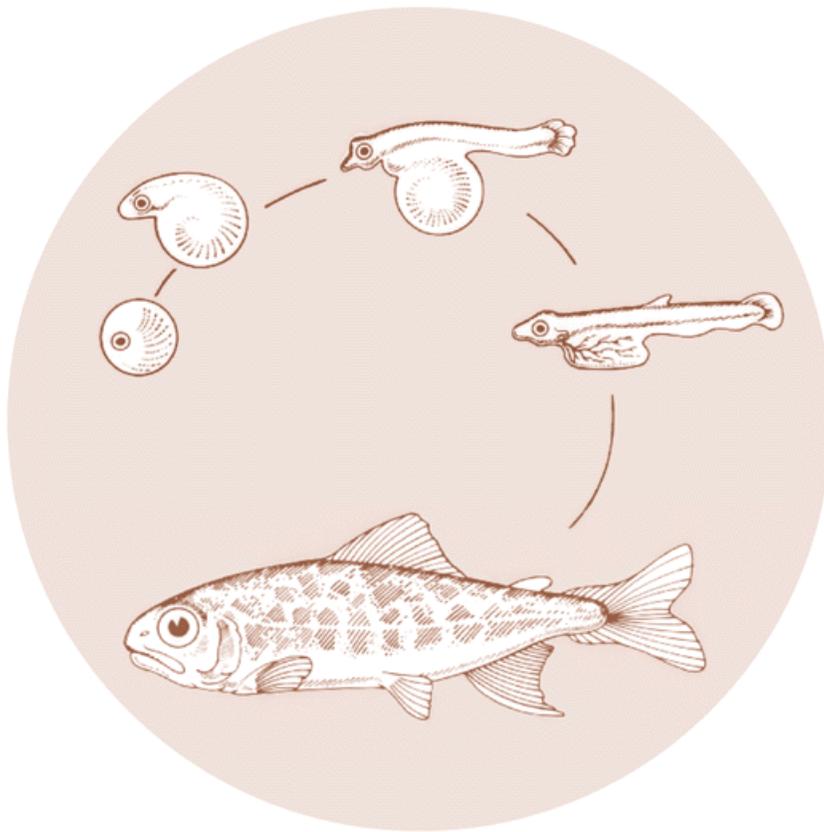


October 1999

ANNUAL CODED WIRE TAG PROGRAM WASHINGTON MISSING PRODUCTION GROUPS

Annual Report 1998



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ANNUAL CODED WIRE TAG PROGRAM

WASHINGTON

**MISSING PRODUCTION GROUPS
ANNUAL REPORT FOR 1998**

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ABSTRACT

The Bonneville Power Administration (BPA) funds the "Annual Coded Wire Tag Program - Missing Production Groups for Columbia River Hatcheries" project. The Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW) and the United States Fish and Wildlife Service (USFWS) all operate salmon and steelhead rearing programs in the Columbia River basin. The intent of the funding is to coded-wire tag at least one production group of each species at each Columbia Basin hatchery to provide a holistic assessment of survival and catch distribution over time and to meet various measures of the Northwest Power Planning Councils (NWPPC) Fish and Wildlife Program.

The WDFW project has three main objectives: 1) coded-wire tag at least one production group of each species at each Columbia Basin hatchery to enable evaluation of survival and catch distribution over time, 2) recover coded-wire tags from the snouts of fish tagged under objective 1 and estimate survival, contribution, and stray rates for each group, and 3) report the findings under objective 2 for all broods of chinook, and coho released from WDFW Columbia Basin hatcheries.

Objective 1 for FY-98 was met with few modifications to the original FY-98 proposal. Under Objective 2, snouts containing coded-wire tags that were recovered during FY-98 were decoded. Under Objective 3, survival, contribution and stray rate estimates for the 1991-96 broods of chinook and 1993-96 broods of coho have not been made because recovery data for 1996-97 fisheries and escapement are preliminary. This report summarizes available recovery information through 1996 and includes some 1997 recoveries by WDFW.

INTRODUCTION

The Columbia Basin Fish and Wildlife Program Section 203 (a) proposes an interim goal of doubling the runs of salmon and steelhead in the Columbia River basin. Doubling means increasing the current run size of 2.5 million fish to 5.0 million fish. As part of this effort Section 206 © states an objective of exploring methods to substantially increase and improve hatchery production at existing hatcheries. Section 206 (e) (1) states that the Bonneville Power Administration (BPA) shall fund collection of Columbia Basin hatchery data for anadromous fish. These data will include at a minimum: number of returning adults; disposition of returning adults; source and description of broodstock; actions to maintain genetic diversity; and size, location and time of release of juvenile fish.

A system of monitoring and evaluating survival and contribution is necessary to measure present and future levels of fish production by various hatchery and natural fish production components. In order to evaluate the success of this program in doubling the size of fish runs, a continuous long term data set is necessary.

In September 1989, under contract from the BPA, the Washington Department of Fisheries (now WDFW) began coded-wire tagging production groups of anadromous salmonids that were not tagged by other programs (i.e. missing production groups). This project began with the tagging of juvenile salmon in 1990 (1989 brood fall chinook and 1988 broods of spring and summer chinook, and coho).

As salmon mature in the ocean they are either harvested in various fisheries, or return to freshwater spawning areas where they can be enumerated. Each fishery or freshwater spawning area is sampled to recover coded-wire tags. Recovery data are reported to the Pacific States Marine Fisheries Commission (PSMFC). Release and recovery data, sampling rates, and ratios of marked to unmarked fish in the sample are stored in PSMFC computers in the Regional Mark Information System (RMIS). These data are used to estimate survival and contribution rates to each fishery for every hatchery or wild production group. Calculated survival and contribution rates are then used as a relative measure of each production group's effectiveness in meeting program goals, which directs future efforts in maintaining or enhancing fish runs in the Columbia Basin and provides valuable information to salmon harvest managers.

Data generated by this and companion projects is used to evaluate hatchery effectiveness by determining survival rates which are used to determine the number of adult fish of each species that each hatchery produces. Having contiguous data allows measurement of annual variation in the number of adults produced each year which then allows judgement on the effectiveness of the hatchery system, in meeting NWPPC Measures, particularly those under Section 8.4C, "Marking of Hatchery Salmon". Because of the utility of the coded-wire tag as a stock assessment tool, the recovery

information provided by these projects helps meet other NWPPC Measures such as those under Sections 6.1, 7.2, 8.1,8.2, and 8.3. In addition, data generated by coded wire tags are used by fishery managers to assess long term changes in stock abundance, in modeling of wild stock abundance, for run reconstruction analysis to determine strength of individual runs within the Basin, and to meet obligations under U.S. v. Oregon and the Pacific Salmon Treaty. Lastly, WDFW uses these data to meet compliance under Section 7 and Section 10 consultation with the National Marine Fisheries Service, which regulates hatchery production under the Endangered Species Act.

APPROACH

The goals of this program are to use the coded-wire tag as a tool to estimate survival and fishery contribution of hatchery reared salmon from WDFW Columbia River hatcheries. The generation of these estimates can then be used for a wide variety of purposes. For this project, meeting the objectives listed below will allow for evaluation of hatchery effectiveness, meeting NWPPC Program Measures and allow operation of hatcheries in the Columbia Basin consistent with ESA concerns. Work has progressed under the following three objectives:

Objective 1. Coded-wire tag at least one group of fish representative of each hatchery's production of a given species that is currently not being tagged through another program.

Objective 2. Recover fish that were coded-wire tagged, decode these tags, and then estimate survival and contribution of each group released each year.

Objective 3. Develop estimates of fishery catch and contribution, and stray rates for chinook and coho released from WDFW Columbia River hatcheries. Use these estimates to determine hatchery effectiveness and report the results in an Annual Report submitted to the Bonneville Power Administration.

RESULTS

Objective 1. A total of 3,424,510 tagged fall chinook, 4,329,990 spring chinook, and 736,098 coho (8,490,598 all species) were released during the contract period (this figure includes fish not tagged under BPA projects). BPA projects tagged 838,242 fall chinook, 557,662 spring chinook, and 560,509 coho (1,956,413 all species). Total expenditures on BPA tagging were \$250,421 (Table 1). Releases of 1997 brood chinook tagged during FY-98 are given in Table 2. Releases of yearling chinook and coho (1996 brood) tagged during FY-98 are given in Tables 3 and 4, respectively. Releases of 1996 brood yearling salmon, and 1997 brood sub-yearling salmon tagged under other program funds are listed in Table 5.

There were differences in the number of fish proposed for tagging and the number actually tagged in FY-98 :

Gray's River Hatchery did not have fall chinook available. Fall chinook have not been tagged at this facility since the 1996 brood.

Elochoman Hatchery had not one, but two 90,000 fall chinook tag groups.

Lower Kalama tagged 113,000 rather than the programmed 125,000 spring chinook.

Objective 2. A total of 7,200 tags were recovered from Columbia River fall, spring, and summer chinook, and coho during FY-98. A total of 841 fish with missing adipose fins had no tag in the snout resulting in a no tag or lost tag rate of 10.5%.

Table 1. Tagging summary and estimated costs during FY-98 for 1996 brood yearling coho and chinook and 1997 brood sub-yearling chinook. Table includes those production groups tagged under contract with BPA. F= Fall ; Sp= Spring.

HATCHERY	SPECIES	TAGGING DATE	NUMBER TAGGED	COST (\$)
GRAYS	TYPE-S COHO	November 13, 1997	30,819	\$3,945
ELOCHOMAN	F.CHINOOK	April 21-28, 1998	180,203	\$23,066
ELOCHOMAN	TYPE-N COHO	June 24-25, 1997	30,078	\$3,850
ELOCHOMAN	TYPE-N COHO	November 19, 1997	30,285	\$3,876
ELOCHOMAN	TYPE-S COHO	November 18, 1996	30,823	\$3,945
NORTH TOUTLE	F. CHINOOK	May 19-22, 1998	90,708	\$11,611
NORTH TOUTLE	SP. CHINOOK	June 9-17, 1997	100,789	\$12,902
NORTH TOUTLE	TYPE-S COHO	October 15-17, 1997	30,640	\$3,922
FALLERT CREEK	F. CHINOOK	May 12-15, 1998	91,277	\$11,683
FALLERT CREEK	SP. CHINOOK	May 21-28, 1998	113,197	\$14,489
FALLERT CREEK	TYPE-S COHO	November 24-25, 1997	30,762	\$3,938
KALAMA FALLS	F. CHINOOK	June 2-6, 1998	93,979	\$12,029
KALAMA FALLS	TYPE-N COHO	December 12-13, 1997	30,533	\$3,908
WASHOUGAL	F. CHINOOK	May 19-22, 1998	90,496	\$11,583
WASHOUGAL	F. CHINOOK	May 26-28, 1998	91,432	\$11,703
WASHOUGAL	TYPE- N COHO ON-STATION	November 13-14, 1997	30,797	\$3,942
WASHOUGAL	TYPE-N COHO KLICKITAT RIVER	November 17-19, 1997	60,911	\$7,797
SPEELYAI	TYPE-S COHO	October 8-13, 1997	208,717	\$26,716
KLICKITAT	F. CHINOOK	May 1-14, 1998	200,147	\$25,619
KLICKITAT	SP. CHINOOK (sub-yearling)	April 24- May 1, 1998	219,959	\$28,155
KLICKITAT	SP. CHINOOK (yearling)	April 1-2, 1997	84,859	\$10,862
KLICKITAT	TYPE-N COHO	September 10-11,1997	46,144	\$5,906
RINGOLD	SP. CHINOOK	November 4, 1997	38,858	\$4,974
TOTALS			1,956,413	\$250,421

Table 2. Releases in 1998 of 1997 brood sub-yearling fall chinook coded wire tagged during FY-97 and FY-98 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE(S)	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
ELOCHOMAN	FALL CHINOOK	June 5, 1998	117,376	2,087,800
NORTH TOUTLE	FALL CHINOOK	June 11-June 30, 1998	78,520	2,252,756
KALAMA FALLS	FALL CHINOOK	June 17, 1998	8,656	172,200
KALAMA FALLS	FALL CHINOOK	June 24, 1998	92,797	516,900
FALLERT CREEK	FALL CHINOOK	June 17-June 24, 1998	88,973	577,430
WASHOUGAL	FALL CHINOOK	June 12; June 17, 1998	78,900	3,593,671
WASHOUGAL	FALL CHINOOK	July 17, 1998	87,711	596,865
KLICKITAT	FALL CHINOOK	May 21- May 31, 1998	187,466	2,181,414
TOTALS			740,399	11,979,036

Table 3. Releases in 1998 of 1996 and 1997 brood spring (SP.) chinook coded wire tagged during FY-97¹ and FY-98 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE(S)	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
FALLERT CREEK	SP.CHINOOK	Feb. 2- 28, 1998	31,920	32,368
FALLERT CREEK	SP.CHINOOK	March 1- 23, 1998	73,595	74,628
KLICKITAT	SP. CHINOOK SUB-YEARLINGS	May 6-7, 1998	214,384	299,380
KLICKITAT	SP. CHINOOK YEARLINGS	March 2-12, 1998	84,859	584,500
RINGOLD	SP. CHINOOK	April 1- 4, 1998	24,641	400,000
NORTH TOUTLE	SP. CHINOOK	Feb. 20- 30, 1998	63,531	67,248
NORTH TOUTLE	SP. CHINOOK	March 1- 15, 1998	31,696	33,550
TOTALS			524,626	1,491,674

Fish would have been tagged in 1997 as sub-yearlings and planted in 1998 as yearlings.

Table 4. Releases in 1998 of 1996 brood coho coded wire tagged during FY-98 under contract with BPA.

HATCHERY	SPECIES	RELEASE DATE	NUMBER TAGGED FISH RELEASED	TOTAL RELEASE
GRAY'S RIVER	TYPE-S COHO	April 22, 1998	29,510	30,019
ELOCHOMAN	TYPE-S COHO	April 3, 1998	29,221	30,216
ELOCHOMAN	TYPE-N COHO	April 15- May 11, 1998	30,037	30,365
ELOCHOMAN	TYPE-N COHO	April 15- May 11, 1998	14,364	14,515
NORTH TOUTLE	TYPE-S COHO	April 1- 30, 1998	30,221	30,517
KALAMA FALLS	TYPE-N COHO	April 13- 19, 1998	23,322	25,214
FALLERT CREEK	TYPE-S COHO	April 1- April 19, 1998	28,175	28,586
SPEELYAI	TYPE-S COHO	October 8-13, 1997	87,785 ²	142,380
SPEELYAI	TYPE-S COHO	October 13-19 ,1997	120,932 ²	749,734
WASHOUGAL	TYPE-N COHO ON-STATION	April 23, 1997	30,377	30,797
WASHOUGAL	TYPE-S COHO KLUCKITAT R.	April 1-9, 199	30,140	30,346
KLUCKITAT	TYPE-N COHO	April 17, 1998	1,552	3,118
KLUCKITAT	TYPE-N COHO	May 1- 31, 1998	24,475	49,160
KLUCKITAT	TYPE-N COHO	June 1- 6, 1998	6,836	13,731
TOTALS			486,947	1,208,698

² Fish were provided to the Yakima tribe and planted in mid-Columbia tributaries.

Table 5. Releases in 1998 of 1996 brood yearling chinook and coho and 1997 brood sub-yearling chinook during FY-98. This table represents groups coded wire tagged under other (non-BPA) funding sources. SP= Spring, SU= Summer.

HATCHERY	SPECIES	RELEASE DATE(S)	NUMBER OF TAGGED FISH RELEASED	TOTAL RELEASE
COWLITZ	FALL CHINOOK	May-July, 1998	194,832	5,945,600
COWLITZ	SP. CHINOOK	March-April, 1998	219,579	842,314
CURL LAKE	SP. CHINOOK	March-April, 1998	47,083	49,790
LEWIS RIVER	SP. CHINOOK	March, 1998	120,118	545,004
LEWIS RIVER	TYPE-N COHO	April- May, 1998	73,093	76,390
LEWIS RIVER	TYPE-S COHO	April- May, 1998	146,584	148,415
KLICKITAT	FALL CHINOOK	June 8- 10, 1998	1,746,017	1,754,100
DEEP RIVER	SP. CHINOOK	April 22, 1998	56,078	56,414
DEEP RIVER	TYPE-S COHO	April 23, 1998	29,474	29,772
LYONS FERRY	FALL CHINOOK YEARLING	April 3-16, 1998	408,365	418,992
TUCANNON	SP. CHINOOK	March-April, 1998	26,134	28,488
RINGOLD	FALL CHINOOK	June & July, 1997	410,434	4,062,997
PRIEST RAPIDS	FALL CHINOOK	June 15-June 26, 1998	194,463	5,029,070
TURTLE ROCK	SU. CHINOOK	April - June, 1998	856,823	1,232,267
CHIWAHA	SP. CHINOOK	April 29, 1998	10,570	15,176
DRYDEN POND	SU. CHINOOK	April 28, 199	535,868	600,127
WELLS DAM	SU. CHINOOK YEARLING	April 1, 1997	325,608	348,559
WELLS DAM	SU. CHINOOK SUB-YEARLING	June 4- 15, 1998	513,016	541,923
METHOW	SP. CHINOOK	April 15- 17, 1998	351,841	371,306
CARLTON POND	SU. CHINOOK	April 14, 1998	266,609	298,844
SIMILKAMEEN	SU. CHINOOK	March 13- 18, 1998	476,037	507,913
TOTALS			7,008,626	22,903,461

Objective 3. Summaries of coded wire tag information for groups of 1989-1993 brood chinook and 1990-1994 brood coho are listed by hatchery. "Survivals" are calculated by dividing the total estimated recoveries by the total number of tagged fish released. "Percent of total survival to fisheries" is calculated by dividing the total estimated recoveries in each fishery or escapement by the total number of estimated recoveries. Type-N coho refer to north migrating coho and Type-S coho to south migrating coho. For descriptions of individual hatcheries the reader is referred to "Operations Plans for Anadromous Fish Production Facilities in the Columbia River Basin: Volume IV"³

Grays River Hatchery- Grays River Hatchery rears and releases Tule fall chinook and Type-S (early) coho. Fall chinook survivals ranged from 0.01% to over 8.8% for broods 1974-1993 (Appendix 1). Releases of 4-5 g fish in June generally result in survivals under 1.0%. Fish released in the fall months (>20 g) generally survive at over 1.0%. Fall chinook from the 1991, 1992 and 1993 broods had survivals of 0.02%, 0.02% and 0.07% respectively. The 1991 and 1992 broods had the lowest returns recorded at this facility. Summer flows in the Gray's River are often inadequate for fish returning to this system. These fish contributed primarily to escapement (40%) and the Canada troll fishery (28%) (Appendix 7). The 1996 brood was the last released from this facility.

Type-S (Early) coho survivals ranged from 0.03-3.70% for broods 1975-1994 (Appendix 6). In the 1989 and 1990 broods, there were early and late releases. In the 1989 brood, the April 15, release slightly outperformed a May 16 release, 0.14% to 0.13%. This was reversed in the 1990 brood. An April 15 release had better survival at 0.05% than the April 1 early release at 0.01%. The mid-April release date maximized survival in both brood years. Survivals of 1991-1994 broods ranged from 0.03-0.57%. The 1992 brood's survival (0.025%) was the lowest recorded at this facility. Grays River Type-S coho contributed primarily to escapement (66%), the Columbia River net fishery (13%), and the Washington Coastal sport fisheries (10%) (Appendix 12).

Elochoman River Hatchery- Elochoman Hatchery rears and releases Tule fall chinook, and both Type-N and Type-S coho. Fall chinook survivals ranged from 0.05-0.9% (Appendix 1). Most tag groups represent fish released in June at sizes ranging from 4.5-6.0 g. Fish from the 1986 and 1987 broods were not tagged. The 1988 brood was used in a release timing study along with fish at Kalama Falls Hatchery. Survival of the three release groups averaged 0.06%, with the lowest survival occurring in the June release. Survivals for 1989-1993 broods varied from 0.5% to 0.18%. The 1991

³ 1992 Annual Report, U.S. Department of Energy, Bonneville Power Administration, Division of Fish and Wildlife.

brood's 0.05% survival was the lowest recorded. These fish contributed primarily to the Canadian troll fishery (12%) and escapement (60%) (Appendix 7).

Type-N (Late) coho survivals at this hatchery range from 0.01-8.07% (Appendix 5). Survival of 1991-1994 brood Type-N coho ranged from 0.01-0.04%. The 1992 brood year survival at 0.01% was a record low. These fish contributed primarily to the Washington coastal sport fisheries (33%), Columbia river net fisheries (24%) and also to escapement (30%) (Appendix 11). Survivals of Elochoman Type-S coho range from 0.05-3.5% (Appendix 6). Survivals of the 1991-1994 broods ranged from 0.05-1.05%. These broods contributed primarily to the Washington coastal sport fisheries (34%) and to escapement (49%) (Appendix 12).

Cowlitz River Hatchery- Cowlitz Hatchery rears and releases fall chinook, spring chinook, and Type-N coho. Survivals of fall chinook range from 0.05-1.73% (Appendix 1). Most tag groups represent fish released in June at sizes ranging from 5.0-6.5 g. Survivals of 1989-1993 broods of fall chinook ranged from 0.08-0.18%. These broods contributed mainly to escapement (68%), but moderate catches were made by Washington coastal troll fishers (6%) and Canadian fishers (7%) (Appendix 7).

Cowlitz spring chinook survivals range from 0.07-10.2% (Appendix 3). Recent tag groups represent fish released as yearlings (45-60 g) in either March, April, or May. Survivals of 1989-1993 brood fish ranged from 0.07-1.14%. The 1993 brood survival was the lowest recorded at 0.07%. For the 1989-1993 brood years, yearling survival was substantially greater, 0.72% than that of sub-yearlings 0.04%. The majority of the survival was as escapement (59%) or to freshwater sport fisheries (14%) (Appendix 10). Moderate catches were made by Washington coastal sport and troll fishers (<5%), and Canadian fishers (12%). Tagged sub-yearlings from the 1989 through 1991 and the 1993 broods; survived at 0.07%, 0.01%, 0.02% and 0.10% respectively. These fish contributed primarily to escapement (61%) and the Washington troll and freshwater sport fisheries (8% each) (Appendix 10).

Survivals of Cowlitz Type-N coho range from 0.15-6.9% (Appendix 5). Survivals of 1991-1994 broods ranged from 0.15- 0.65%. The 1991 brood had the lowest recorded survival 0.15%. Escapement and the Washington Coast sport fishery accounted for 71% and 13% of the total survival, respectively (Appendix 11).

North Toutle Hatchery- North Toutle Hatchery rears and releases Tule fall chinook and Type-S coho. Recently, brood year 1993, 1995 and 1996 spring chinook yearlings were also released. The hatchery was destroyed in the 1980 eruption of Mt. Saint Helens. The hatchery was partially restored and operated in 1987, and is now in full production. Survivals of 1971-1977 brood fall chinook ranged from 0.3-0.9% (Figure 19). Chinook released at North Toutle Hatchery range in size from 4.5-5.5 g, and are released primarily in June. The survival of the 1989-1993 brood fall chinook ranged

from 0.02-0.19% (Appendix 1). The 1991 and 1992 broods had the lowest survivals recorded here at 0.2%. The majority of fish were caught by Canadian fishers (14%), Oregon fishers (6%) and in the freshwater sport fishery (13%) (Appendix 7). Escapement was nearly 56% of the total survival.

Toutle Type-S coho survivals range from 0.08-5.9% (Appendix 6) Survivals of the 1991-1994 brood fish fluctuated from 0.08-0.42%. The 1992 brood had the lowest survival (0.08%) recorded for this facility. Oregon and Washington coastal fishers caught the majority (5% each) of these fish. Escapement averaged nearly 88% of the total survival (Appendix 12)

Fallert Creek Hatchery- Fallert Creek Hatchery rears and releases Tule fall chinook, spring chinook, and Type-S coho. Fall chinook are typically reared until June and released at 4.5-5.5 g. Tag data for this hatchery are limited (Appendix 1) and have ranged from 0.06-1.0%. This hatchery was only recently included in this project. Returns for the 1992 and 1993 broods were 0.29% and 0.19% respectively. Northern fisheries, Alaska (16%) and Canada (13%) had substantial components of the catch. Escapement was 60% (Appendix 7).

Spring chinook are normally reared until late-March or April and released at sizes ranging from 45-55 g. These fish were included in the project beginning with the 1989 brood and survived at 0.36%. The 1990 brood survival was 0.47%. Subsequent brood year survivals dropped to 0.05% and 0.04% (Appendix 3). Nearly 66% of the total survival was to escapement. The freshwater sport fishery also had a large component (18%) of the total survival (Appendix 10).

Tag groups of 1980 and 1981 brood Type-N coho were released from the hatchery and had survivals of 2.7% for each brood. There were no subsequent releases of tagged Type N coho. Type S coho survivals varied from 0.08 to 5.96%. Survivals of the 1991-1994 broods of Type-S coho ranged from 0.08-0.55% (Appendix 6), with the 1992 having the lowest survival recorded at 0.08%. Washington coastal sport fishers harvested the largest proportion (16%) of these fish. Nearly 79% of the total survival was to escapement (Appendix 12).

Kalama Falls Hatchery- Kalama Falls Hatchery rears and releases fall chinook, and Type-N coho. Fall chinook are reared to 4.5-5.5 g and released in late-May to July. Fall chinook (1971-1981 broods) survivals have ranged from 0.1-1.35% (Appendix 1). The 1988 brood was tagged as part of a release timing study along with Elochoman Hatchery. Single tag groups were released in each of three months: June, July, and August of 1989. The average survival of the three 1988 brood groups was 0.17%. The June release had the lowest overall survival and the July group the highest overall survival. About 41% of the total survival was to escapement. Survivals of later 1992 and 1993 broods were 0.22% and 0.13% respectively (Appendix 1). Fish were

harvested primarily in the Alaskan (9%) and Canadian (14%) fisheries (Appendix 7). Escapement was 71% for these broods. There was a 30% increase in escapement since the 1988 brood, reflecting harvest restrictions to conserve endangered stocks under the Endangered Species Act.

Type-N coho survivals range from 0.07-8.85% (Appendix 5) with the 1994 brood's 0.07% being the lowest survival recorded for this facility. Fish of this stock were not tagged prior to 1983. Survivals of the 1991-1994 broods ranged from 0.07-0.23%. Washington Coast sport fishers caught the highest proportion (16%) of these fish, followed by Oregon sport anglers (4%) (Appendix 11). As with most other stocks, escapement increased to 79%.

Lewis River Hatchery- Lewis River Hatchery rears and releases spring chinook and both Type-N and Type-S coho. The 1988 through 1994 brood spring chinook were tagged with funds provided by Pacific Power and Light Company. Survivals ranged from 0.03-2.07% (Appendix 3), with 1991 having the lowest recorded survival for this facility at 0.03%. For the 1989-1993 broods, survival varied from 0.03-0.18%. The freshwater sport fishery (41%) and escapement (39%) accounted for the greatest portion of total survival (Appendix 10).

Eight broods of Type-N coho have been tagged at Lewis River Hatchery. Funding for this tagging is from the Pacific Salmon Treaty (PST). Survivals range from 0.20-8.35% (Appendix 5). Survivals of the 1991-1994 broods ranged 0.20-0.77%. The lowest survival (0.02%) is associated with the 1992 brood. The majority of the survival of these broods was to Washington coastal fisheries (13%) the Canada troll (8%), and Columbia River net fisheries (6%) (Appendix 11). Escapement accounted for about 66% of the total survival.

Survivals of Type-S coho range from 0.26-6.9% (Appendix 6). The survival of 1991-1994 broods ranged from 0.26% to 0.84%. As with Type N coho at this facility, the lowest survival (0.26%) is associated with the 1992 brood. The Washington coast and Oregon sport fisheries caught moderate numbers of these fish 8% and 5% respectively. Escapement accounted for the majority (85%) of the total survival (Appendix 12). The 1990 brood was reared at Speelyai Hatchery.

The Lewis River supports a viable self-sustaining population of naturally reproducing fall chinook. Survivals of these wild chinook have ranged from 0.08-1.89% (Appendix 1). Survivals of the 1989-1993 broods ranged from 0.08-0.60%. Unlike hatchery chinook, who's survival bottomed with the 1992 brood; the wild component had their lowest survival, in the 1993 brood at 0.08%. The majority of the survival was to escapement (52%). Significant catches were made by freshwater sport (17%), and Alaskan fisheries (12%) (Appendix 7).

Speelyai Hatchery- Speelyai Hatchery rears both coho and spring chinook, but transfers most of these fish to Lewis River. Releases directly from the hatchery support a resident coho fishery in Merwin Lake. There was one release of 1990 brood year spring chinook yearlings. Survival was 0.13%, with the majority of the survival to escapement, 64%. For the past two years, Speelyai Hatchery has raised coho which are planted by the Yakima Indian Nation into mid-Columbia tributaries. Two groups of one hundred thousand fish are tagged and released under this program. Unless releases of tagged fish continue at Speelyai, this will be the last time this facility will be included in subsequent annual reports.

Washougal River Hatchery- Washougal Hatchery rears and releases tule fall chinook and Type-N coho. Type-S coho have been reared at the hatchery in the past. The hatchery also provides Type-N coho for off-station plants into the Klickitat River as part of mitigation for the U.S. v. Oregon court decision. These fish are released either directly into the river from transport trucks, or from Champion Pond (1992-93 broods).

Fall chinook survivals range from 0.01-1.5% (Appendix 1). Generally, higher survivals have been obtained from larger fish (> 15 g) released in the early fall, however most of the chinook production is released in June at sizes ranging from 4.5-6.0 g. Survivals of the 1986, 1987, 1989 and 1990 broods were all about 0.2%. As with many other tule stocks, survival dropped in the 1991 brood to 0.01%. For the 1989-1993 broods, Canadian fisheries (12%), Alaska (6%) and escapement (71%) accounted for most of the survival (Appendix 7).

Survivals of Type-N coho released on-station range from 0.08-5.2% (Appendix 5). Survivals of 1991-1994 brood coho ranged from 0.08-0.46%. Most of the catch was by Washington coastal sport fishers (17%) and Columbia River netters (9%). Escapement accounted for about 63% of the total survival (Appendix 11).

Fewer Type-N coho released off-station into the Klickitat River survived than those released at either Washougal or Klickitat Hatcheries. Survival of the 1991-1994 broods ranged from 0.02-0.04% (Appendix 5). The majority of the surviving fish released off-station contributed to the Washington coastal fisheries (33%) and the Columbia River net fisheries and Oregon sport fisheries (14% for both). Escapement amounted to 33% of the total survival (Appendix 11).

Fish from the 1992 and 1993 brood years were also released from Champion Pond, having survivals of 0.05% and 0.27%, respectively (Appendix 5). Survivals were better than for trucked fish. The Washington coastal sport fishery claimed 65%, the Columbia River Net 12%, and escapement 11% (Appendix 11). The trucked group and Champion Pond groups have the lowest escapement percentages in recent years and reflect the off station release and lack of a hatchery return site.

Klickitat River Hatchery- Klickitat Hatchery currently rears Upriver Bright chinook that are imported as eggs from Lyons Ferry Hatchery. Prior to introducing this stock at Klickitat, Tule fall chinook were released. The hatchery also rears and releases spring chinook and Type-N coho. Type-S coho were reared previously. Spring chinook have been tagged in recent years as part of a BPA funded experiment to determine the effects of acclimation to river water prior to release. Survivals of fall chinook range from 0.02-1.0% (Appendix 1). Survivals from the 1989-1993 broods ranged from 0.02-0.29%. The 1991 brood's 0.02% survival was the lowest recorded here. The majority of the catch was in the Alaska fisheries (34%), Columbia River net fishery (21%) and the Canadian troll fishery (17%) (Appendix 8). Escapement accounted for only 17%.

Spring chinook have been released since 1989. Survivals ranged from 0.07% though 0.29% (Appendix 3). Nearly 94% of the total survival was in escapement (Appendix 10). The greatest catches were reported in Alaskan, freshwater sport and Oregon commercial fisheries (all 1%).

Survivals of Type-N coho have range from 0.07-4.5% (Appendix 5). Survival of the 1991-1994 broods ranged from 0.07-0.14%, with 1994's 0.07% the lowest for this facility. Washington coastal sport fishers and Canadian trollers took large segments of these fish, 32% and 30%, respectively (Appendix 11). Very few fish (0.8%) returned to the hatchery.

Lyons Ferry Hatchery- Lyons Ferry Hatchery rears and releases Snake River fall chinook. In recent years 100% of the releases have been marked or tagged to ensure the genetic purity of this stock. The hatchery has generally released four groups of fall chinook, both yearlings or sub-yearlings. About half of the yearling and sub-yearling production was loaded onto barges and released downstream of the hatchery, bypassing several dams. Barging ceased with the 1991 brood at this facility. Survivals of sub-yearling fish (0.01-0.68%) have been much lower than survivals of yearling fish (0.09-7.4%, Appendix 2). Survivals of barged fish, regardless of age, have been equal to or greater than survivals of fish released on-station, except for 1984 and 1988 brood sub-yearlings. The 1989-1993 sub-yearling fish, released on-station or barged, contributed primarily to the Canadian commercial fisheries (22% barged, 6% on station), the Columbia River net fishery (14% barged, 19% on station), the Oregon commercial fishery (1% barged, 8% on station) and escapement (47% barged, 56% on station, Appendix 8). Escapement of sub-yearling fish released on-station appears to be ten percent greater than those released from barges for the 1998-93 broods, although this represents only two broods from each release strategy. Contribution of yearling fish, regardless of release type, has been mainly to Columbia River net and Canadian fisheries (Appendix 8). Escapement amounted to approximately 60-65% of the survival for hatchery and barged fish. The estimated escapement reported is an underestimate, because data from trapping operations at the dams are not available. The method of release did not appear to affect fishery distribution within either the sub-

yearling or yearling groups.

Tucannon River Hatchery- The Tucannon Hatchery is a satellite rearing and capture location operating in conjunction with the Lyons Ferry Hatchery. Wild spring chinook returning to the Tucannon River were captured at the Tucannon River trap beginning in 1985 to supply to supply brood for the hatchery releases. Adults are now transported to the Lyons Ferry Hatchery and spawned there. This change in procedure has resulted in higher adult pre-spawning survivals, and higher egg to fry survivals. After rearing to approximately 18 g at the Lyons Ferry Hatchery, these fish are transported to an acclimation pond at the Tucannon Hatchery, reared through the winter, and volitionally released in the spring. Survivals of these yearling plants have ranged from 0.03-0.35% (Appendix 3). Survival of the 1989-1993 broods varied from 0.03%-0.26%. About 97% of the total was to escapement. A few fish (< 1%) have been captured in each of the Canadian net, Oregon fisheries, and Washington troll fisheries (Appendix 10). No tag recoveries from these broods were found in the Columbia River net or freshwater sport fisheries.

Ringold Springs Hatchery- Ringold Springs Hatchery rears spring chinook and in the 1970's has reared a few groups of upriver bright fall chinook. The fish are released as yearlings ranging in size between 45-115 g. Broods between 1978 and 1988 were not tagged. Survival of the 1989-1993 brood spring chinook ranged from 0.03 to 0.41% (Appendix 3). The 1991 brood return was the lowest recorded (0.03%) at this facility since 1975. Adults from the 1989-1993 broods were recovered at the hatchery (66%) or in the freshwater sport fishery (33%). A small percentage 0.9% was captured in the Columbia River net fishery (Appendix 10). Since the 1994 brood, fall chinook are again reared at this facility.

Priest Rapids Hatchery- Priest Rapids Hatchery rears and releases Upriver Bright chinook. Most fish are released in June as sub-yearlings ranging in size from 5-9 g. Survivals have ranged from 0.03-2.0% depending on brood (Appendix 2). Survivals of the 1989-1993 broods fell ranging from 0.03%-0.65%, with the 1991 brood's 0.03% the lowest recorded. Survivals of these broods were in the Alaskan (12%), Columbia River net (21%), and Canadian fisheries (13%) (Appendix 8). Forty seven percent of fish made it to escapement.

Hanford Reach Wild Upriver Bright (URB) Fall Chinook: In 1986, efforts commenced to capture juvenile fall chinook that are naturally produced along the Hanford Reach of the Columbia River. Juveniles are captured in June, when about 1.5-2.5 grams in size. The fish are tagged and released back into the river. From 1988 through 1991 tagging was under the auspices of WDFW. For the 1992 and 1993 brood years, tagging was done cooperatively through WDFW and Columbia River Intertribal Fish Commission. Reported returns from the last two brood years may not fully reflect the portion recovered by WDFW and should be considered preliminary. Survivals of the 1989-

1993 broods ranged from 0.12-0.47% (Appendix 2). The majority of the survival was to the Alaskan (20%), Canadian fisheries (12%) and the Columbia River net fishery (20%) (Appendix 8). Escapement was 41%.

Rocky Reach Hatchery- Rocky Reach Hatchery rears fall chinook and coho, although the coho program was discontinued after 1993 and replaced with a sub-yearling fall chinook program. Rocky Reach rears and releases both yearling and sub-yearling fall chinook. The yearling fish are released at 41-50 g in April or May from the Turtle Rock facility. Survivals of yearling fish have ranged from 0.08-3.56% (Appendix 2). The 1989-1993 brood survivals ranged from 0.11-0.65%. Chinook released as yearlings contributed primarily to the Canadian (22%) and Columbia River net fisheries(31%) (Appendix 8). Escapement was approximately 13% of the total survival.

Rocky Reach coho were tagged only in the 1976, and 1989 through 1991 broods and were released at the Turtle Rock facility. Survivals were 0.9% in 1976, and ranged from 0.01-0.15% through 1989-1991 (Appendix 6). The majority of survivors from the 1991 brood contributed to the Oregon sport fishery (75%) and escapement (25%) (Appendix 12).

Eastbank Hatchery Complex- The Eastbank complex consists of a central adult holding, incubation, and rearing facility with associated acclimation ponds located on the Chiwawa River, Wenatchee River, Similkameen River, and net pens located on Lake Wenatchee. Chiwawa River spring chinook yearlings are released from acclimation ponds located on the Chiwawa River. The 1989-1993 broods survived at 0.03 to 0.44% (Appendix 3). Most of this survival was to escapement (89%), although some fish (9%) were caught in the fresh water sport fishery (Appendix 10). Dryden Pond is located on the Wenatchee River and rears and releases Wenatchee summer chinook yearlings. Survival of the 1989 -1993 broods varied from 0.01 to 0.52% (Appendix 4). Alaskan (30%) and Canadian fishers (16%) caught the majority of these fish, although catches were made in a number of fisheries (Appendix 9). Escapement was 44% of the total survival. The Similkameen Pond rears and releases yearling summer chinook. Survival of the 1989-1990 broods ranged from 0.01 to 1.90% (Appendix 4). Fishery catches for this group were very similar to the Dryden Pond group (Appendix 9), with most fish caught by Alaskan (13%) and Canadian fishers (14%), however Similkameen Pond had a larger escapement of 69%. The Carlton rearing pond is also associated with this complex. It produces spring chinook. 1989-1993 brood survivals varied from 0.01% through 0.09% (Appendix 3). Alaskan (18%) and Canadian (5%) fishers captured the greatest percentage of fish (Appendix 10.). Escapement was high at 72%

Wells Dam Hatchery- Wells Dam Hatchery rears and releases yearling and sub-yearling summer chinook. Yearling summer chinook are released at sizes ranging from 30-45 g in mid-April. Survivals of yearling releases have ranged from 0.06-0.94%

(Appendix 4). Survivals of the 1989-1993 brood yearlings ranged from 0.06%-0.21%; a reduction from previous years. These broods contributed primarily to Alaskan (21%) and Canadian and fisheries (8%) (Appendix 9). Escapement composed 62% of overall survivals.

Survivals of 1989-1993 brood sub-yearling releases were far less, ranging from 0.002 - 0.03% (Appendix 4). Contribution of sub-yearling fish was primarily to Alaskan (18%) and Canadian fishers (18%) (Appendix 8). Columbia River net fisheries and Puget Sound sport anglers both tallied 6%. Escapement was 51%.

Methow Hatchery- The Methow Hatchery rears spring and summer chinook and has recently outplanted fish into the Twisp and Chewuch Rivers. Methow 1992 and 1993 Brood spring chinook survived at 0.085 and 0.04% respectively and 2% of recoveries were to the Oregon troll fishery and 98% to escapement (Appendix 3 &10) 1991 brood summer chinook survived at 0.02% and recoveries were 7% to Alaskan fisheries, 4% to Oregon trollers and 89% to escapement (Appendix 4&9). The Chewuch River received 1992 and 1993 brood spring chinook which survived at 0.19% and 0.04%, respectively (Appendix 3). Only the Oregon commercial fishery reported returns of 3% and escapement accounted for the remaining 97% (Appendix 10). 1992 and 1993 brood spring chinook were also released in the Twisp River. Survivals were 0.12% and 0.02,% respectively (Appendix 3). All recoveries (100%) were to escapement (Appendix 10).

SUMMARY

In FY-98 all three objectives were met. Under **objective one**, at least one production group from every hatchery was coded-wire tagged. Tag numbers declined from previous fiscal years due to shortages of fish at some hatcheries, or changes in rearing programs. Under **objective two**, returning adults to each hatchery were surveyed for the absence of an adipose fin and the snout from these fish was removed. Coded-wire tags were extracted from these snouts and the data will be sent to the PSMFC data base in Portland, Oregon. For **objective three** survival and contribution rates were determined for coho salmon released between 1993 and 1996 (1991-1994 broods) and chinook released between 1988 and 1994 (1989-1993 broods).

Delays have developed in reporting retrieval data to the PSMFC's RMIS data base. Some WDFW data for 1996 and 1997 freshwater recoveries are reported here, but have as not yet been incorporated into the RMIS data base. These data should be viewed as preliminary as expansion factors for the freshwater fisheries may be subject

to revision. Other reporting agencies also continue to have a backlog of data to report to the RMIS,

Averaged survivals of fall chinook sub-yearlings and spring chinook upper river yearlings tended to be lower than 0.5% since the 1986 brood year, regardless of hatchery or natural origin (Figure 1,2,3, 4 and Appendix 1, 3). Lower river spring chinook yearlings dropped below 0.5% since the 1990 brood year (Figure 4 and Appendix 3).

Major El Niño events occurred in 1986-87, 1991-92 and 1997-98. The 1991 brood year had the lowest reported survivals at each tule chinook hatchery and the lowest yearly average tule survival. Somewhat surprisingly, wild fall chinook in the Lewis River had their lowest survivals in the 1993 brood year. This trend toward a lower survival in the 1991 brood, apparently held true for summer chinook as well. The 1991 brood also had the lowest average yearly survival. In spring chinook, lowest average survival was in the 1990 brood (Appendix 3,4). Fortunately, for hatchery tules, the last two brood years are showing increases in percent survival. With the exception of Rocky Reach and Lyons Ferry yearlings, these upward trends also held true for upriver brights.

Coho data show a continued trend toward low survival for both strains (Figure 5). Average survivals have been below 1% for Type N coho since the 1990 brood year, and for Type S coho since the 1989 brood. Presumably, the same deleterious factors affecting chinook survival are also affecting coho. The cause for the continued low survivals of coho may be due to unfavorable ocean conditions caused by the 1991-92 El Niño and the lingering pool of warm water that resided off the Washington coast. For Type N, coho the 1992 brood had the lowest survivals for four of the seven facilities and had the lowest average survival. For Type S coho, survivals also were minimal in the 1992 brood at four of the five facilities (Appendix 5 and 6). However, returns from 1993 and 1994 broods show improved survivals due to improving ocean conditions from the demise of the 1991-92 El Niño. Coho survivals vary among hatcheries but in some cases, are equal to, or lower than survivals of sub-yearling fall chinook of the same brood.

Additionally, large increases in the percentage of fish making escapement have been documented in recent broods. This is probably a reflection in the curtailment of fishing seasons and fishing effort in order to protect endangered and threatened Columbia River salmonids. Commercial fisheries have been closed completely and there have been local and temporal closures of the sport fishery to protect listed species and allow hatcheries to accumulate sufficient brood stocks.

In summary, generally, there was a trend to very low survivals of 1991 and 1992 brood chinook and coho. This was probably due to poor ocean conditions from recent El Niño events. At the same time, there was an increase in the percent of fish reaching

escapement. This shift from harvest to escapement is due to restrictions and closures of fishing seasons to protect endangered Columbia River salmon and steelhead under the Endangered Species.

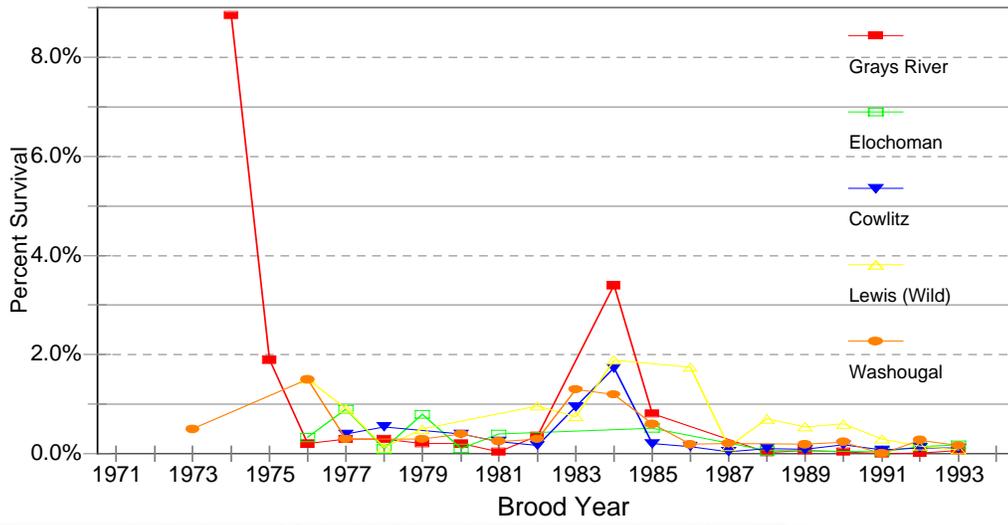


Figure 1. Percent survival by brood of Columbia River tle fall chinook released from WDFW hatcheries.

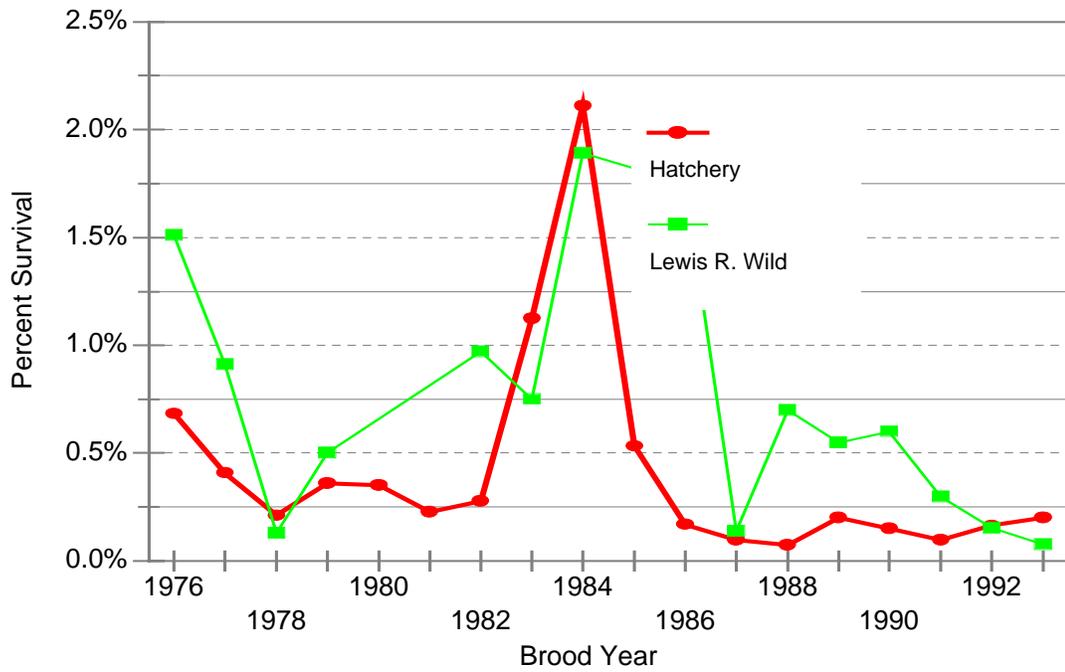


Figure 2. Average percent survival by brood of tule fall chinook released from WDFW lower Columbia River hatcheries compared with percent survival of Lewis River wild fall chinook.

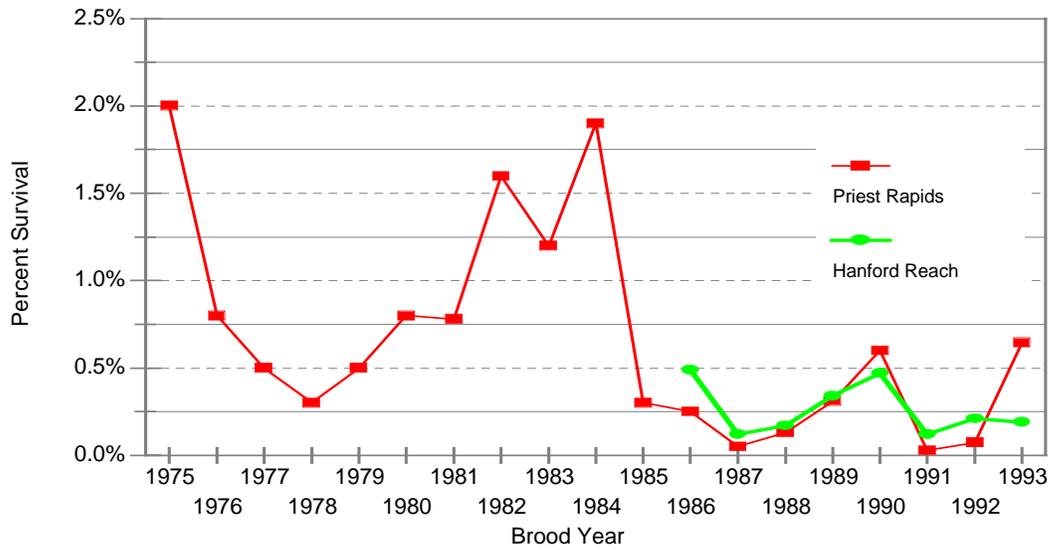


Figure 3. Average percent survival of upriver bright fall chinook released from Priest Rapids hatchery and Hanford Reach wild chinook

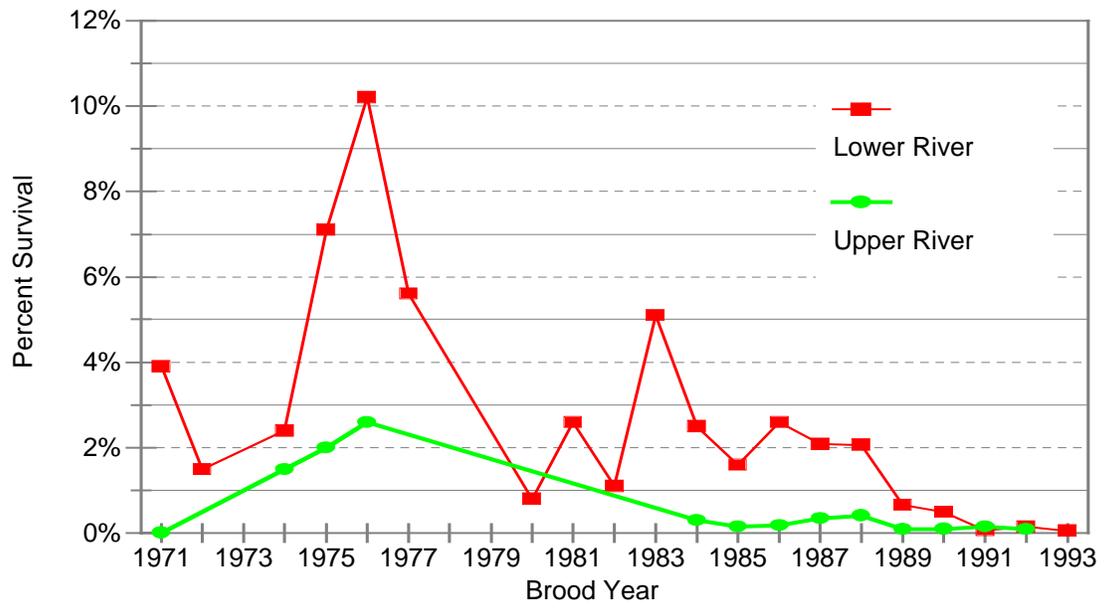


Figure 4. Average survival of spring chinook by brood for upper and lower Columbia River WDFW hatcheries.

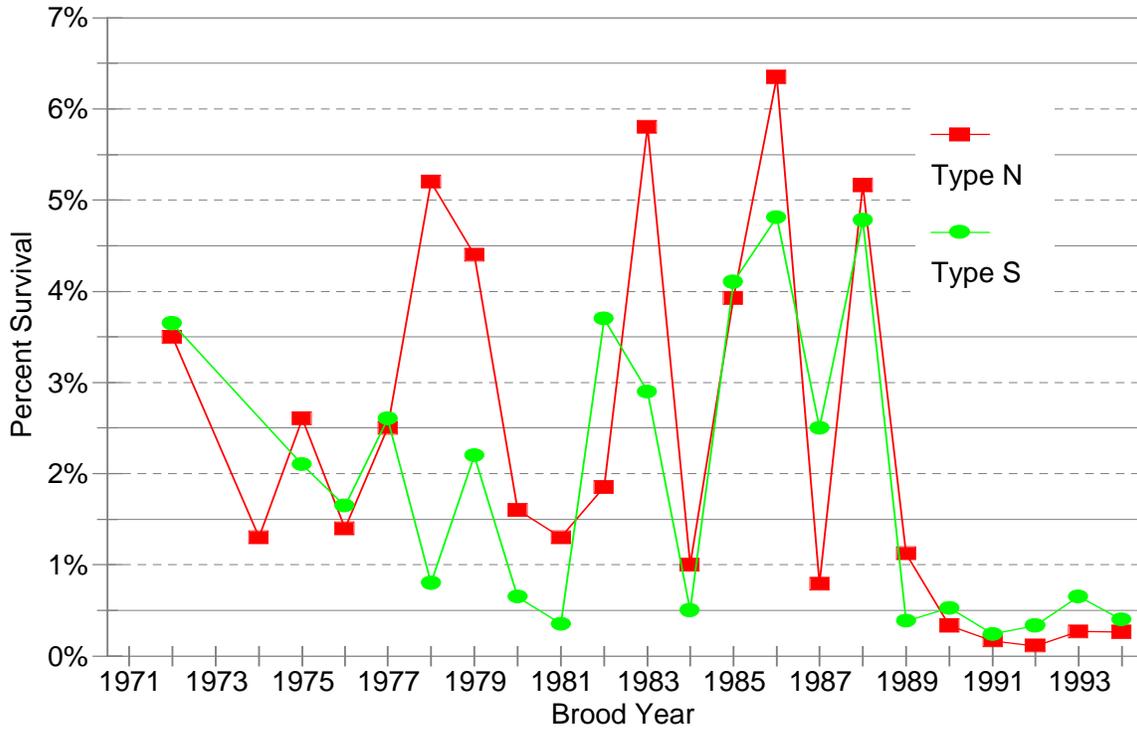


Figure 5. Average percent survival of Type N and Type S coho released from WDFW Columbia River Hatcheries

Appendix 1. Survivals by brood of Columbia River Tule Fall Chinook.

Brood Year	Grays River	Elochoman	Cowlitz	N. Toutle	Fallert Ck.	K. Falls	Lewis Wild	Klickitat	Washougal	Avg.
1971				0.40%	1.01%	1.35%				0.69%
1972				0.30%	0.28%	0.45%				0.26%
1973				0.90%	0.06%	0.90%			0.50%	0.59%
1974	8.85%									
1975	1.90%							0.50%		0.95%
1976	0.20%	0.33%		0.70%		0.68%	1.51%	1.00%	1.50%	0.68%
1977	0.30%	0.90%	0.40%	0.60%	0.06%	0.30%	0.91%	0.30%	0.30%	0.41%
1978	0.30%	0.10%	0.55%			0.10%	0.13%	0.10%		0.21%
1979	0.21%	0.80%			0.19%	0.30%	0.50%	0.20%	0.30%	0.36%
1980	0.20%	0.11%	0.40%		0.57%	0.43%		0.03%	0.40%	0.35%
1981	0.04%	0.40%	0.25%			0.20%		0.04%	0.25%	0.23%
1982	0.36%		0.17%				0.97%		0.30%	0.28%
1983			0.95%				0.75%		1.30%	1.13%
1984	3.40%		1.73%				1.89%		1.20%	2.11%
1985	0.81%	0.52%	0.20%						0.60%	0.53%
1986			0.15%				1.75%	0.44%	0.19%	0.17%
1987			0.05%	0.03%			0.14%		0.21%	0.10%
1988	0.03%	0.06%	0.11%			0.17%	0.70%			0.07%
1989	0.07%		0.09%	0.04%			0.55%	0.06%	0.19%	0.10%
1990	0.04%		0.18%	0.14%			0.60%	0.18%	0.24%	0.15%
1991	0.01%	0.05%	0.08%	0.02%			0.30%	0.02%	0.01%	0.03%
1992	0.02%	0.14%	0.12%	0.02%	0.29%	0.22%	0.15%	0.11%	0.28%	0.15%
1993	0.07%	0.18%	0.11%	0.19%	0.19%	0.13%	0.08%	0.29%	0.17%	0.15%
Mean	0.989%	0.326%	0.346%	0.303%	0.331%	0.436%	0.729%	0.251%	0.467%	0.441%
Standard Error	0.519%	0.086%	0.105%	0.089%	0.105%	0.103%	0.147%	0.073%	0.103%	0.099%

Appendix 2. Survivals by brood of Columbia River upriver bright fall chinook.

Brood Year	Lyons Ferry		Lyons Ferry		Priest Rapids	Handford Reach	Rocky Reach/ Turtle Rock	Average
	Yearlings On Station	Yearlings Barged	Sub-yearlings On Station	Sub-yearlings Barged				
1971								
1972								
1973								
1974								
1975					2.00%			2.00%
1976					0.80%			0.80%
1977					0.50%			0.50%
1978					0.30%			0.30%
1979					0.50%			0.50%
1980					0.80%			0.80%
1981					0.78%			0.78%
1982					1.60%		0.26%	1.60%
1983	7.40%				1.20%		3.56%	1.20%
1984	0.70%		0.60%	0.10%	1.90%		0.47%	1.90%
1985	1.60%	1.90%	0.20%	0.20%	0.30%		1.08%	0.30%
1986	1.43%	1.54%	0.44%		0.25%	0.49%	0.08%	0.37%
1987	0.32%	1.16%	0.02%	0.02%	0.05%	0.12%	0.21%	0.09%
1988	1.35%	1.51%	0.04%	0.01%	0.13%	0.17%		0.15%
1989			0.09%	0.11%	0.31%	0.34%	0.65%	0.33%
1990	0.09%	0.09%		0.22%	0.60%	0.47%	0.11%	0.54%
1991	0.17%	0.19%			0.03%	0.12%	0.21%	0.07%
1992	0.72%		0.68%		0.07%	0.21%	0.28%	0.14%
1993	1.13%				0.65%	0.19%	0.26%	0.42%

Mean	1.491%	1.065%	0.296%	0.110%	0.672%	0.264%	0.652%	0.673%
Standard Error	0.643%	0.281%	0.096%	0.033%	0.135%	0.050%	0.289%	0.133%

Appendix 3. Survivals by brood of Columbia River spring chinook.

Brood Year	combined North Cowlitz	Fallert Toutle	Lewis Creek	River	Klickitat	Tucannon	Ringold	Chiwawa	Carlton Pond	Turtle Rock	Lower R. Averages	Upper R. Averages
1971	3.90%										3.90%	
1972	1.50%						0.01%				1.50%	0.01%
1973												
1974	2.40%										2.40%	
1975	7.10%						1.50%				7.10%	1.50%
1976	10.20%						2.00%				10.20%	2.00%
1977	5.60%						2.60%				5.60%	2.60%
1978												
1979												
1980	0.80%										0.80%	
1981	2.60%										2.60%	
1982	1.10%										1.10%	
1983	5.10%										5.10%	
1984	2.50%										2.50%	
1985	1.60%					0.30%					1.60%	0.30%
1986	2.60%					0.24%			0.08%		2.60%	0.16%
1987	2.08%					0.16%			0.21%		2.08%	0.19%
1988				2.07%		0.35%					2.07%	0.35%
1989	1.14%		0.36%	0.46%	0.28%	0.26%	0.41%	0.44%		0.65%	0.65%	0.41%
1990	0.37%		0.47%	0.65%	0.07%	0.03%	0.19%	0.04%	0.09%	0.11%	0.50%	0.09%
1991	0.14%	0.05%	0.05%	0.03%	0.18%	0.04%	0.03%	0.06%		0.21%	0.07%	0.10%
1992	0.33%	0.03%	0.05%	0.18%	0.29%	0.11%	0.20%	0.03%	0.01%	0.28%	0.15%	0.15%
1993	0.07%		0.04%	0.05%	0.08%	0.11%	0.08%	0.04%	0.01%	0.26%	0.05%	0.10%
Mean	2.691%	0.040%	0.192%	0.573%	0.180%	0.186%	0.780%	0.123%	0.037%	0.258%	2.628%	0.612%
Standard Error	0.594%	0.007%	0.083%	0.288%	0.042%	0.040%	0.310%	0.071%	0.021%	0.065%	0.571%	0.226%

Appendix 4. Survivals by brood of Columbia River summer chinook.

Brood Year	Dryden Pd.	Similkameen	Wells Hatch. Yearling	Wells Hatch. Sub-yearling	Averages
1971					
1972					
1973					
1974			0.22%		0.22%
1975			0.55%	0.22%	0.39%
1976			0.94%	0.14%	0.54%
1977				0.07%	0.07%
1978					
1979					
1980					
1981					
1982					
1983			0.17%	0.04%	0.11%
1984			0.14%	0.20%	0.17%
1985			0.50%	0.04%	0.27%
1986			0.50%	0.00%	0.25%
1987			0.31%	0.00%	0.16%
1988			0.16%	0.00%	0.08%
1989	0.52%	1.90%		0.03%	0.81%
1990	0.09%	0.25%	0.06%	0.00%	0.10%
1991	0.02%	0.24%		0.01%	0.09%
1992	0.04%	0.21%	0.21%		0.15%
1993	0.01%	0.01%	0.21%	0.02%	0.06%
Mean	0.137%	0.520%	0.331%	0.059%	0.231%
Standard Error	0.086%	0.310%	0.069%	0.021%	0.052%

Appendix 5. Survivals by brood of Columbia River Type N coho.

Type N Coho Brood Year	Elochoman	Cowlitz	K. Falls	Lewis River	Washougal	Wash. to Klick.	Klickitat	Type N Averages
1971								
1972	1.70%	4.30%					4.50%	3.50%
1973								
1974	1.90%	1.40%					0.60%	1.30%
1975							2.60%	2.60%
1976							1.40%	1.40%
1977					2.90%		2.10%	2.50%
1978					5.20%			5.20%
1979					4.40%			4.40%
1980		2.10%			1.10%			1.60%
1981		2.10%			0.50%			1.30%
1982		1.60%			2.10%			1.85%
1983	3.60%	6.90%	6.90%					5.80%
1984	0.60%	1.70%	1.10%				0.60%	1.00%
1985	4.50%	2.50%	6.50%				2.20%	3.93%
1986		4.34%		8.35%				6.35%
1987		0.79%						0.79%
1988	8.07%	4.61%	8.85%	6.71%	4.59%	1.59%	1.70%	5.16%
1989	0.30%	1.17%	0.68%	1.75%	3.25%	0.19%	0.55%	1.13%
1990	0.35%	0.65%	0.16%	0.77%	0.17%	0.10%	0.13%	0.33%
1991	0.01%	0.15%	0.11%	0.60%	0.13%	0.03%	0.14%	0.17%
1992	0.01%	0.23%	0.08%	0.20%	0.08%	0.03%	0.14%	0.11%
1993	0.04%	0.65%	0.23%	0.39%	0.46%	0.02%	0.11%	0.27%
1994	0.02%	0.44%	0.07%	0.77%	0.41%	0.04%	0.07%	0.26%

Mean	1.76%	2.10%	2.47%	2.44%	1.95%	0.29%	1.20%	2.32%
Standard Error	0.69%	0.44%	1.04%	1.06%	0.51%	0.20%	0.33%	0.42%

Appendix 6. Survivals by brood of Columbia River Type S coho.

Type S Coho Brood Year	Grays River	Elochoman	N. Toutle	Fallert Ck.	Lewis River	Turtle Rk./ Rocky Reach	Type S Averages
1971							
1972		1.40%	5.90%				3.65%
1973							
1974							
1975	2.10%						2.10%
1976	2.40%					0.90%	1.65%
1977	1.10%		4.10%				2.60%
1978	0.40%		1.20%				0.80%
1979	2.20%						2.20%
1980	0.70%				0.60%		0.65%
1981	0.50%				0.20%		0.35%
1982	0.50%				6.90%		3.70%
1983	2.90%						2.90%
1984	0.50%						0.50%
1985	3.00%				5.20%		4.10%
1986			5.10%		4.52%		4.81%
1987			3.60%		1.40%		2.50%
1988	3.70%	3.46%	5.19%	5.96%	5.58%		4.78%
1989	0.13%	0.20%	0.55%	0.25%	1.03%	0.15%	0.39%
1990	0.03%	0.47%	1.42%	0.93%	0.32%	0.01%	0.53%
1991	0.04%	0.17%	0.22%	0.26%	0.32%	0.01%	0.17%
1992	0.03%	1.02%	0.08%	0.08%	0.26%		0.29%
1993	0.57%	1.05%	0.13%	0.55%	0.84%		0.63%
1994	0.50%	0.05%	0.42%	0.47%	0.49%		0.39%

Mean	1.183%	0.976%	2.326%	1.215%	2.128%	0.268%	1.889%
Standard Error	0.273%	0.369%	0.627%	0.738%	0.653%	0.185%	0.339%

Appendix 7. Percent contribution and percent of total survival to fisheries of tule fall chinook released from WDFW Columbia River Hatcheries.

	Grays River	Elochoman	Cowlitz	N. Toutle	Fallert Ck.	K. Falls	Lewis Wild	Washougal	Klickitat	Avg.
Percent										
Alaska	0.0016	0.0197	0.0039	0.0053	0.0181	0.0163	0.0591	0.0130	0.0454	0.02
California										
Canada Net	0.0007	0.0004	0.0006	0.0004	0.0011	0.0033	0.0033	0.0036	0.0032	0.00
Canada	0.0005	0.0020	0.0022	0.0028		0.0043		0.0054	0.0032	0.00
Canada Troll	0.0099	0.0168	0.0058	0.0082	0.0137	0.0197	0.0325	0.0144	0.0225	0.01
Columbia	0.0044	0.0025	0.0013	0.0004			0.0104	0.0047	0.0285	0.00
Escapement	0.0144	0.0830	0.0812	0.0459	0.0669	0.1271	0.2490	0.1445	0.0228	0.09
Freshwater		0.0034	0.0044	0.0109			0.0837	0.0006		0.02
Oregon	0.0005	0.0022	0.0051	0.0005	0.0016	0.0022	0.0058	0.0029	0.0017	0.00
Oregon		0.0025	0.0003	0.0042				0.0005		0.00
Oregon	0.0009		0.0018	0.0002	0.0038	0.0049	0.0291	0.0047	0.0025	0.00
Other	0.0001		0.0002		0.0011			0.0005		0.00
Puget Sound		0.0004	0.0004		0.0011					0.00
Puget Sound	0.0003				0.0049					0.00
Wash.				0.0032						0.00
Wash.	0.0013	0.0040	0.0044	0.0004		0.0038	0.0021	0.0036	0.0022	0.00
Washington	0.0013	0.0016	0.0075				0.0037	0.0052	0.0008	0.00
Total Survival	0.0357	0.1386	0.1191	0.0821	0.1124	0.1816	0.4788	0.2036	0.1328	0.16

Percent of Total	Grays River	Elochoman	Cowlitz	N. Toutle	Fallert Ck.	K. Falls	Lewis Wild	Washougal	Klickitat	Avg.
Alaska	4.48	14.24	3.3	6.40	16.10	9.06	12.35	6.37	34.17	11.8%
California										
Canada Net	1.89	0.32	0.51	0.43	0.98	1.81	0.70	1.79	2.45	1.20
Canada	1.42	1.46	1.86	3.41		2.42		2.64	2.38	2.79
Canada Troll	27.59	12.14	4.9	10.02	12.20	9.97	6.78	7.07	16.92	12.60
Columbia	12.26	1.78	1.1	0.43			2.17	2.33	21.48	5.93
Escapement	40.33	59.87	68.05	55.86	59.51	70.69	52.00	70.96	17.18	54.9%
Freshwater		2.43	3.72	13.22			17.48	0.31		7.43
Oregon	1.42	1.62	4.31	0.64	1.46	1.21	1.22	1.4	1.26	1.61
Oregon			0.25	5.12				0.23		1.84
Oregon	2.59	1.78	1.52	0.21	3.41	2.72	6.09	2.33	1.92	2.59
Other	0.24		0.17		0.98			0.23		0.38
Puget Sound		0.32	0.34		0.98					0.65
Puget Sound	0.71				4.39					2.54
Wash.										
Wash.	3.54	2.91	3.72	3.84		2.11	0.43	1.79	1.65	2.49
Washington	3.54	1.13	6.26	0.43			0.78	2.56	0.59	2.18
Total	100.00	100.00	100.01	100.00	100.00	99.99	100.00	100.01	100.00	100.

Appendix 8a. Percent contribution to fisheries of Upriver Bright fall chinook.

Percent Contribution	Klickitat	Lyons Ferry	Lyons Ferry	Lyons Ferry	Lyons Ferry	Priest Rapids	Hanford	Turtle	Avg.
		Yearlings	Yearlings	Sub-yearlings	Sub-yearlings		Wild	Rock	
		-Barged		-Barged					
Alaska	0.0454	0.0833	0.0012	0.0140	0.0111	0.0418	0.0569	0.0515	0.0361
California		0.0223			0.0007	0.0002			0.0077
Canada Net	0.0032	0.0701	0.0030	0.0093	0.0024	0.0024	0.0042	0.0094	0.0129
Canada Sport	0.0032	0.1146	0.0085	0.0049	0.0030	0.0039	0.0034	0.0089	0.0186
Canada Troll	0.0225	0.1761	0.0180	0.0149	0.0332	0.0357	0.0262	0.0466	0.0449
Columbia River Net	0.0285	0.7183	0.0159	0.0691	0.0221	0.0711	0.0575	0.0890	0.1304
Escapement	0.0228	3.2695	0.0853	0.2024	0.0749	0.1598	0.1168	0.0375	0.4882
Freshwater Sport				0.0016		0.0058	0.0129	0.0038	0.0054
Oregon Commercial	0.0017	0.2637	0.0053	0.0271	0.0017	0.0024	0.0008	0.0033	0.0381
Oregon Other		0.0260		0.0027	0.0009			0.0204	0.0125
Oregon Sport	0.0025	0.0942		0.0036	0.0013	0.0089	0.0042	0.0011	0.0160
Other		0.0028				0.0017	0.0004		0.0014
Puget Sound Net		0.0080				0.0001		0.0006	0.0029
Puget Sound Sport		0.0028		0.0020	0.0009	0.0010	0.0005	0.0002	0.0012
Wash. Coastal Net									
Wash. Coastal Sport	0.0022	0.0848	0.0035	0.0029	0.0035	0.0041	0.0008	0.0092	0.0137
Washington Troll	0.0008	0.1013	0.0015	0.0044	0.0046	0.0006	0.0007	0.0054	0.0149
Total Survival	0.1328	5.0380	0.1423	0.3588	0.1602	0.3396	0.2852	0.2869	0.8262

Appendix 8b. Percent of total survival to fisheries of Upriver Bright fall chinook.

Percent of Total Survival	Klickitat	Lyons Ferry Yearlings	Lyons Ferry Yearlings Barged	Lyons Ferry Sub-yearlings	Lyons Ferry Sub-yearlings Barged	Priest Rapids	Hanford Wild	Turtle Rock	Avg.
	Alaska	34.17	1.65	0.85	3.90	6.91	12.31	19.96	17.97
California		0.44			0.41	0.05			0.30
Canada Net	2.45	1.39	2.13	2.60	1.49	0.71	1.47	3.29	1.94
Canada Sport	2.38	2.27	5.96	1.36	1.90	1.16	1.20	3.12	2.42
Canada Troll	16.92	3.50	12.67	4.15	20.73	10.52	9.20	16.26	11.74
Columbia River Net	21.48	14.26	11.18	19.26	13.82	20.94	20.15	31.07	19.02
Escapement	17.18	64.90	59.96	56.41	46.75	47.05	40.94	13.06	43.28
Freshwater Sport				0.43		1.71	4.51	1.32	1.99
Oregon Commercial	1.26	5.24	3.73	7.55	1.08	0.71	0.28	1.16	2.63
Oregon Other		0.52		0.74	0.54			0.38	0.55
Oregon Sport	1.92	1.87		0.99	0.81	2.63	1.47	7.00	2.39
Other		0.06				0.5	0.14		0.23
Puget Sound Net		0.16				0.03		0.21	0.13
Puget Sound Sport		0.06		0.56	0.54	0.29	0.18	0.09	0.29
Wash. Coastal Net									
Wash. Coastal Sport	1.65	1.68	2.45	0.80	2.17	1.21	0.28	3.20	1.68
Washington Troll	0.59	2.01	1.06	1.24	2.85	0.18	0.23	1.88	1.41
Total	100.00	100.01	100.00	100.00	100.00	100.00	100.00	100.01	100.00

Appendix 9. Percent contribution and percent of total survival to fisheries of summer chinook.

	Wells		Similkameen	Methow	Turtle Rk.	Avg.	
	Dryden Pond	yearlings					sub-yearlings
Percent Contribution							
Alaska	0.0348	0.0414	0.0024	0.0482	0.0016	0.0717	0.0333
California	0.0003			0.0003			0.0003
Canada Net	0.0045	0.0085	0.0004	0.0061		0.0145	0.0068
Canada Sport	0.0028	0.0061		0.0078		0.0123	0.0073
Canada Troll	0.0109	0.0064	0.0021	0.0375		0.1072	0.0328
Columbia River Net	0.0023		0.0008	0.0068	0.0196	0.0181	0.0095
Escapement	0.0511	0.1241	0.0068	0.2597	0.0008	0.3308	0.1289
Freshwater Sport	0.0017			0.0007		0.0059	0.0028
Oregon Commercial	0.0039	0.0091		0.0022		0.0042	0.0049
Oregon Other	0.0003			0.0022		0.0098	0.0041
Oregon Sport	0.0009	0.0047		0.0004		0.0022	0.0021
Other	0.0002			0.0005			0.0004
Puget Sound Net							
Puget Sound Sport	0.0003	0.0003	0.0008	0.0011		0.0042	0.0013
Wash. Coastal Net	0.0001			0.0001		0.0014	0.0005
Wash. Coastal Sport	0.0005			0.0019			0.0012
Washington Troll	0.0015	0.0009	0.0001	0.0029		0.0243	0.0059
Total	0.1161	0.2015	0.0134	0.3784	0.0220	0.6066	0.2230
	Wells		Similkameen	Methow	Turtle Rk.	Avg.	
	Dryden Pond	yearlings					sub-yearlings
Percent of Total Survival							
Alaska	29.99	20.54	17.69	12.73	7.23	11.83	16.67
California	0.27			0.09			0.18
Canada Net	3.87	4.20	3.08	1.62		2.39	3.03
Canada Sport	2.37	3.04		2.05		2.02	2.37
Canada Troll	9.36	3.19	15.38	9.92		17.67	11.11
Columbia River Net	1.97		6.15	1.80		2.99	3.23
Escapement	43.96	61.56	50.77	68.59	89.16	54.53	61.43
Freshwater Sport	1.49			0.19		0.97	0.88
Oregon Commercial	3.39	4.52		0.59	3.61	0.69	2.56
Oregon Other	0.81			0.10		0.37	0.43
Oregon Sport	0.27	2.33		0.59		1.61	1.20
Other	0.2			0.14			0.17
Puget Sound Net							
Puget Sound Sport	0.27	0.16	6.15	0.30		0.69	1.51
Wash. Coastal Net	0.41			0.50		0.23	0.38
Wash. Coastal Sport	0.07			0.01			0.04
Washington Troll	1.29	0.47	0.77	0.78		4.00	1.46
Total	99.99	100.01	100.00	100.00	100.00	99.99	100.00

Appendix 10. Percent contribution and percent of total survival to fisheries of spring chinook.

Percent Contribution	Cowlitz	Cowlitz	Fallert Cr.	Lewis R.	Klickitat	Tucannon	Ringold	Chiwawa	Carlton Pd.	Chewuch	Twisp	Methow
	Yearlings	Sub-yearlings										
Alaska		0.72	5.26	3.15	7.05	1.10				18.08		
California												
Canada Net		2.49	4.31	1.43	1.81	0.50	0.33			2.97		
Canada Sport		1.24	2.15	1.14	0.93	0.46	0.98			1.37		
Canada Troll		7.96	2.15	3.62	4.31	0.53				0.92		
Columbia River Net		1.00	0.48	0.19	0.64	0.43		0.91		0.92		
Escapement		59.46	61.00	65.59	38.56	93.55	97.40	65.55	88.71	72.31	97.24	98.39
Freshwater Sport		13.94	8.13	17.54	40.77	1.07		33.23	9.37			
Oregon Commercial		0.03	6.94	2.19	0.64	1.07	0.33	0.30		1.83	2.76	100.00 1.61
Oregon Other		1.86		0.29								
Oregon Sport		1.05		1.53	0.82	0.64	0.65					
Other		0.04				0.39				1.37		
Puget Sound Net		0.10										
Puget Sound Sport		1.04			1.46				1.10			
Wash. Coastal Net												
Wash. Coastal Sport		4.32	1.67	0.95	1.11							
Washington Troll		4.77	7.89	2.38	1.92	0.25	0.36		0.83	0.23		
Total Survival		100.00	100.00	100.00	100.02	99.99	100.00	99.99	100.01	100.00		

Percent of Total Survival	Cowlitz	Cowlitz	Fallert Cr.	Lewis R.	Klickitat	Tucannon	Ringold	Chiwawa	Carlton Pd.	Chewuch	Twisp	Methow
	Yearlings	Sub-yearlings										
Alaska	0.0052	0.0023	0.0061	0.0184	0.0021					0.0082		
California												
Canada Net	0.0178	0.0019	0.0028	0.0047	0.0001	0.0004				0.0014		
Canada Sport	0.0089	0.0010	0.0022	0.0024	0.0001	0.0011				0.0006		
Canada Troll	0.0570	0.0010	0.0071	0.0113	0.0010					0.0004		
Columbia River Net	0.0072	0.0002	0.0004	0.0017	0.0001		0.0017			0.0004		
Escapement	0.4258	0.0270	0.128	0.1007	0.1797	0.1136	0.1199	0.0699	0.0328	0.0533		0.0454
Freshwater Sport	0.0998	0.0036	0.0342	0.1065	0.0021		0.0608	0.0074				
Oregon Commercial	0.0112	0.0031	0.0043	0.0017	0.0020	0.0004	0.0006		0.0008	0.0015	0.0382	0.0007
Oregon Other	0.0023		0.0006									
Oregon Sport	0.0075		0.003	0.0021	0.0012	0.0008			0.0006			
Other	0.0003				0.0008							
Puget Sound Net	0.0007											
Puget Sound Sport	0.0074			0.0038				0.0009				
Wash. Coastal Net												
Wash. Coastal Sport	0.0310	0.0007	0.0019	0.0029								
Washington Troll	0.0341	0.0035	0.0047	0.005	0.0005	0.0004		0.0007	0.0001			
Total Survival	0.7161	0.0443	0.1953	0.2612	0.1920	0.1166	0.1830	0.0789	0.0453	0.0548	0.0382	0.0461

Appendix 11. Percent contribution and percent of total survival to fishery of Type N coho.

Wash. to Champion

	Elochoman	Cowlitz	K. Falls	Lewis R.	Washougal	Klickitat	Pond.	Klickitat	Avg.
Percent Contribution									
Alaska				0.0011					0.0011
California									
Canada Net				0.0073					0.0073
Canada Sport		0.0046	0.0109	0.0040					0.0195
Canada Troll	0.0027	0.0255	0.0175	0.0406	0.0109	0.0011	0.0171	0.0311	0.1464
Columbia River Net	0.0054	0.0101	0.0117	0.0297	0.0251	0.0044	0.0158	0.0176	0.1198
Escapement	0.0067	0.2733	0.0543	0.3170	0.1692	0.0099		0.0008	0.8312
Freshwater Sport		0.0013					0.0053		0.0066
Oregon Commercial				0.0015	0.0008				0.0023
Oregon Other				0.0139					0.0139
Oregon Sport		0.0131	0.0092		0.0126	0.0044	0.0079	0.0210	0.0682
Other									
Puget Sound Net				0.0015					0.0015
Puget Sound Sport		0.0013		0.0015					0.0028
Wash. Coastal Net	0.0074								0.0074
Wash. Coastal Sport		0.0503	0.0200	0.0604	0.0461	0.0099	0.0897	0.0336	0.3100
Washington Troll		0.0036		0.0007	0.0042	0.0007	0.0026	0.0000	0.0118
Total Survival	0.0221	0.3831	0.1236	0.4792	0.2689	0.0304	0.1384	0.1042	1.5498

	Elochoman	Cowlitz	K. Falls	Lewis R.	Washougal	Wash. to Klickitat	Champion Pond.	Klickitat	Avg.
Percent of Total Survival									
Alaska				0.23					0.23
California									
Canada Net				1.53					6.83
Canada Sport		1.19	8.78	0.84					3.60
Canada Troll	12.12	6.66	14.19	8.48	4.05	3.61	12.38	29.84	11.14
Columbia River Net	24.24	2.65	9.46	6.19	9.35	14.46	11.43	16.94	11.96
Escapement	30.30	71.33	43.92	66.16	62.93	32.53		0.81	39.93
Freshwater Sport		0.34					3.81		0.34
Oregon Commercial				0.31	0.31				1.48
Oregon Other				2.90					2.90
Oregon Sport		3.41	7.43		4.67	14.46	5.71	20.16	8.02
Other									0.31
Puget Sound Net				0.31					
Puget Sound Sport		0.34		0.31					0.34
Wash. Coastal Net	33.33								33.33
Wash. Coastal Sport		13.14	16.22	12.61	17.13	32.53	64.76	32.26	26.95
Washington Troll		0.94		0.15	1.56	2.41	1.90	0.00	1.16
Total	100.00	100.00	100.00	100.02	100.00	100.00	99.99	100.00	100.00

Appendix 12. Percent contribution and percent of total survival to fisheries of Type S coho.

Percent Contribution	Grays River	Elochoman	Toutle	Fallert Ck.	Lewis R.	Rocky Reach/ Turtle Rock	Average
Alaska							
California							
Canada Net							
Canada Sport							
Canada Troll			0.0028		0.0031		0.0029
Columbia River Net	0.0347	0.0016	0.0021	0.0064	0.0024		0.0095
Escapement	0.1497	0.0319	0.1904	0.2894	0.4042	0.0022	0.1780
Freshwater Sport					0.0021		0.0021
Oregon Commercial	0.0007						0.0007
Oregon Other		0.0090	0.0101				0.0095
Oregon Sport	0.0200			0.0129	0.0258	0.0067	0.0164
Other							
Puget Sound Net							
Puget Sound Sport							
Wash. Coastal Net							
Wash. Coastal Sport	0.0234	0.0221	0.0108	0.0580	0.0380		0.0305
Washington Troll				0.0016	0.0007		0.0012
Total survival	0.2285	0.0646	0.2162	0.3684	0.4763	0.0090	0.2272

Percent of Total Survival	Grays River	Elochoman	Toutle	Fallert Ck.	Lewis R.	Rocky Reach/ Turtle Rock	
Alaska							
California							
Canada Net							
Canada Sport							
Canada Troll			1.29		0.66		0.97
Columbia River Net	15.20	2.53	0.97	1.75	0.51		4.19
Escapement	65.50	49.37	88.08	78.56	84.85	25.00	65.23
Freshwater Sport					0.44		0.44
Oregon Commercial	0.29						0.29
Oregon Other		13.92	4.67				9.30
Oregon Sport	8.77			3.5	5.42	75	23.17
Other							
Puget Sound Net							
Puget Sound Sport							
Wash. Coastal Net							
Wash. Coastal Sport	10.23	34.18	4.99	15.75	7.98		14.63
Washington Troll				0.44	0.15		0.30
Total	100.00	100.00	100.00	100.00	100.01	100.00	100.00