	82	84	0	0	0	0	0	0	0	0	0	0	0	--	13	--	13	13
		85	6	61	0	0	0	0	0	0	0	0	67	--	2	--	2	69
		86	74	46	0	0	0	0	0	0	0	0	120	25	10	71	106	226
		87	41	55	0	3	0	0	0	0	0	0	99	65	60	27	152	251
		88																
07-27-26	83	85	0	0	0	0	0	0	0	0	0	0	0	--	34	--	34	34
		86	8	24	0	0	0	0	0	0	0	0	32	22	10	59	91	123
		87	29	38	0	4	0	0	0	2	2	0	75	47	68	35	150	225
		88											0				0	0
		89											0				0	0
07-30-51	84	86	1	20	0	0	0	0	0	0	0	0	21	21	5	64	90	111
		87	2	16	0	5	0	0	0	0	0	0	23	21	48	20	89	112
		88											0				0	0
		89											0				0	0
		90											0				0	0
07-30-52	84	86	0	0	0	0	0	0	0	0	3	0	3	11	4	32	47	50
		87	7	18	0	4	0	0	0	0	2	0	31	26	44	11	81	112
		88											0				0	0
		89											0				0	0
		90											0				0	0
07-33-29	85	87	0	0	0	0	0	0	0	0	1	0	1	5	7	0	12	13
		88											0				0	0
		89											0				0	0
		90											0				0	0
		91											0				0	0
07-33-30	85	87	0	0	0	0	0	0	0	0	0	0	0	5	2	0	7	7
		88											0				0	0
		89											0				0	0
		90											0				0	0
		91											0				0	0

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