FISHERY RESEARCH

LOWER SNAKE RIVER COMPENSATION PLAN CHINOOK SALMON FISH HATCHERY EVALUATIONS—IDAHO

Project Progress Report

Report Period October 1, 2001 to September 30, 2002

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Lower Snake River Compensation Plan
Chinook Salmon Fish Hatchery Evaluations—Idaho
Part 1: Chinook Salmon

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ABSTRACT

This annual report summarizes Idaho-Lower Snake River Compensation Plan (LSRCP) Hatchery Evaluation monitoring activities from October 1, 2001 through September 30, 2002. Included in this report are all 2002 adult Chinook salmon *Oncorhynchus tshawytscha* returns and all releases of brood year 2000 juvenile spring and summer Chinook salmon. Juvenile release information includes data from 2001 parr and presmolt releases as well as smolt release data from spring 2002. Information presented in this report supersedes that included in previous reports.

Total adult and jack returns of spring and summer Chinook salmon to the upper Snake River drainage in 2001 were above the most recent 10-year average and above the LSRCP return goal of 58,677 Chinook salmon above Lower Granite Dam. Lower Granite Dam counts included 77,114 spring Chinook salmon and 24,112 summer Chinook salmon from wild-, natural-, or hatchery-origin, of which 2,089 and 1,953, respectively, were jacks.

Estimated contribution of Chinook salmon from LSRCP fish hatcheries operated by IDFG include 15,222 for McCall stock released at Knox Bridge, 980 for Sawtooth stock released at Sawtooth Fish Hatchery, and 6,762 for the Clearwater Fish Hatchery from releases at three satellite facilities (2,977 at Powell, 1,330 at Red River, and 2,455 at Crooked River). These numbers include the estimated number of fish harvested in the Pacific Ocean and the Columbia and Snake River basins as well as recoveries at the hatchery weirs.

Smolt-to-adult return (SAR) rates for brood year 1997 LSRCP spring and summer Chinook salmon (including the estimated harvest) ranged from 0.66% for Crooked River to 1.7% for McCall Fish Hatchery.

Idaho-LSRCP hatcheries (McCall, Clearwater, and Sawtooth) released a combined 5,277,566 brood year 2000 Chinook salmon in 2001 and 2002 (1,064,250 summer Chinook salmon smolts, 46,975 summer Chinook salmon parr, 2,738,879 spring Chinook salmon smolts, 993,474 presmolts, and 433,497 spring Chinook salmon parr).

Representative groups of brood year 2000 Chinook salmon juveniles were tagged with passive integrated transponders (PIT) to estimate survival to Lower Granite Dam. Estimated survival rates ranged from 4.70% for presmolts released in 2001 from the Red River Pond on the South Fork Clearwater River to 82% for smolts released in the spring of 2002 from the Powell satellite facility on the upper Lochsa River.

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INTRODUCTION

The U.S. Army Corps of Engineers (USACE) constructed four hydroelectric dams (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite) on the lower Snake River between 1961 and 1975. Fishery managers and biologists expected the survival of downstream migrating smolts and upstream migrating adults to be reduced by dam construction and operation and the alteration of the river ecosystem. A joint Coordination Act Report (CAR) written by the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) in 1972 was submitted to the USACE describing the impacts of the four Lower Snake River dams on both fish and wildlife. Based on that report, the USACE submitted a Special Report to Congress which was used to authorize the Lower Snake River Compensation Plan (LSRCP) through the Water Resources Development Act of 1976 (90 Stat. 2917) in an effort to mitigate for the reduced survival of anadromous salmonids resulting from dam construction and operation. The primary compensation tool specified in the LSRCP was a hatchery mitigation program. In 1977, the USFWS was given budgeting and administrative responsibility for operation and maintenance funding of LSRCP fish hatchery programs through an interagency agreement among the USACE, NMFS, and the USFWS.

The LSRCP hatchery program specified the use of fish hatcheries to produce and release enough juvenile anadromous salmonids to meet adult return goals that were established to offset the estimated mortality caused by the four lower Snake River dams. Original mortality estimates for spring and summer run Chinook salmon *Oncorhynchus tshawytscha* attributable to the four lower Snake River dams were derived by applying a 15% smolt mortality rate at each of the four projects (a total estimated loss of 48%). That expected loss was multiplied by the estimated return of spring/summer Chinook salmon adults (122,200) to the Snake River in 1957 (prior to dam construction) resulting in a mitigation goal of 58,677 (50,677 spring run and 8,000 summer run) spring and summer run Chinook salmon above Lower Granite Dam (LSRCP 1991, Table 1). Additionally, a return goal of 18,300 fall run Chinook salmon above Lower Granite was also established using similar criteria.

To achieve the established mitigation goals, LSRCP-funded hatcheries were constructed in Idaho, Oregon, and Washington. Hatcheries located in Idaho include three operated by Idaho Department of Fish and Game (IDFG) and one operated by the USFWS. Facilities operated by IDFG include Clearwater, McCall, and Sawtooth fish hatcheries (with four associated satellite facilities) (Figure 1; Table 2). Facilities operated by USFWS include Dworshak National Fish Hatchery (DNFH) and the associated Kooskia satellite facility (Figure 1). Adult return goals for LSRCP hatcheries operated by IDFG account for 39,360 of the 58,677 return goal above Lower Granite Dam (Table 2). Hatchery capacity specifications for LSRCP facilities operated by IDFG were based on adult escapement goals (Table 2) and an average smolt-to-adult return (SAR) rate of 0.87%.

In addition to the LSRCP funded hatcheries located in Idaho, IPC (Idaho Power Company) owns and maintains three additional Chinook salmon hatcheries that are operated by IDFG (Rapid River, Oxbow, and Pahsimeroi fish hatcheries) (Figure 1). Specific information pertaining to the DNFH and IPC hatcheries are summarized in separate reports.

Table 1. Adult spring and summer run Chinook salmon return goals for the LSRCP program.

Agency / River System	Run Type	Adult Return Goal
IDFG		
S.F. Salmon River	Summer	8,000
Upper Salmon River	Spring	19,445
Clearwater River	Spring	11,915
USFWS		
Clearwater River	Spring	9,135
ODFW		
Grande Ronde River	Spring	5,820
Imnaha River	Spring	3,210
WDFW		
Tucannon River	Spring	1,152
	GRAND TOTAL	**58,677**

Table 2. Adult spring and summer run Chinook salmon return goals for LSRCP funded hatcheries located in Idaho and operated by IDFG. Return goals listed for satellite facilities are a subset of the overall hatchery return goal (in bold font).

Hatchery and Satellite	First Year of Operation	Run Type	Adult Return Goal
McCall Hatchery	1979	Summer	8,000
Sawtooth Hatchery	1985	Spring	19,445
EF Salmon R. Satellite	1984	Spring	6,090
Clearwater Hatchery	1990	Spring	11,915
Powell Satellite	1989	Spring	2,553
Red River Satellite	1986	Spring	2,553
Crooked River Satellite	1990	Spring	6,809
		TOTAL	**39,360**

LSRCP Hatcheries Operated by IDFG

McCall Fish Hatchery

McCall Fish Hatchery was built in 1979 and is located on the North Fork of the Payette River in the city of McCall, Idaho (Figure 1). It is the incubation and rearing facility for the South Fork Salmon River (SFSR) Chinook salmon program. An adult trapping and spawning facility is located on the upper SFSR near Warm Lake (Figure 1). The adult escapement goal for the SFSR is 8,000 adults above Lower Granite Dam (LGD). Original broodstock for the SFSR program was composed of summer run adults collected at Little Goose Dam from 1974 to 1978, from LGD in 1979, and from LGD and the SFSR trap in 1980 (Kiefer et al. 1992). Adults

collected during these years (1974-1980) were spawned at Rapid River or Dworshak National Fish hatcheries. Juveniles produced from these adults were released into the upper SFSR above the current location of the adult trap. Beginning in 1981, broodstock collection has come exclusively from adults captured at the adult trap site on the SFSR. From the inception of the SFSR program through brood year 1990, not all of the juvenile Chinook salmon released were marked with a fin clip. Because of this, an unknown proportion of the unmarked returning adults through 1995 were hatchery-origin. Beginning with brood year 1991, all juvenile Chinook salmon released into the upper SFSR were marked or tagged and the origin of adults returning from these releases could be distinguished from naturally produced adults either from a fin clip or from the presence of a coded wire tag (CWT) or visual implant.

Sawtooth Fish Hatchery

Sawtooth Fish Hatchery was constructed in 1985 and is located on the mainstem Salmon River approximately ten km upstream from the town of Stanley, Idaho (Figure 1). The hatchery consists of an adult weir, adult trap, spawning and incubation facilities, and rearing space for 2.3 million Chinook salmon smolts at 15 fish per pound. The original escapement goal for Sawtooth was 19,445 adult Chinook salmon above LGD from juvenile releases at Sawtooth Fish Hatchery, East Fork Salmon River, and Valley Creek.

A rearing pond was constructed in 1966 at the current Sawtooth Fish Hatchery site and received fry plants from Hayden Creek, Rapid River, and Marion Forks Fish Hatchery in Oregon in the late 1960s (Bowles and Leitzinger 1991). During the 1970s, several releases into the rearing pond from Rapid River stock were made. Bowles and Leitzinger (1991) note that adult returns from these releases were negligible. The original brood source for the Sawtooth Fish Hatchery program came from adults captured at a temporary weir operated from 1981-1984 at the site of the current hatchery location. It was estimated that at least 50% of the adults trapped in 1981 resulted from a hatchery smolt release (914,000) in 1979 that was Rapid River stock raised at the Mullen Fish Hatchery (Moore 1981). Also, an unknown proportion of adults trapped in 1982 consisted of age-5 adults from the same Rapid River smolt release. Beginning in 1983, all returning hatchery adults at the trap were Sawtooth Fish Hatchery stock. Eggs collected from adults trapped at the temporary weir were incubated and reared at the McCall Fish Hatchery from 1981-1983 and at Pahsimeroi Fish Hatchery in 1984. Smolts reared at McCall and Pahsimeroi for brood years 1981-1984 were released in the Upper Salmon in 1983-1986 at the current hatchery location. Brood year 1985 was the first year that all adult trapping, incubation, and rearing occurred at the Sawtooth Fish Hatchery. Through brood year 1990, not all of the juvenile Chinook salmon released were marked with a fin clip. Because of this, an unknown proportion of the unmarked returning adults through 1995 were hatchery-origin. Beginning with brood year 1991, all juvenile Chinook salmon released at or above the Sawtooth Fish Hatchery Weir were marked or tagged, and the origin of adults returning from those releases could be distinguished from naturally produced adults either from a fin clip or from the presence of a CWT.

The East Fork Salmon River adult trap is a satellite facility of Sawtooth Fish Hatchery that began operation in 1984. It is located approximately 29 km upstream of the mouth of the East Fork Salmon River (Figure 1). The escapement goal for the East Fork Satellite Weir is 6,090 above LGD (Table 2). Eggs from adults that are trapped and spawned at the East Fork satellite are transferred to the Sawtooth Fish Hatchery for incubation and rearing. Adult collection and spawning occurred at the East Fork satellite from 1985-1993 (Brent Snider, IDFG, personal communication). From 1994-1997, the trap was operated but, due to low numbers of returning adults, all adults captured were released above the weir to spawn naturally. Trapping

operations for Chinook salmon were discontinued from 1998-2002 due to low numbers of returning adults.

While Valley Creek was initially slated to receive releases of up to 300,000 smolts annually, due to lack of adult returns to Sawtooth Fish Hatchery, no juvenile releases have been made to Valley Creek since the beginning of the Sawtooth Fish Hatchery program.

Clearwater Fish Hatchery

Clearwater Fish Hatchery was constructed in 1992 and is located on the North Fork Clearwater River approximately one km above the mouth near the town of Orofino, Idaho. The original adult escapement goal for Clearwater Fish Hatchery was set at 11,915 Chinook salmon above LGD. Clearwater Fish Hatchery contains adult holding, spawning, incubating facilities, and rearing space for 1,500,000 Chinook smolts and 1,700,000 steelhead smolts. Three satellite facilities (Red River, Crooked River, and Powell) associated with Clearwater Fish Hatchery were constructed prior to Clearwater Fish Hatchery (Table 2; Figure 1). Incubation and initial rearing of all Chinook salmon juveniles released at the three satellite facilities occurs at Clearwater Fish Hatchery.

Red River Satellite—In 1976, a rearing pond and temporary weir were constructed at the site of the current satellite facility as part of the Columbia River Fisheries Development Program (Kiefer et al. 1992). In 1986, the satellite facility was updated and a permanent weir was installed near the rearing pond as part of the LSRCP program. Both fall presmolt and spring smolt releases have occurred at Red River. The Red River satellite facility is located approximately 21 km upstream from the mouth of Red River and approximately 183 km upstream from Clearwater Fish Hatchery.

Crooked River Satellite—An adult trap and juvenile rearing ponds were constructed on Crooked River in 1989. The adult trap is located on Crooked River approximately one km upstream from the mouth. The juvenile rearing ponds are located approximately 16 km upstream of the adult trap. The Crooked River satellite facility is located approximately 150 km upstream from the Clearwater Fish Hatchery. Both fall presmolt and spring smolt releases have occurred at Crooked River. There are no adult holding facilities at Crooked River and all adults retained for broodstock are transported to the Red River facility. Initially, Red River and Crooked River adults were kept separate and treated as two different stocks. However, in 1997 the decision was made to treat the Red River and Crooked River adults as a single stock (South Fork Clearwater stock) (McGhee and Patterson 1999).

Powell Satellite—Construction of an adult trap, weir, holding ponds, and a juvenile rearing pond was completed in 1989 and adult trapping began in 1988. The Powell facility is located on the upper Lochsa River approximately 200 km upstream from the Clearwater Fish Hatchery (Figure 1). Originally, a floating weir that spanned the Lochsa River was used to guide fish into Walton Creek where another weir guided them into the trap box. The floating weir was operated from 1988 to 1992. High water events in 1992 caused extensive damage to weir panels and the floating weir has not been operated since. Since 1992, fish have no longer been guided to Walton Creek by a mechanical structure, but rather from the attraction flow of Walton Creek, which is the water source for the Powell satellite facility. It should be noted that Walton Creek is a small tributary with no natural run of Chinook salmon. Adults that are retained for broodstock are spawned at the Powell facility and eggs are transferred to the Clearwater Fish Hatchery for incubation and rearing. Both fall presmolt and spring smolt releases occur at the Powell facility.

Hatchery Evaluation Component of LSRCP

The LSRCP includes a Hatchery Evaluation Study (HES) component to monitor and evaluate the hatchery mitigation program. The primary goal of the HES is to work with individual hatcheries to help determine the best hatchery management practices that allow the hatcheries to meet LSRCP and IDFG anadromous fisheries goals. Objectives to address the goal are: 1) to monitor and document the extent to which hatcheries meet their mitigation goals and 2) to conduct small-scale manipulative studies involving modified or alternative hatchery practices that show potential for increasing adult returns and achieving LSRCP and IDFG goals. These small-scale studies may be printed and bound as independent reports.

In addition to monitoring production and productivity of the LSRCP hatcheries, some production and productivity data collected from natural populations that are adjacent to the LSRCP hatchery programs are also reported. These data are typically collected by ongoing IDFG research programs (e.g., Idaho Supplementation Studies and Idaho Natural Production Monitoring programs).

The primary purpose of this report is to summarize activities at each of the LSRCP funded hatcheries operated by IDFG and to estimate at what level each facility contributed to fisheries in the Pacific Ocean and Columbia River as well as to the adult return above LGD and back to the respective hatchery trapping facilities. This includes reporting adult returns to hatchery facilities and juvenile rearing and release information on a yearly basis. Additionally, life stage specific survival during periods when fish are not directly associated with the hatcheries are reported to address overall survival from release to return. In each annual report, a brood year is summarized or "closed out" by consolidating the juvenile rearing, release, and adult return information from a given brood year. Because of the five year generation length of Chinook salmon, there is an associated five-year lag before being able to summarize the productivity of a brood year. For the 2002 reporting period, productivity of brood year 1997 is summarized. To avoid unnecessary duplication of data reporting, only the major components of data collected by hatchery staff are reported. Specific hatchery broodstock collection, spawning, incubation, and rearing summaries can be found in hatchery specific brood year reports available from IDFG.

This report is organized into three major sections: (1) juvenile release and survival information for brood year 2000 juveniles including parr or presmolts released in 2001 and yearling smolts released in 2002; (2) adult return information, by age class, collected in 2002 including the estimated number of spring and summer Chinook salmon harvested in the ocean, Columbia and Snake River fisheries, the number that passed over LGD, and the number of adults that returned to each hatchery; and (3) productivity estimates of the adults that returned to each hatchery facility from brood year 1997 (i.e. brood year reconstruction and parent:progeny relationships).

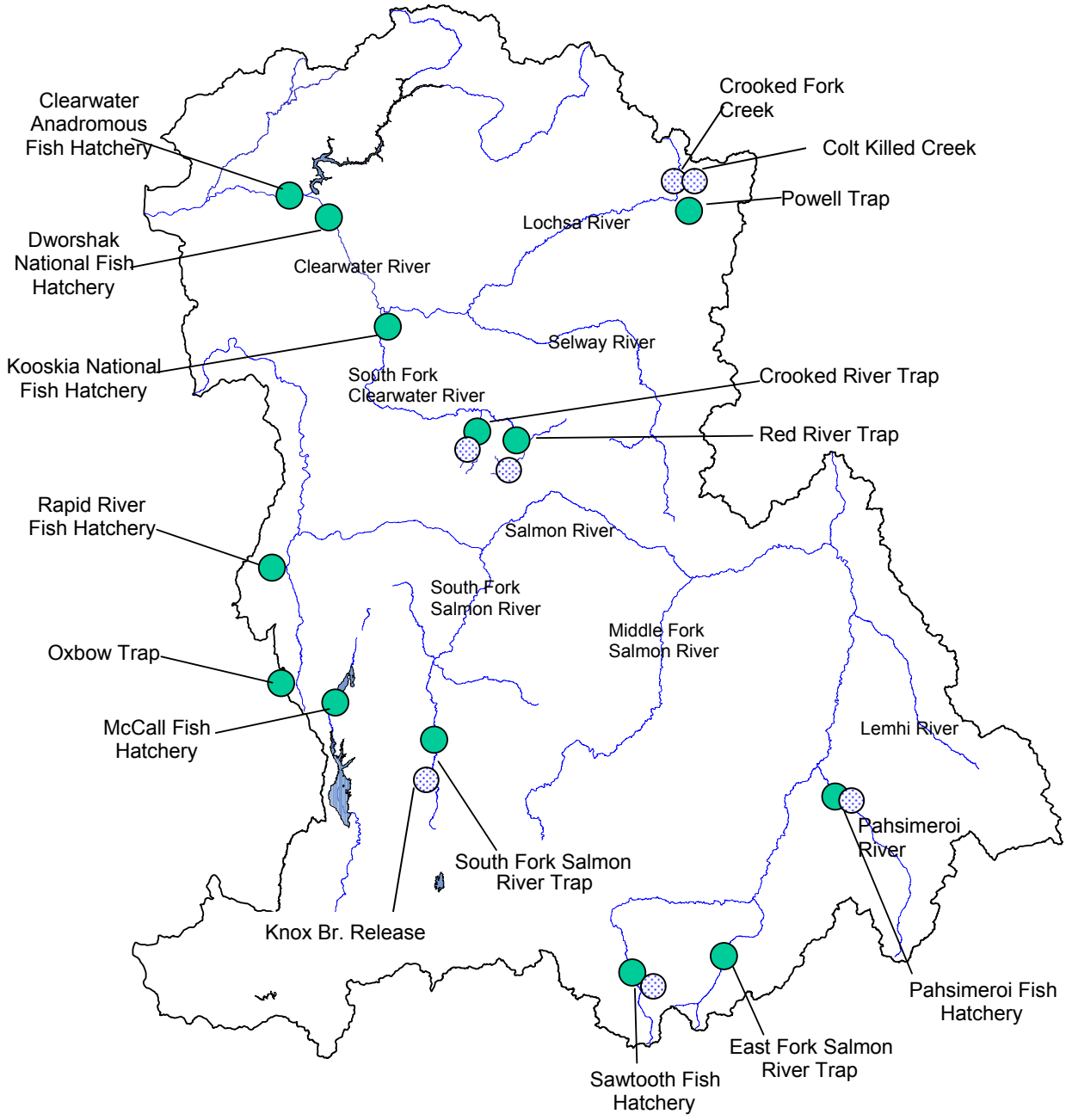


Figure 1. Locations of Chinook salmon hatcheries and trapping facilities in Idaho. Solid circles represent adult trapping or hatchery locations. Circles with dot matrix represent locations where natural origin Chinook salmon were PIT tagged for survival estimates.

METHODS

Smolt Survival From Release To Lower Granite Dam

Survival estimates of hatchery-origin juvenile Chinook salmon from release at the hatcheries to arrival at LGD is estimated using PIT tag release groups from the various hatchery facilities. Specifically, the SURPH (Survival Under Proportional Hazards) computer program is used to generate a point estimate of survival and associated 95% confidence intervals. The program uses the Cormack-Jolly-Seber model (Cormack 1964; Jolly 1965; Seber 1965) for single release and multiple recapture events (Lady et al. 2001). This method accounts for differences in collection efficiency at the dams so comparisons between release groups from different facilities and releases from different time periods are appropriate. PIT tag groups are generally made up of 300-700 fish from all LSRCP facilities released every year to evaluate migration timing and survival of hatchery-reared juveniles. In addition to reporting survival rates of hatchery-origin fish, survival rates for several groups of natural-origin Chinook PIT tagged from other ongoing research projects in Idaho located adjacent to hatchery release sites are also reported for comparison. All PIT-tagged natural-origin fish were captured using rotary screw traps as they volitionally emigrated from the rearing areas. In order to make comparisons with the hatchery-origin releases, natural-origin fish were classified as parr, presmolts, or smolts based on the date they were captured and tagged. Subyearlings trapped prior to September 1 are considered parr, and those captured on or after September 1 are considered presmolts. Yearling smolts are captured between February and June of the following year.

To compare arrival timing at LGD from different release groups, the “arrival window” in which the middle 80% of PIT tag detections occurred is also reported. This interval provides a measure of how “spread out” the major component of each release group of juveniles were as they passed LGD.

Estimating Downstream Harvest (Ocean and Columbia River)

In order to estimate the total production of the LSRCP hatchery facilities in Idaho, estimates of harvest from fisheries in the ocean and Columbia River are also reported. Estimates are generated by utilizing CWT harvest data retrieved from the Regional Mark Information System (RMIS) database that is maintained by the Pacific States Marine Fisheries Commission (PSMFC). Coded wire tag recoveries are expanded based on two criteria: 1) the estimated sample rate of the fishery, and 2) the proportion of the release group that was tagged with CWT. These expanded values represent the total estimated harvest of each release group.

Adult Returns to Lower Granite Dam

Adult returns to LGD are comprised of both spring and summer run components. Adult counting facilities operated by the Fish Passage Center (FPC) at Lower Snake and Columbia river hydroelectric projects categorize spring and summer runs based on the arrival timing at individual projects. For example, Chinook salmon arriving at LGD between March 1 and June 17 are classified as spring run while Chinook salmon arriving between June 18 and August 17 are classified as summer run. The FPC does not discriminate Chinook salmon return numbers by their respective origins (wild or hatchery). Some hatchery-origin Chinook salmon have no external mark, and a visual determination of origin is not possible.

PIT tag data have shown that some spring run Chinook salmon arrive at LGD after June 17 and some summer run Chinook salmon arrive prior to June 17. Therefore, arrival timing alone may not be sufficient to accurately determine the numbers of spring and summer Chinook salmon returns. In order to reduce the discrepancy created by this observed overlap in arrival timing at LGD, the U.S. v. Oregon Technical Advisory Committee (TAC) estimates the proportions of Chinook salmon crossing LGD that are spring or summer run and also hatchery- or wild-origin by using data collected at hatcheries and from fisheries. Therefore, while the total reported number of adult Chinook salmon arriving at LGD is the same for both methods, proportions of the total return that are composed of wild and hatchery or spring and summer run adults are different. It should be noted that TAC estimates do not include jacks. Adult Chinook salmon return data presented in this report are derived from both methods (FPC and TAC).

Estimating Harvest from Fisheries in Idaho

The occurrence of Chinook salmon sport fisheries in Idaho are variable and from 1979 through 1996 only occurred on the Little Salmon River (a terminal fishery for the Rapid River Fish Hatchery). From 1979 to 2002, some limited sport fisheries occurred in the Salmon and Clearwater rivers. Estimates of harvest from these fisheries are determined from IDFG regional staff and from IDFG staff funded through the LSRCP Harvest Monitoring Program (HMP). Methods include a combination of angler check stations, roving creel, and voluntary drop-off check station boxes.

Adult Age Classification

Depending on the availability of known age information (e.g. CWT, PIT tags, or other age-specific marks) recovered from returning adults, age composition of adults returning to individual LSRCP hatchery facilities is determined from either visual examination of length frequency histograms, or in cases where some known age information is available, the computer program Rmix is used. Rmix was developed by Du (2002) as an add-on program to the R (Development Core Team 2004) computing environment that utilized the original MIX program developed by Macdonald and Pitcher (1979). Rmix was designed to estimate the parameters of a mixture distribution with overlapping components, such as the overlapping length distributions associated with adult salmon returns composed of multiple age classes. Rmix utilizes the maximum likelihood estimation method.

The age notations used throughout this report for returning adults refer to the total age of the fish (fresh- and saltwater) and assume all juveniles migrate to the ocean as age-1+ smolts. Therefore, fish that spend one, two, or three years in the ocean are classified as three-, four-, and five-year-olds, respectively.

Determination of Origin

Chinook salmon bearing an external mark, typically an adipose or ventral fin clip, are classified as hatchery-origin. However, some hatchery-origin fish have no external mark but do have a CWT inserted in their snout. All externally unmarked fish with a CWT were also classified as hatchery-origin. Some hatchery-origin fish are referred to as reserve or production fish; the terms reserve and production are used in reference to a hatchery-origin Chinook salmon with an adipose fin clip (AD) that can be legally harvested in a selective sport fishery. Other hatchery-origin fish are referred to as supplementation fish. Supplementation fish refer to Chinook salmon that are part of the Idaho Supplementation Study (ISS) or the Nez Perce Tribal

(NPT) hatchery program and are not intended to contribute to selective sport fisheries. Supplementation fish are typically marked with a right ventral (RV) or left ventral (LV) fin clip or with a CWT and no external mark. For a more detailed explanation of the ISS program, refer Bowles and Leitzinger (1991).

Brood Year Reconstruction, SARs, and Progeny-to-Parent Ratios

In order to reconstruct a brood year for hatchery-origin Chinook salmon, adults that return from a given brood year over three return years are summarized. For example, the 1997 brood year includes age-3 fish that return in 2000, age-4 fish that return in 2001, and age-5 fish that return in 2002. These returns include fish recovered at the hatchery weir, those recovered in fisheries, and those that were recovered as strays at trap sites or during spawning ground surveys. For those recovered in mixed stock fisheries (ocean, Columbia and Snake rivers), the total number of fish harvested from each age class is estimated based on the number of CWTs recovered from each age class expanded by the sample rate of the fishery, and the tagging rate. For those recovered in terminal fisheries, the number of fish harvested in each age class is estimated based on the number of CWTs recovered from each age class expanded by tagging rate. The proportion of the expanded recoveries from each age class is then applied to the total estimated harvest in the terminal fishery.

Smolt-to-adult survival rates are estimated by summing up the total returns from a given brood year (brood year reconstruction as described above) divided by the number of smolts released from the brood in question.

Female-progeny to female-parent ratios are estimated by dividing the number of female returns from a brood year by the number of females that were spawned to create the brood in question. For example, brood year 1997 female-progeny to female-parent ratio is calculated by dividing the age-4 and age-5 females that returned in 2001 and 2002, respectively, by the number of females that were spawned in 1997. A ratio of one signifies the brood was at replacement or, simply stated, that each female spawned in 1997 produced one returning female adult. Two different female-progeny to female-parent ratios are provided in this report: one includes only the number of female-progeny that returned to the hatchery weir, and the second includes the estimated number of females harvested in addition to those returning to the weir. Harvest information includes ocean, Columbia and Snake rivers, and terminal fisheries. The number of females harvested is estimated by applying the sex ratio of males and females recovered at the hatchery weir to the estimated number of fish harvested in each fishery with the assumption that there is no gender bias in the fisheries. The sex ratio determined at the weir does not include age-3 males because there appears to some selectivity against age-3 males in the harvest.

RESULTS

Brood Year 2000 Juvenile Releases

From July 17, 2001 through April 26, 2002, a total of 5,277,566 brood year 2000 juvenile Chinook salmon were released from three LSRCP hatcheries (McCall, Sawtooth, and Clearwater) operated by IDFG (Table 3). An additional 5,444,356 brood year 2000 juvenile Chinook salmon were release from two IPC and two USFWS fish hatcheries in Idaho (Table 3).

Smolt releases occurred from March 11 through April 26, 2002 and subyearling parr and presmolts were released from July 17 through October 11, 2001 (Table 3).

Table 3. Brood year 2000 juvenile Chinook salmon released in 2001 (subyearling parr and presmolts) and 2002 (yearling smolts) from hatcheries located in Idaho.

Rearing Hatchery	Life Stage	Release Date	Release Location	Marks	Purpose[a]	Number Released
Clearwater	Parr	7/24	Pete King Creek*	CWT	ISS	17,025
	Parr	7/24	Fishing Creek*	CWT	ISS	13,919
	Parr	7/25-7/26	Colt Killed Creek*	LV	ISS	298,742
	Parr	7/17	Upper Selway R.*	AD	NPT	103,811
	Presmolt	9/28	Crooked R.	LV	ISS	155,887
	Presmolt	9/28	Red R.	RV	ISS	84,238
	Presmolt	10/1	Walton Creek	AD	LSRCP	559,630
	Presmolt	10/10	Boulder Creek*	AD	NPT	104,720
	Presmolt	10/11	Meadow Creek*	AD	NPT	89,490
	Smolt	4/10-4/12	Crooked River	AD	LSRCP	726,489
	Smolt	4/10-4/12	Red River	AD	LSRCP	350,318
	Smolt	4/10	Walton Creek	AD	LSRCP	349,890
	Smolt	4/9	N. Fork Clearwater	AD		206,473
	Smolt	4/10	Legendary Bear*	CWT	ISS	57,461
	Smolt	4/2	Lolo Creek	CWT	NPT	149,185
	Smolt	4/2	Mill Creek*	CWT	NPT	40,433
	Smolt	4/5	Boulder Creek*	CWT	NPT	101,473
	Smolt	4/4	Newsome Creek	CWT	NPT	74,555
	Smolt	4/16 & 4/26	Meadow Creek*	CWT	NPT	296,841
			Total			**3,780,580**
McCall	Presmolt	8/2	Stolle Pond	CWT	ISS	46,975
	Smolt	3/25-3/28	Knox Bridge	AD/CWT	LSRCP	1,022,550
	Smolt	3/25-3/28	Knox Bridge	RV	ISS	41,700
			Total			**1,111,225**
Sawtooth	Smolt	4/9, 4/19, 4/23	Sawtooth Weir	AD/CWT	LSRCP	265,642
	Smolt	4/9, 4/19, 4/23	Sawtooth Weir	CWT	ISS	120,119
			Total			**385,761**
Pahsimeroi	Smolt	4/15	Pahsimeroi R.	AD	IPC	418,417
	Smolt	4/15	Pahsimeroi R.	CWT	ISS	89,923
			Total			**508,340**
Rapid River	Smolt	3/12	Rapid River	AD/CWT	IPC	2,669,476
	Smolt	3/14	Little Salmon R.*	AD	IPC	300,018
	Smolt	3/11	Hells Canyon Dam	AD	IPC	500,195
						3,469,689
Dworshak[b]	Smolt	3/27-3/28	NF Clearwater R.	AD	LSRCP	**1,017,873**
Kooskia[b]	Smolt	4/4	Clearwater R.	AD	USFWS	**449,454**
			Grand Total			**10,722,922**

* This is an offsite release and no adult trapping facilities exists to evaluate adult returns.

[a] ISS = Idaho Supplementation Study, LSRCP = Lower Snake River Compensation Program, NPT= Nez Perce Tribal release, IPC=Idaho Power mitigation program, USFWS = United States Fish and Wildlife Service program.

[b] Data is from Burge et al. 2005.

Migration Timing and Survival of Brood Year 2000 Juvenile Chinook Salmon

Representative groups from all hatchery facilities were PIT tagged to evaluate migration timing and survival to LGD. These evaluation groups include fish released as subyearling parr and presmolts as well as yearling smolts. Travel time is not reported for juveniles tagged and released as subyearlings in the summer/fall periods.

Hatchery-Origin Yearling Smolts

Median travel time for yearling smolts from release to detection at LGD ranged from 14 days at Sawtooth Fish Hatchery to 54 days at Rapid River Fish Hatchery (Table 4). Travel time does not appear to be related to survival and is more likely a function of release date. It appears that fish released in earlier periods (mid-late March) linger in Idaho before actively migrating downstream.

The majority of juvenile Chinook salmon released as yearling smolts from Idaho fish hatcheries arrived at LGD from mid-April to mid-May (Figure 2, Table 4). The "80% arrival window" for yearling smolt releases averaged 22 days and ranged from 14 to 36 days (Table 4).

Survival estimates for yearling smolts from release to LGD ranged from 38% for the Sawtooth Fish Hatchery release to 82% for the Powell release group (Table 4, Figure 4). There appears to be a linear relationship between estimated survival and distance to LGD (r^2 =0.65; Figure 5) indicating a reduced survival rate for fish with longer migration distances.

Hatchery-Origin Subyearling Parr and Presmolts

Generally, arrival timing to LGD of hatchery-origin juvenile Chinook salmon released as subyearling parr and presmolts was more protracted than for those released as yearling smolts (Table 4, Figure 3). The majority of individuals released as parr and presmolts arrived at LGD from early April to late May. While the number of individuals detected at LGD from the parr and presmolt releases was low (average: nine detections per release; range: 0-28 detections), the arrival timing was consistent across all subyearling release groups with the exception of the Red River release. The "80% arrival window" for parr and presmolt releases averaged 45 days (range: 27-64 days) compared to 22 days for the yearling smolt releases (Table 4; Figure 3).

Averaged over all release sites, the estimated survival to LGD of hatchery-origin juveniles released as subyearling parr and presmolts was 6.1% (range: 4.6-9.7%), a substantial decrease from the hatchery-origin smolt survival (Figure 4 and 6), and is likely due to the over-winter mortality associated with fish released as subyearlings.

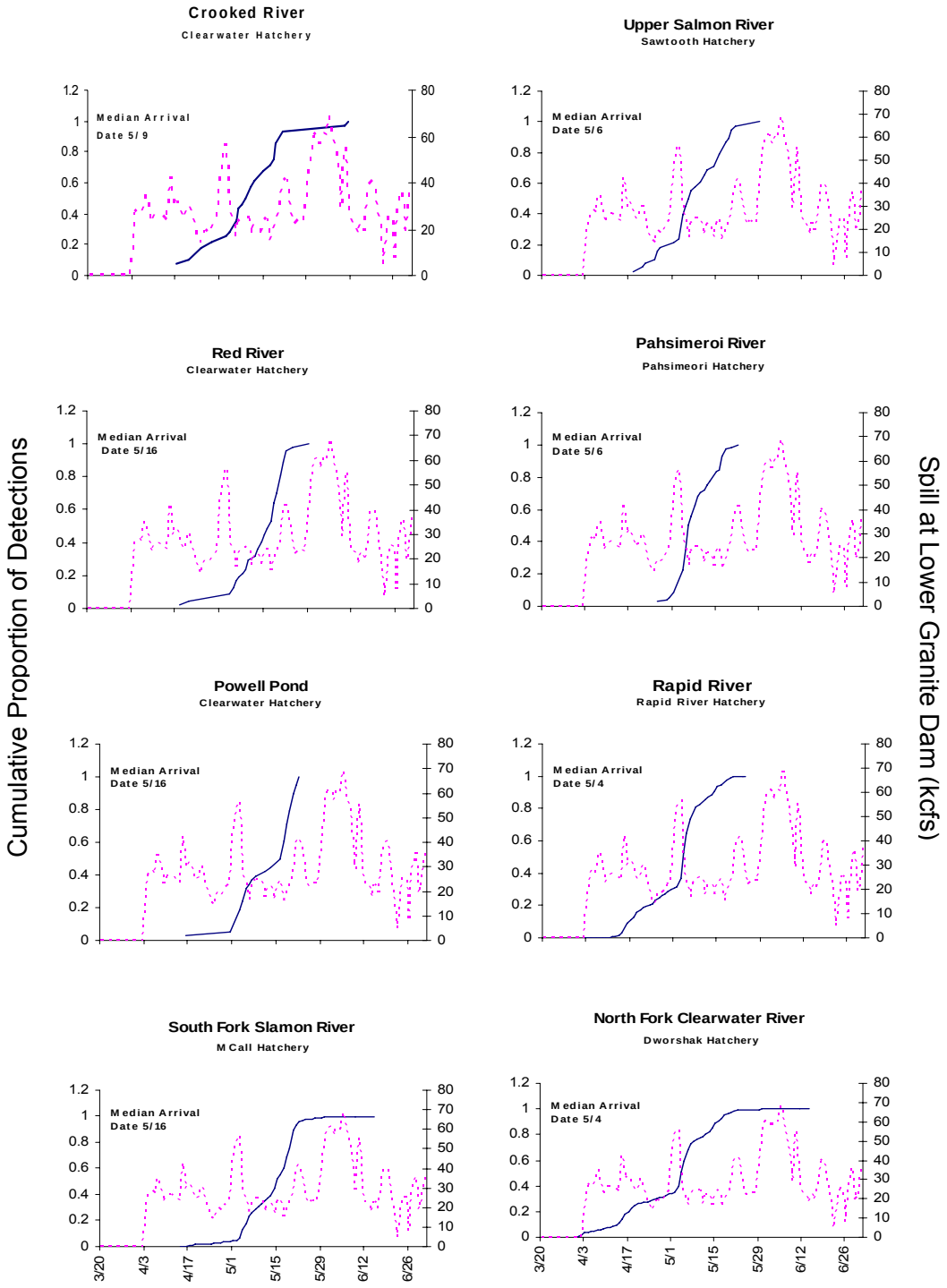


Figure 2. Migration and arrival timing of PIT tagged juvenile Chinook salmon released as yearling smolts from hatcheries in Idaho. First Y-axis (solid line) represents the cumulative proportion of PIT tag detections at Lower Granite Dam. The second Y-axis (dotted line) represents the average daily spill (kcfs) at Lower Granite Dam (spill data from FPC [http://www.fpc.org], detection data from PTAGIS [www.ptagis.org]).

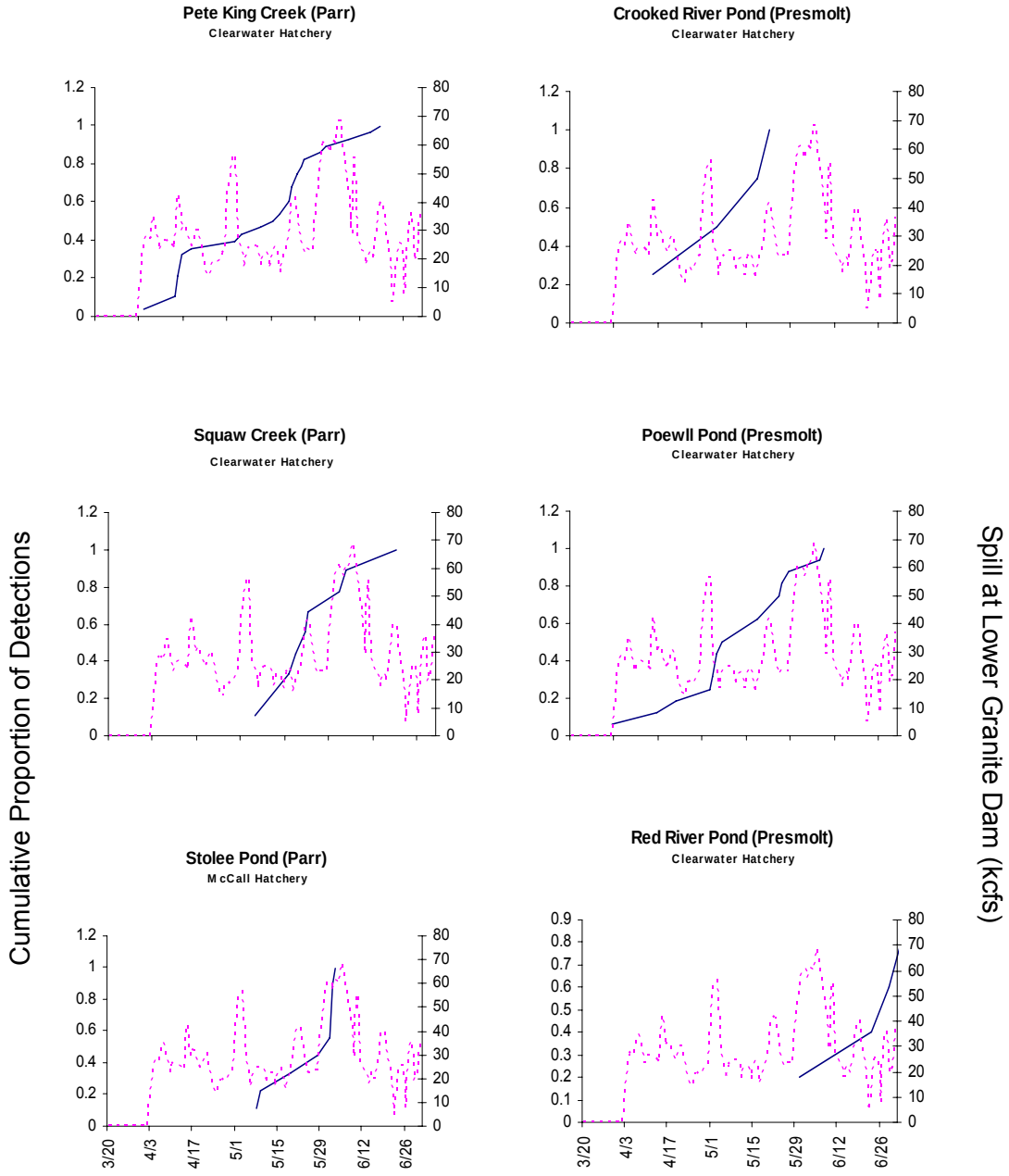


Figure 3. Migration and arrival timing of PIT tagged juvenile Chinook salmon released as subyearling parr or presmolt from hatcheries in Idaho. First Y-axis (solid line) represents the cumulative proportion of PIT tag detections at Lower Granite Dam. The second Y-axis (dotted line) represents the average daily spill (kcfs) at Lower Granite Dam (spill data from FPC [http://www.fpc.org], detection data from PTAGIS [www.ptagis.org]).

Table 4 Estimated survival, migration and arrival timing of brood year 2000 juvenile Chinook salmon released from fish hatcheries located in Idaho and from natural-origin juveniles PIT tagged in populations adjacent to the hatchery release sites. Probability of detection is based on output from the SURPH computer program and represents collection efficiency of the juvenile detection system at Lower Granite Dam. Survival data for natural-origin fish is from Dave Venditti (IDFG, personal communication). Interrogation data is from the PTAGIS database (http://www.ptagis.org).

Rearing Hatchery	Life Stage	Release Site	Program*	Distance to LGD (Km)	Release Date	Number PIT Tagged	Number of Unique Detections at LGD	Estimated Survival (%) to LGD (95% CI)	Probability of Detection	Median Arrival Date	Median Travel Time (days)	80% Arrival Window (# of days)
Clearwater	Parr	Pete King Creek	Supp.	217	7/24/01	1,000	28	9.7 (7.4-11.9)	0.29	5/15	NA	4/14-6/08 (56)
		Fishing Creek	Supp.	304	7/24/01	700	9	4.6 (3.0-6.2)	0.28	5/21	NA	5/05-6/03 (30)
		Crooked Fork Creek	Natural	321	7/13-8/31	370	13	11.0 (7.0-15.0)	0.31	5/19	NA	4/25–5/29 (34)
		Colt Killed Creek	Supp.	341	7/25/01	700	0	—	—	—	—	—
	Presmolt	Crooked R.	Supp.	280	9/28/01	500	4	7.1 (1.2-13.0)	0.11	5/5	NA	4/15-5/22 (38)
		Crooked R.	Natural	280	10/4-10/30	207	11	24.6 (1.4-47.8)	0.22	4/26	NA	4/3–6/30 (89)
		Red R.	Supp.	299	9/28/01	500	5	4.7 (1.1-8.2)	0.21	6/29	NA	5/03-7/05 (64)
		Red R.	Natural	299	10/9-11/6	400	22	11.1 (7.6-14.7)	0.50	5/11	NA	4/10–6/23 (75)
		Powell Pond	LSRCP	321	10/1/01	699	16	4.9 (3.2-6.6)	0.47	5/7	NA	4/16-6/07 (53)
		Crooked Fork Creek	Natural	321	8/1-10/14	1164	71	24.0 (18.0–30.0)	0.25	5/20	NA	4/18–6/19 (62)
		Colt Killed Creek	Natural	321	9/23-10/25	728	36	19.7 (15-23.9)	0.25	5/24	NA	4/23–6/17 (56)
	Smolt	American River	Natural	272	4/12-6/27	326	80	64.0 (54.0-74.0)	0.38	6/23	21	6/2–7/5 (34)
		Crooked R.	LSRCP	280	4/10/02	300	28	45.7 (36.3-55.2)	0.20	5/9	30	4/21-5/21 (31)
		Crooked R.	Natural	280	4/4-6/26	917	128	43.3 (35.9–50.6)	0.32	6/24	46	5/31–7/6 (37)
		Red R.	LSRCP	299	4/10/02	301	47	72.3 (61.5-83.2)	0.22	5/16	37	5/05-5/22 (18)
		Red R.	Natural	299	4/10-6/27	586	121	69.6 (54-85.7)	0.29	6/24	29	6/1–7/5 (35)
		Powell Pond	LSRCP	321	4/10/02	300	38	82.1 (66.4-97.8)	0.15	5/16	36	5/03-5/20 (18)
		Crooked Fork Creek	Natural	321	3/28-6/15	139	22	40.0 (30.0–50.0)	0.40	6/16	50	4/27–6/23 (57)
McCall	Parr	Stolle Pond	Supp.	470	07/23/01	600	9	5.6 (3.1-8.1)	0.27	6/1	NA	5/08-6/03 (27)
		Knox Br.	Natural	457	6/25-8/30	833	23	10.1 (7.4–12.8)	0.27	5/3	NA	4/15–5/31 (47)
	Smolt	Knox Br.	LSRCP	457	3/25/02	51,750	6,394	59.2 (57.9-60.5)	0.21	5/15	52	5/04-5/20 (17)
		Knox Br.	Supp.	457	3/25/02	698	55	63.4 (51.7-75.1)	0.14	5/11	48	5/04-5/18 (15)
		Knox Br.	Natural	457	3/21-7/2	650	66	50.5 (40.6–60.5)	0.20	6/20	44	5/20–6/23 (34)
Sawtooth	Smolt	Sawtooth Weir	LSRCP	747	4/23/02	496	38	58.5 (45.4-71.7)	0.13	5/6	14	4/25-5/20 (26)
		Sawtooth Weir	Supp.	747	4/23/02	989	96	38.4 (33.8-43.1)	0.25	5/17	25	5/09-5/20 (12)
		Sawtooth Weir	Natural	747	3/14-6/30	695	104	59.0 (51.0–67.0)	0.25	5/21	34	5/05–6/01 (27)
Pahsimeroi	Smolt	Pahsimeroi R.	IPC	630	4/15/02	494	72	69.1 (57.7-80.4)	0.21	5/6	22	5/04-5/17 (14)
		Pahsimeroi R.	Supp.	630	4/15/02	498	67	68.3 (57.7-78-9)	0.20	5/10	26	5/03-5/20 (18)
Rapid River	Smolt	Rapid River	IPC	283	3/12/02	51,910	7,905	74.8 (73.3-76.2)	0.21	5/4	54	4/17-5/14 (27)
Dworshak	Smolt	Dworshak	LSRCP	116	3/27/02	54,726	6,448	82.1 (79.8-84.3)	0.14	5/4	38	4/14-5/16 (33)
Kooskia	Smolt	Clear Creek	Supp	176	4/4/02	1,504	187	80.0 (72.6-87.3)	0.16	5/7	34	4/17-5/22 (36)

* Natural = refers to natural-origin fish and is used as a comparison to hatchery-origin fish in areas adjacent hatchery programs; ISS= fish released as part of the Idaho Supplementation Study; LSRCP = fish released as part of the LSRCP mitigation program; IPC = fish released as part of the Idaho Power Co. mitigation program.

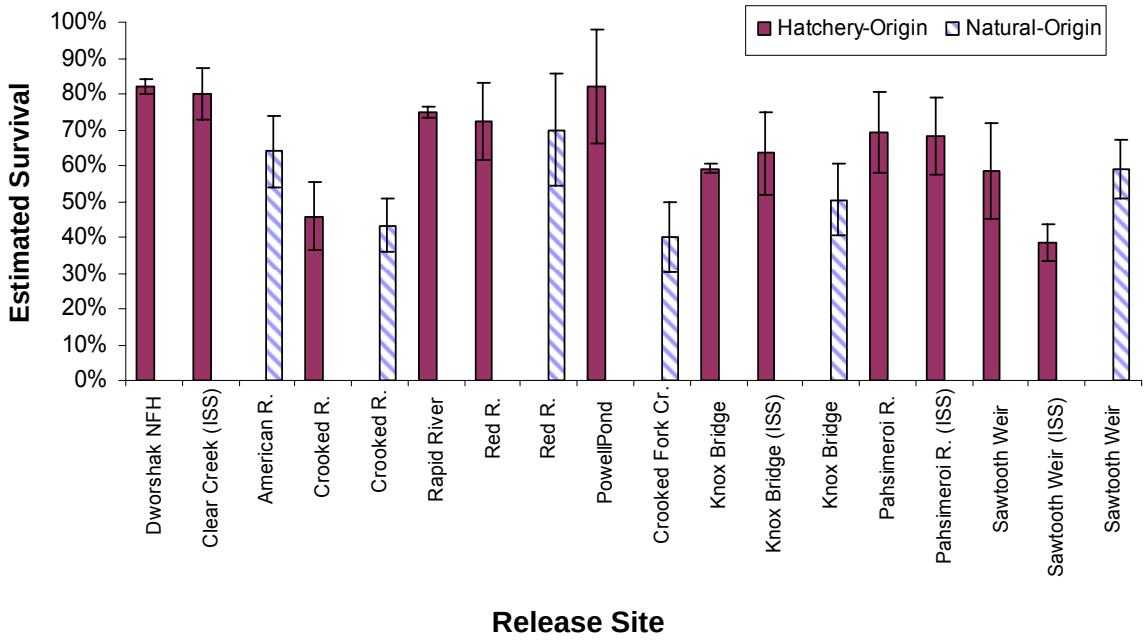


Figure 4. Estimated survival to Lower Granite Dam of hatchery- and natural-origin Chinook salmon tagged and released as yearling smolts, spring 2002. Release sites are ordered in increasing distance from Lower Granite Dam (see Table 4). Error bars represent 95% confidence intervals.

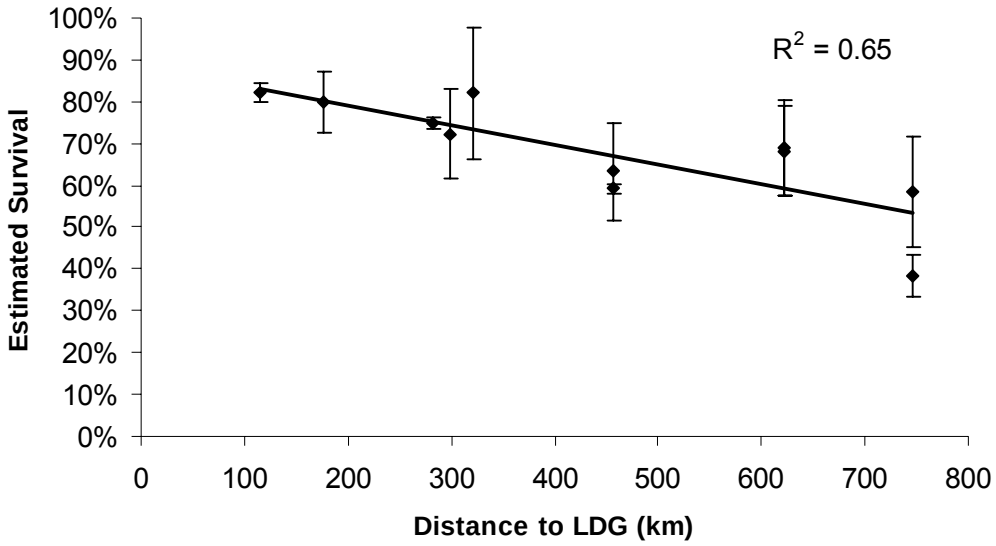


Figure 5. Relationship between estimated survival and distance from release site to Lower Granite Dam (LGD) for hatchery-origin Chinook salmon PIT tagged and released as yearling smolts, 2002. Error bars represent 95% confidence intervals.

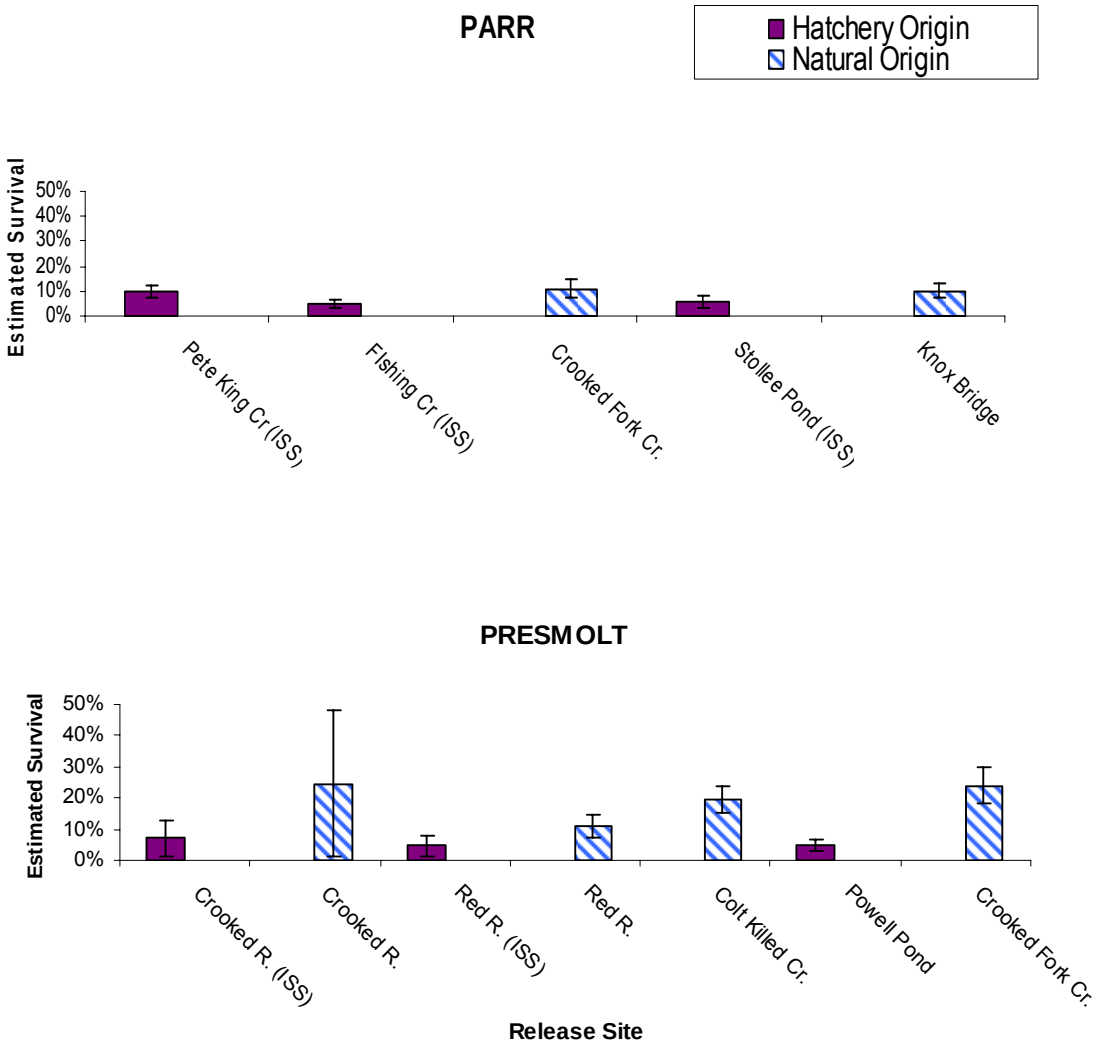


Figure 6. Estimated survival to Lower Granite Dam of hatchery- and natural-origin Chinook salmon tagged and released as subyearling parr (top panel) and presmolts (bottom panel) during the summer/fall 2001. Release sites are ordered in increasing distance from Lower Granite Dam (see Table 4). Error bars represent 95% confidence intervals.

Naturally Produced Chinook Salmon

Naturally produced Chinook salmon were PIT tagged throughout the Salmon and Clearwater river subbasins as both subyearling parr and presmolts and yearling smolts (Table 4; Figure 4 and 6).

Arrival timing to LGD of natural-origin juveniles that were tagged as yearling smolts was generally later and more protracted than the hatchery-origin smolts. The date at which 50% of the natural-origin juveniles arrived at LGD was three to four weeks later than the hatchery-origin fish with the exception of the natural-origin smolts captured near the Sawtooth Fish Hatchery

Weir (Table 4). The 80% arrival window for natural-origin smolts ranged from 27 to 57 days and averaged 39 days compared to a range of 14 to 36 days and an average of 22 days for hatchery-origin smolts. Averaged over all release sites, the estimated survival rate for natural-origin yearling smolts was 54% (range 40-69%) compared to 66% (range 45-82%) for the hatchery-origin smolts. However, when comparing survival of natural- and hatchery-origin juveniles released from locations of close proximity, the survival rates were more similar between the two groups (Table 4; Figure 4).

Median arrival date to LGD of natural-origin juveniles tagged as subyearling parr and presmolts was similar to the hatchery-origin subyearlings, however, the natural-origin groups arrived at LGD over a longer time period (Table 4). The 80% arrival window for natural-origin juveniles tagged as subyearling parr and presmolts averaged 61 days (range: 34-89 days) compared to an average of 45 days for the hatchery-origin parr and presmolts (range: 27-64 days). Averaged over all release sites, the estimated survival rate for natural-origin juveniles tagged as subyearling parr or presmolts was 16.8% (range: 10.1-24.6%) compared to 6.1% for the hatchery-origin parr and presmolts (range: 4.6-9.7%).

Juvenile Out-Migration Conditions

During the period April 1–May 20, 2002 when the majority of juvenile Chinook salmon were actively migrating, daily flows in the lower Salmon River (measured at Whitebird, Idaho) averaged 14.8 kcfs and ranged from 6-37 kcfs (Figure 7). Daily flows in the lower Salmon River were below the most recent ten-year average of 18.3 kcfs (range 7.7-40.2). However, during the middle of April 2002, a time when hatchery fish are known to be actively migrating from Idaho, flows in the lower Salmon River doubled from 12 to 25 kcfs (Figure 7).

During the same period (4/1-5/20), daily flows on the lower Clearwater River (measured at Peck, Idaho) averaged 31.5 kcfs and ranged from 22.6-58.1 kcfs (Figure 7). Daily flows in the lower Clearwater River were above the most recent ten-year average of 28.3 kcfs (range: 14.1-42.2). Similar to the Salmon River, the lower Clearwater River flows doubled for a short period during the middle of April 2002.

Average daily flow in the Snake River, measured at LGD, from April 1-May 20 was 71.7 kcfs and ranged from 53.0 to 121.4 kcfs (Figure 8). Daily flow at LGD was below the most recent ten-year average of 86.4 kcfs (range: 58-122) (Figure 8). However, during most of April, flows in 2002 were above the 1992-2001 average. Spill at LGD occurred throughout the entire 2002 migratory period averaging 24.6 kcfs and ranged from 13.0 to 56.8 kcfs (Figure 8). Average daily spill at LGD in 2002 was above the most recent ten-year average of 18.5 kcfs (range 1.9–40.1). The continuous spill was reflected in the relatively low detection probabilities for the PIT tagged fish at LGD (Table 4). Lower detection probabilities at LGD had the effect of reducing precision of the juvenile survival estimates (wider confidence intervals). In addition to spilling throughout the entire migratory period, testing of the new Removable Spillway Weir (RSW) was being conducted in 2002, which also may have contributed to the reduced collection efficiency.

Dam Operations

In 2002, essentially all spring/summer yearling Chinook salmon collected at Snake River dams (Lower Granite, Little Goose, and Lower Monumental) were transported and released back into the river below Bonneville Dam (Table 5). At McNary Dam, 99.95% of yearling Chinook collected were bypassed back to the river.

Table 5. Number of yearling Chinook collected and transported at Lower Granite Dam, Little Goose Dam, Lower Monumental Dam and McNary Dam in 2002. Data from FPC (http://www.fpc.org).

Project	# Collected	# Transported	% Transported
Lower Granite Dam	1,537,299	1,495,285	97.27%
Little Goose Dam	1,907,346	1,905,706	99.91%
Lower Monumental Dam	2,214,728	2,142,235	96.73%
McNary Dam	1,698,877	912	0.05%
Total	**7,358,250**	**5,544,138**	**75.35%**

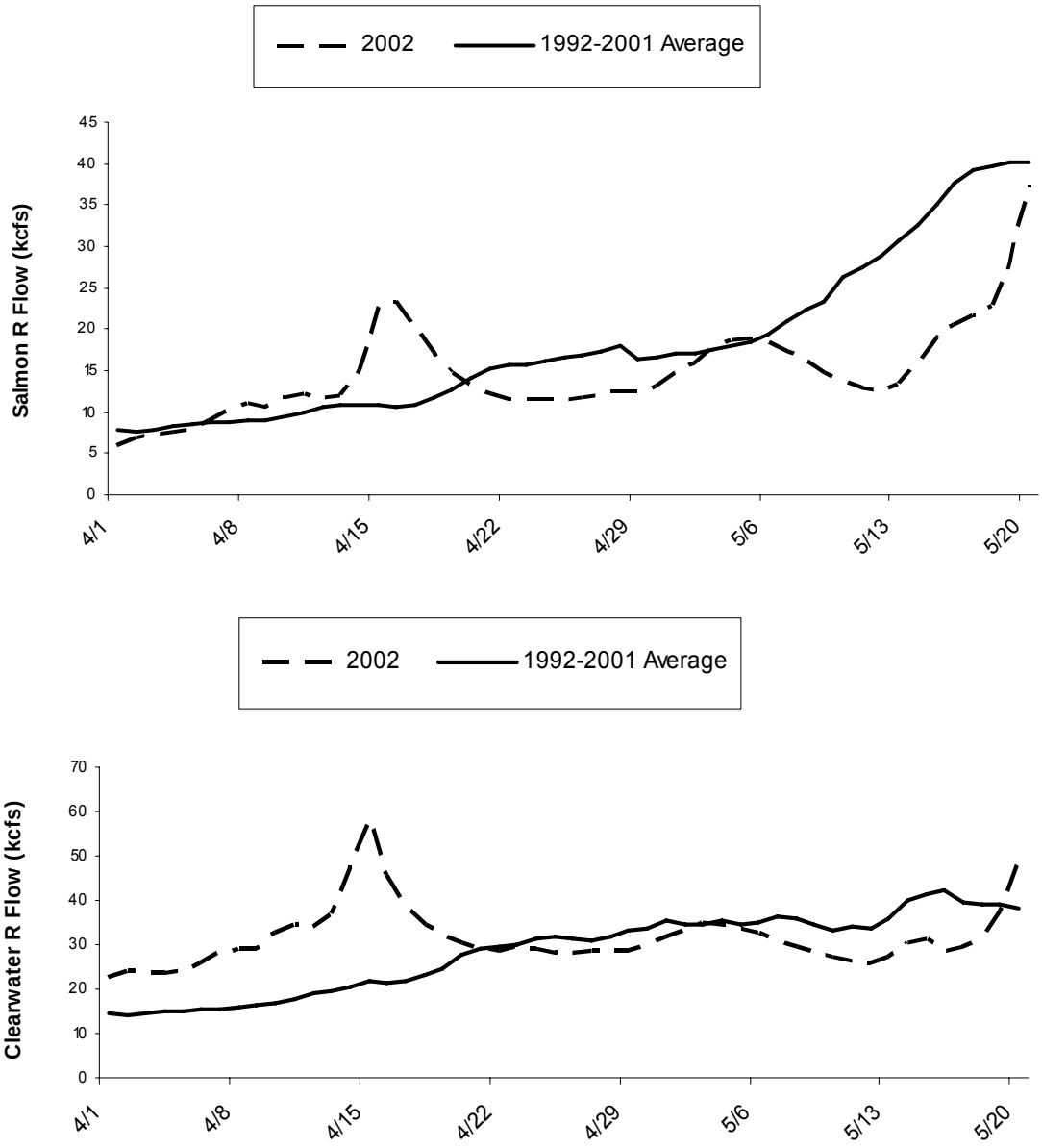


Figure 7. Average daily flow (kcfs) on the lower Salmon River at Whitebird (top panel) and on the lower Clearwater River at Peck (bottom panel) in 2002 and ten-year average daily flows for the period 1992-2001(data from FPC (http://www.fpc.org).

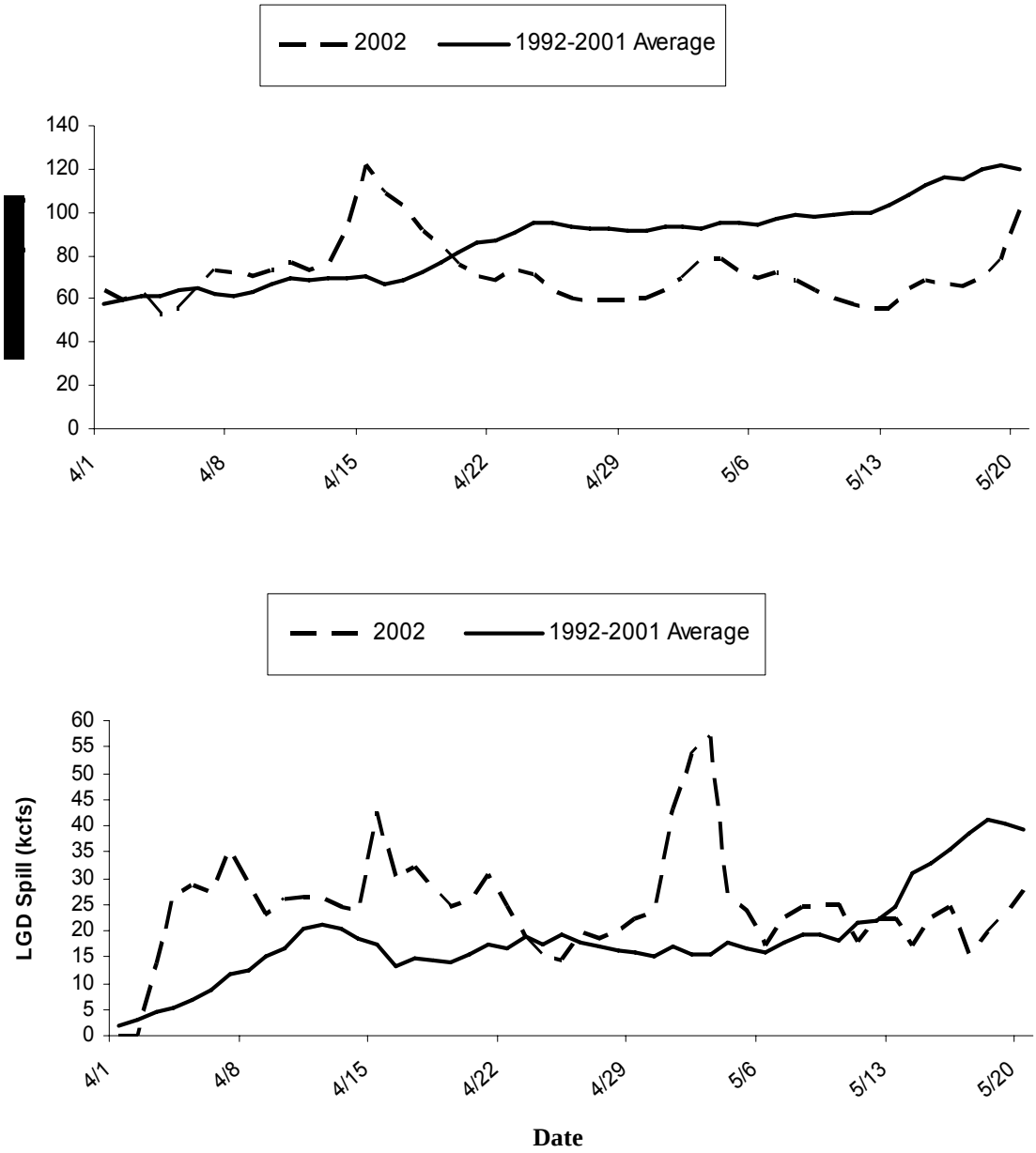


Figure 8. Average daily flow (top panel) and spill (bottom panel) at Lower Granite Dam in 2002 and ten-year average daily flow and spill for the period 1992-2001 (data from FPC (http://www.fpc.org).

2002 Adult Returns to LGD

During the 2002 spawning migration, 101,226 combined hatchery- and natural-origin Chinook salmon crossed LGD between March 20 and August 17 of which 97,184 were adults and 4,042 were jacks. The 2002 return was 53% of the return in 2001 but 2.6 times greater than the most recent 10-year average (Table 6).

Table 6. Hatchery- and natural-origin spring and summer Chinook salmon from wild-, natural-, or hatchery-origin counted at Lower Granite Dam. Spring Chinook salmon are defined as crossing LGD March 1 to June 17 and summer Chinook salmon as crossing June 18 to August 17. Data obtained from Fish Passage Center (http://www.fpc.org).

	Lower Granite Dam Count						
Return Year	Spring Adult	Spring Jack	Spring Total	Summer Adult	Summer Jack	Summer Total	Spring and Summer Combined
2002	75,025	2,089	**77,114**	22,159	1,953	**24,112**	**101,226**
2001	171,958	3,135	**175,093**	13,735	3,804	**17,539**	**192,632**
2000	33,822	10,318	**44,140**	3,939	3,756	**7,695**	**51,835**
1999	3,296	2,507	**5,803**	3,260	1,584	**4,844**	**10,647**
1998	9,854	109	**9,963**	4,355	328	**4,683**	**14,646**
1997	33,855	81	**33,936**	10,709	127	**10,836**	**44,772**
1996	4,207	1,639	**5,846**	2,607	944	**3,551**	**9,397**
1995	1,105	373	**1,478**	692	157	**849**	**2,327**
1994	3,120	43	**3,163**	795	73	**868**	**4,031**
1993	21,035	183	**21,218**	7,889	130	**8,019**	**29,237**
1992	21,391	533	**21,924**	3,014	298	**3,312**	**25,236**
1991	6,623	980	**7,603**	3,809	1,179	**4,988**	**12,591**
1990	17,315	244	**17,559**	5,093	128	**5,221**	**22,780**
1989	12,955	1,549	**14,504**	3,169	902	**4,071**	**18,575**
1988	29,495	924	**30,419**	6,145	362	**6,507**	**36,926**
1987	28,835	946	**29,781**	5,891	660	**6,551**	**36,332**
1986	31,576	1,307	**32,883**	6,154	1,255	**7,409**	**40,292**
1985	25,207	2,530	**27,737**	4,938	1,568	**6,506**	**34,243**
1984	6,511	1,410	**7,921**	5,429	1,815	**7,244**	**15,165**
1983	9,517	509	**10,026**	3,895	767	**4,662**	**14,688**
1982	12,367	379	**12,746**	4,210	318	**4,528**	**17,274**
1981	13,115	527	**13,642**	3,326	479	**3,805**	**17,447**
1980	5,461	1,298	**6,759**	2,688	759	**3,447**	**10,206**
1979	6,753	786	**7,539**	2,714	858	**3,572**	**11,111**
1992-2001	**Ten Year**	**Average**					**38,476**

The estimated number of wild and natural fish crossing LGD in 2002 from TAC was 29,872. Based on this TAC estimate, total adult hatchery escapement above LGD was 67,312, which is above the LSRCP escapement goal of 58,677 spring/summer Chinook. However, it should be noted that not all hatchery fish crossing LGD originate from LSRCP funded hatcheries and include fish destined to return to IPC funded hatcheries.

2002 Adult Returns and Harvest Information by Hatchery Facility

McCall Fish Hatchery

Adult Returns—Trapping of adult Chinook salmon at the South Fork Salmon River (SFSR) trap began on June 26 and continued until September 13 when the weir was removed. The first Chinook salmon was captured on June 28 and the last was captured on September 5. During the 2002 trapping period, 8,603 Chinook salmon were captured including 7,322 (3,995

males and 3,327 females) hatchery- and 1,281 (762 males and 519 females) natural-origin fish (McPherson et al. 2004). The 2002 adult return was below the 2001 total return of 10,922, but 2.7 times higher than the previous ten-year average (IDFG unpublished data).

During the 2002 adult migration, 44 CWTs were recovered from McCall Fish Hatchery Chinook salmon from fisheries in the ocean, Columbia River, Snake River below LGD, and strays in Columbia and Snake River tributaries. Expansions based on sample and tagging rates resulted in an estimate of 537 McCall Fish Hatchery fish recovered in 2002 (Table 7). Estimated harvest from the terminal fishery that occurred on the SFSR from June 19 to July 18 included 6,843 from the sport fishery and 423 from the tribal fishery. During spawning ground surveys above the SFSR weir, IDFG research staff collected 97 adipose-clipped Chinook salmon that had escaped above the weir. It is suspected that some hatchery-origin fish spawned below the SFSR weir but data is not available to make that estimate. Total estimated harvest and escapement of McCall hatchery-origin Chinook salmon for 2002 was 15,222 (Table 7), which is nearly twice the LSRCP return goal of 8,000

Table 7. Estimated harvest and escapement of hatchery-origin Chinook salmon in 2002. Recoveries are from fish released from McCall Fish Hatchery into the South Fork Salmon River (SFSR) at Knox Bridge and include fish from brood year 1997, 1998, and 1999.

Release Group/Site	Location and Recovery Type	Number CWTs Recovered	Expanded Estimate
	Ocean	9	55
SFSR-Knox Bridge	Columbia River		
	Non-Treaty Sport	18	294
	Non-Treaty Commercial	3	22
	Treaty Net	8	133
	Treaty C&S	0	0
	Strays	5	22
	Snake River		
	Non-Treaty Sport	1	11
	Idaho		
	Sport Harvest		6,843
	Tribal Harvest		423
	Strays*		97
	SFSR weir		7,322
Total		**44**	**15,222**

* Idaho strays include hatchery-origin fish that were recovered above the SFSR weir during spawning ground surveys. Data from Venditti et al. 2005.

Run Timing—Arrival timing of adults to the SFSR trap in 2002 resembles a bimodal distribution. The majority of adults retuned in the first mode from late June to late July (Figure 9). The second mode occurred during August and early September. The median arrival date for males occurred on 7/15 and 7/11 for hatchery- and natural-origin fish, respectively. Median arrival date for females occurred on 7/8 and 7/6 for hatchery- and natural-origin females, respectively. Based on the run timing data, it appears that a portion of the 2002 return escaped above the trapping facility before the weir was put into operation (Figure 9).

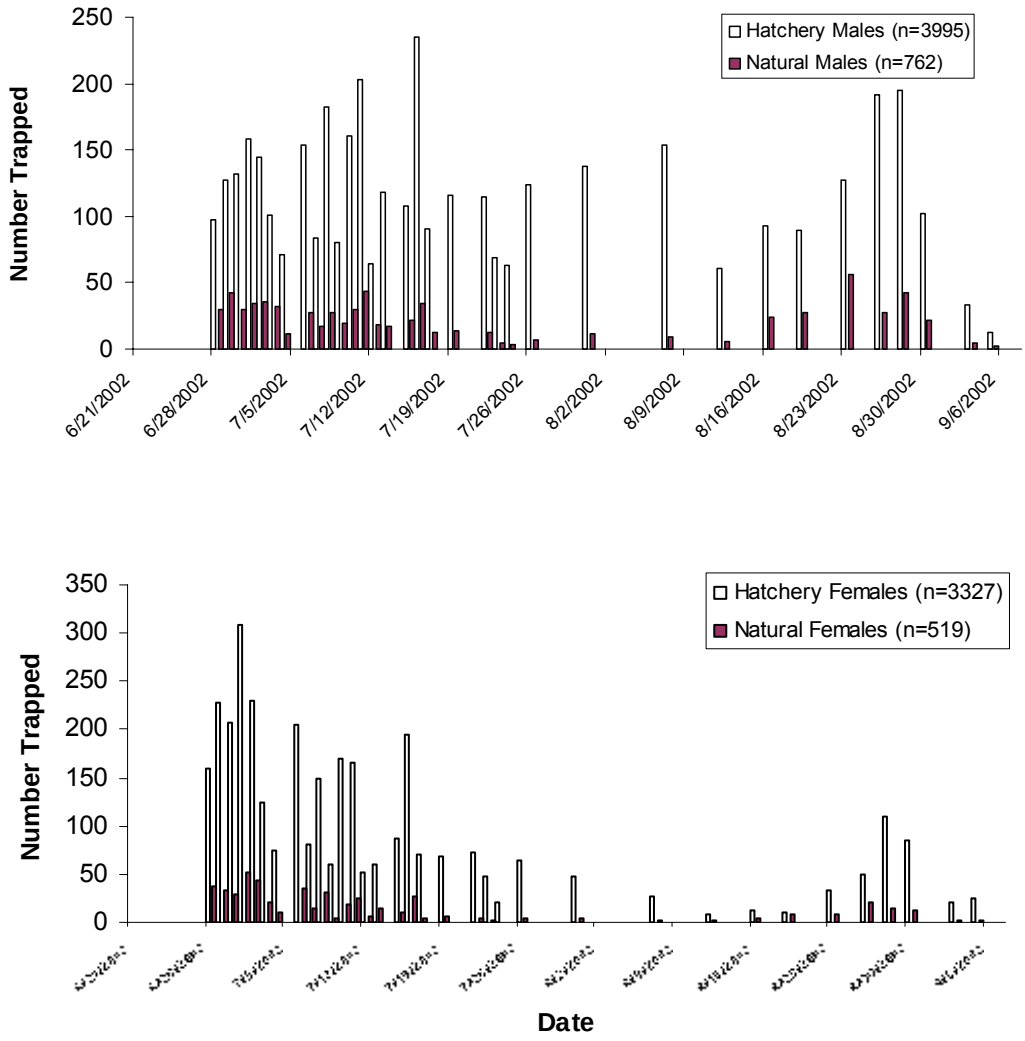


Figure 9. Run timing of hatchery- and natural-origin Chinook salmon at the South Fork Salmon River Trap in 2002.

Age Structure—Age classification of returning hatchery-origin adults was estimated using the computer program Rmix. Coded-wire tags were recovered from 485 (109 age-3, 304 age-4, and 72 age-5) of the 7,322 hatchery-origin fish that returned to the SFSR trap in 2002. Results from the Rmix analysis indicated that the male return was composed of 28% age-3, 67.6% age-4, and 4.4% age-5 returns. The female return was composed of 69.1% age-4 and 30.9% age-5 fish (Table 8). One age-3 female with a CWT was recovered in 2002 but was not included in the Rmix analysis. Average length-at-age for males and females is displayed in Table 8.

Table 8. Estimated age structure of hatchery-origin Chinook salmon that returned to South Fork Salmon River Trap in 2002. Average length-at-age is based on fish recovered with CWTs. Fish lengths are in centimeters. SD = standard deviation. The "Number Represented" and associated confidence interval is based on the Rmix analysis.

Gender	Age	CWTs Recovered	Average Length (SD)	Number Represented (95% CI)	Percent of Return
Male	3	109	53.4 (4.2)	1119 (+/-62)	28.0%
	4	138	79.5 (6.0)	2702(+/-78)	67.6%
	5	6	94.7 (7.8)	174(+/-52)	4.4%
Male Total		***253***		***3995***	***100%***
Female	4	166	78.2 (4.0)	2298(+/-74)	69.1%
	5	66	88.3 (4.6)	1029(+/-74)	30.9%
Female Total		***232***		***3327***	***100%***
Total		**485**		**7322**	

Age classification of natural-origin adults for the 2002 adult return is based on a visual examination of the length frequency data. Length criteria used to distinguish age classes for males and females is shown in Figure 10 and Table 9 below. Based on these length criteria, the male return was composed of 5% one-ocean, 78.5% two-ocean, and 16.5% three-ocean fish. The female return was composed of 53.9% two-ocean and 46.1% three-ocean.

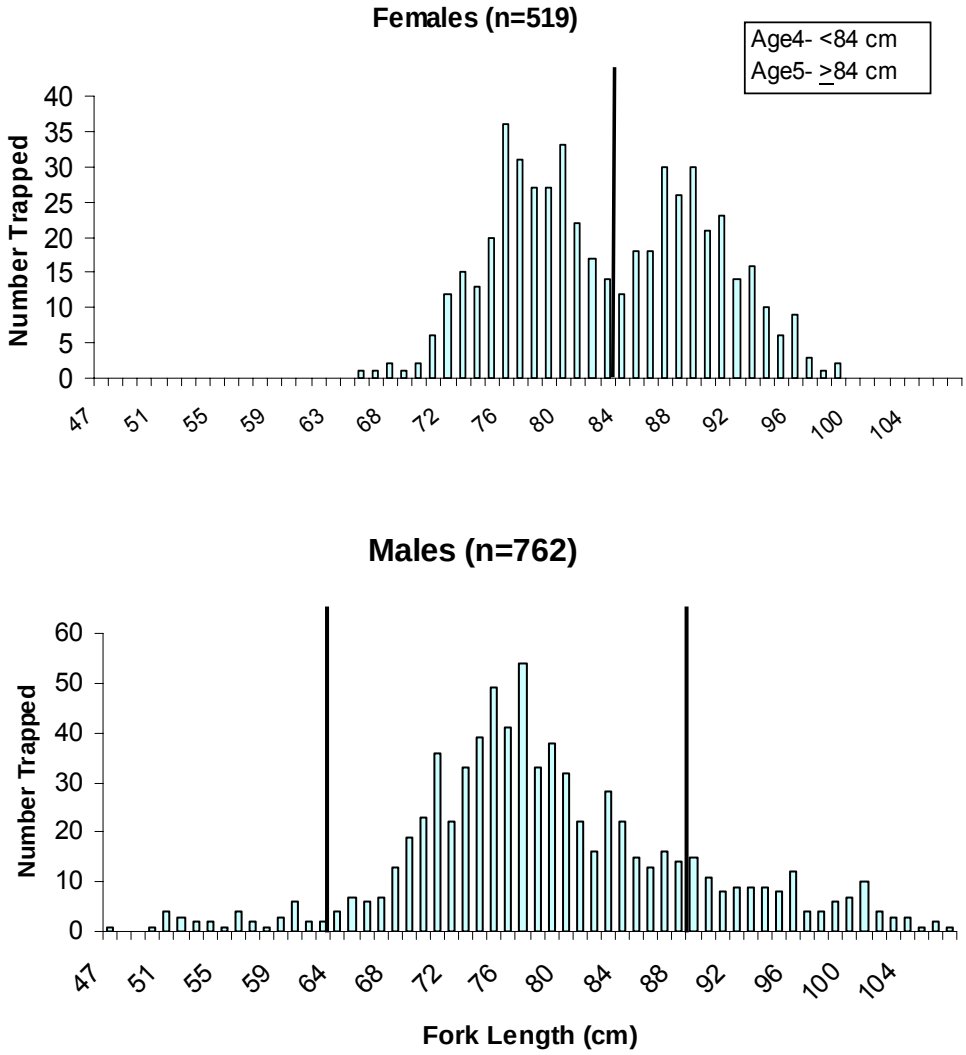


Figure 10. Length frequency and estimated age class of natural-origin Chinook salmon trapped at the South Fork Salmon River Trap in 2002. Dark vertical bars represent length cutoffs used for age determination.

Table 9. Estimated age composition of natural-origin Chinook salmon that returned to the South Fork Salmon River Trap in 2002.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<65	38	5.0%
	4	65-88	598	78.5%
	5	>88	126	16.5%
Male Total			***762***	
Female	4	<84	280	53.9%
	5	≥84	239	46.1%
Female Total			***519***	
Total			**1281**	

Sex composition—The sex composition of returning hatchery–origin adults (expressed as a percent of the 2002 return) was 54.6% males and 45.4% females including one-ocean jacks and 47.1% males and 52.9% females excluding one-ocean jacks (Table 8). The sex composition of natural-origin adults was 59.5% males and 40.5% females including one-ocean jacks and 58.2% males and 41.8% females excluding one-ocean jacks (Table 9).

1997 Brood Year Reconstruction and SAR—In 2002, the last of the progeny from the 1997 broodstock returned to the SFSR weir. In 1997, 374 females were spawned to create the release of 49,872 parr in August 1998 and 1,182,611 smolts in April 1999 above the SRSR weir (Table 10). From the 1,232,483 parr and smolts released above the SFSR weir, 12,308 adults returned to the weir in 2000, 2001, and 2002 (Table 11). Additionally, an estimated 1,395 fish were harvested in the Columbia and Snake rivers, 7,501 were harvested in the SFSR fishery, and 36 were recovered as strays resulting in 21,240 fish and an overall SAR of 1.7%.

Female Progeny:Female Parent Ratio—From the 374 females that were spawned in 1997, 4,536 females returned to the SFSR weir in 2001 and 2002 resulting in a female progeny:female parent ratio of 12.1 (Table 11). In addition to the 4,536 females recovered at the weir, an estimated 4,280 brood year 1997 females were harvested or recovered as strays in 2001 and 2002 resulting in a total recovery of 8,816 females and a female progeny:female parent ratio of 23.6 indicating the SFSR Fish Hatchery program was well above replacement for brood year 1997 (Table 11).

Table 10. Number of females spawned and survival of resultant progeny from egg to release at the McCall Fish Hatchery for brood year 1997 fish released above the South Fork Salmon River weir.

# of Females Spawned	Average Fecundity	# of Green Eggs	# of eyed Eggs	# of Smolts released	Green Egg to Release Survival
374	4497	1,678,162	1,446,576	1,232,483[a]	73.4%

[a] Includes 49,872 parr released into Stolle pond in August of 1998

Table 11. Estimated escapement and harvest of brood year 1997 hatchery-origin Chinook salmon adults from McCall Fish Hatchery in 2000, 2001, and 2002. Numbers in parentheses represent the percentage of the total for each recovery type. Estimated harvest and strays are reported for the area downstream of Lower Granite Dam (Blw LGD) and upstream of Lower Granite Dam (Abv LGD) separately.

Recovery Type	Age-3 Recoveries in 2000	Age-4 Recoveries in 2001	Age-5 Recoveries in 2002	Total Brood Year Recoveries
Hatchery Weir	3,004(25.2%)	8,101(66.1%)	1,203(8.7%)	12,308
Harvest (Blw LGD)	14(1%)	1,177(84.4%)	204(14.6%)	1,395
Strays (Blw LGD)	18	0	0	18
Harvest (Abv LGD)[a]	347(4.6%)	5,991(79.9%)	1,163(15.5%)	7,501
Strays (Abv LGD)	0	18	0	18
Total Recoveries	3,383(15.9%)	15,287(72%)	2,570(12.1%)	21,240
Estimated # of Females[b]	0(0%)	6,619(75.1%)	2,197(24.9.5%)	8,816
# of Females at Weir	0(0%)	3,507(77.3%)	1,029(22.7%)	4,536

[a] Harvest above Lower Granite Dam does not include NPT terminal harvest because data was not available to estimate harvest by age class for 2000, 2001, and 2002 fisheries.

[b] The fraction of total recoveries estimated to be female is based on the sex ratio of age-4 and age-5 fish observed at the SFSR weir in 2001 and 2002 respectively. In 2001, 43.3% of the age-4 hatchery-origin fish were female. In 2002, 85.5% of the age-5 hatchery-origin fish were female.

Sawtooth Fish Hatchery

Adult Returns—Trapping of adult Chinook salmon at the Sawtooth Fish Hatchery began on May 28 and continued until September 9 when the weir panels were removed. The first Chinook salmon was captured on June 15 and the last was captured on September 9. During the 2002 trapping period, 1,786 Chinook salmon were captured including 923 (368 males, 555 females) hatchery- and 863 (516 males, 347 females) natural-origin fish (Snider et al. 2004). The 2002 adult return was below the 2001 total return of 2,103 Chinook, but 3.6 times higher than the previous ten-year average (IDFG unpublished data).

Harvest of Sawtooth Fish Hatchery fish in 2002 from ocean and Columbia River fisheries was estimated at 56 and one additional stray fish was recovered in the Deschutes River (Table 12). No fisheries targeting Sawtooth stock fish occurred in Idaho in 2002 and no incidental take of Sawtooth Fish Hatchery fish in the Lower Salmon River fishery was observed. In total, an estimated 980 hatchery-origin fish contributed to the weir return and to fisheries in 2002 (Table 12).

Table 12. Estimated harvest and escapement of hatchery-origin Chinook salmon in 2002. Recoveries are from fish released from Sawtooth Fish Hatchery.

Release Group/Site	Location and Recovery Type	Number CWTs Recovered	Expanded Estimate
	Ocean	0	0
Sawtooth Weir	Columbia River		
	Non-Treaty Sport	1	6
	Non-Treaty Commercial	0	0
	Treaty Net	15	50
	Treaty C&S	0	0
	Strays	1	1
	Idaho		
	Harvest	0	0
	Strays	0	0
	Sawtooth Hatchery Weir	—	923
Total		**17**	**980**

Run Timing—Arrival timing of adults to the Sawtooth Fish Hatchery facility in 2002 resembles a bimodal distribution and is typical of previous years. The majority of adults retuned in the first mode from mid-June to late July (Figure 11). The second mode occurred between mid-August and early September and consisted primarily of males, the majority of which were natural-origin (Figure 11). Median arrival date for males occurred on July 9 for both hatchery- and natural-origin adults. Median arrival date for females occurred on July 5 and July 6 for hatchery- and natural-origin females, respectively.

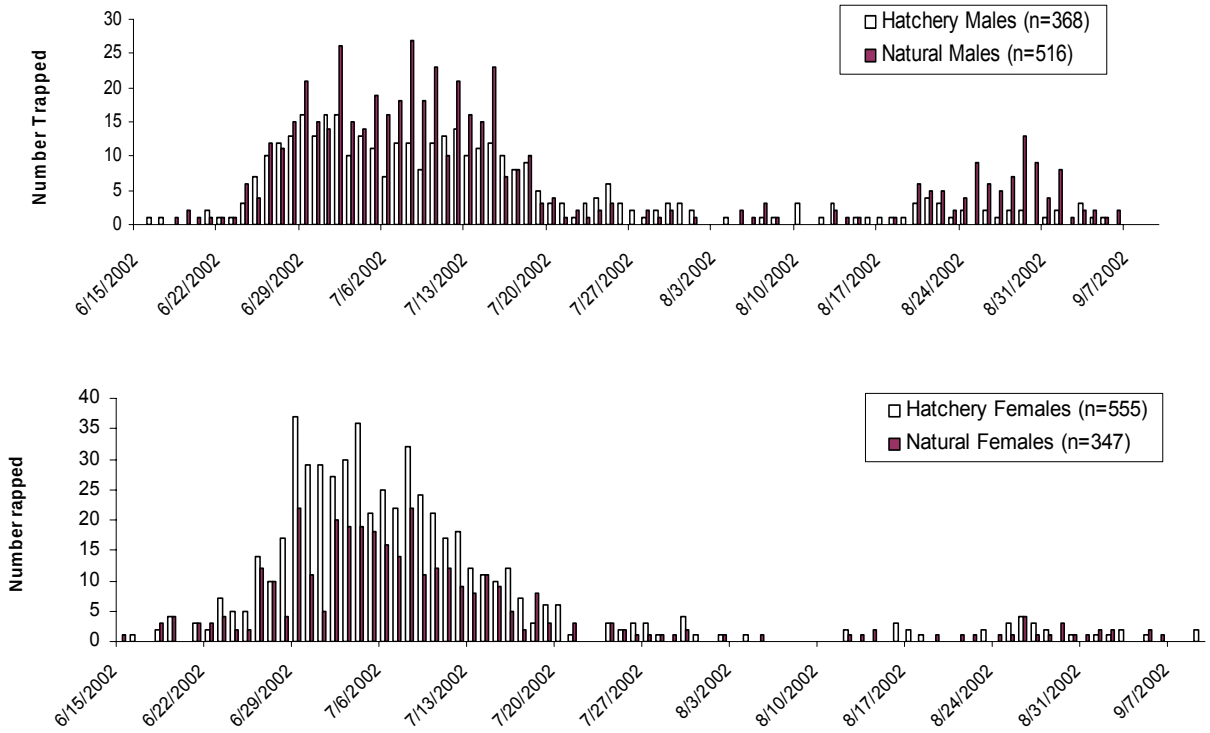


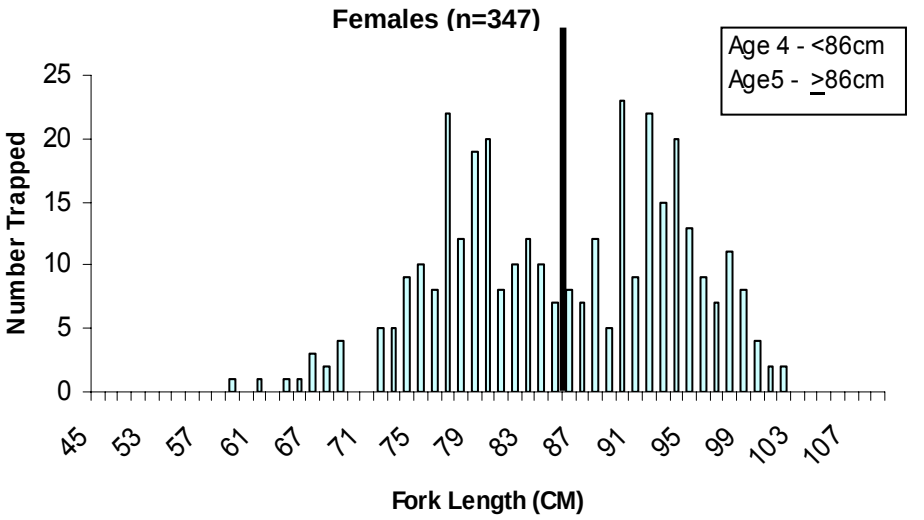
Figure 11. Run timing of hatchery- and natural-origin Chinook salmon at Sawtooth Fish Hatchery in 2002.

Age Structure—Age classification of returning hatchery-origin adults was estimated using the computer program Rmix. Coded wire tags were recovered from 363 (7 Age-3, 210 Age-4, and 146 Age-5) of the 923 hatchery-origin fish that returned to the Sawtooth Fish Hatchery in 2002. Results from the Rmix analysis indicated that the male return was composed of 16% Age-3, 73% Age-4, and 11% Age-5 returns. The female return was composed of 63% Age-4 and 37% Age-5 fish (Table 13). No Age-3 females with CWTs were recovered in 2002. Average length at age for males and females is displayed in Table 13.

Table 13. Estimated age structure of hatchery-origin Chinook salmon that returned to Sawtooth Fish Hatchery in 2002. Average length-at-age is based on fish recovered with CWTs. Fish lengths are in centimeters. SD= standard deviation. The "Number Represented" and associated confidence intervals are based on the Rmix analysis.

Gender	Age	CWTs Recovered	Average Length (SD)	Number Represented (95% CI)	Percent of Return
Male	3	7	52.7 (6.3)	59 (+/-14)	16%
	4	97	78.4 (6.5)	268 (+/-21)	73%
	5	20	94.4 (7.5)	41 (+/-17)	11%
Male total		*123*		*368*	
Female	4	113	77.4 (4.7)	346 (+/-27)	63%
	5	126	90.1 (4.6)	209 (+/-27)	37%
Female Total		*239*		*555*	
Total		**363**		**923**	

Age classification of natural-origin adults for the 2002 adult return is based on a visual examination of the length frequency data. Length criteria used to distinguish age classes for males and females is shown in Figure 12 and Table 14 below. Based on these length criteria, the male return was composed of 4% one-ocean, 69% two-ocean, and 27% three-ocean fish. The female return was composed of 49% two-ocean and 51% three-ocean.



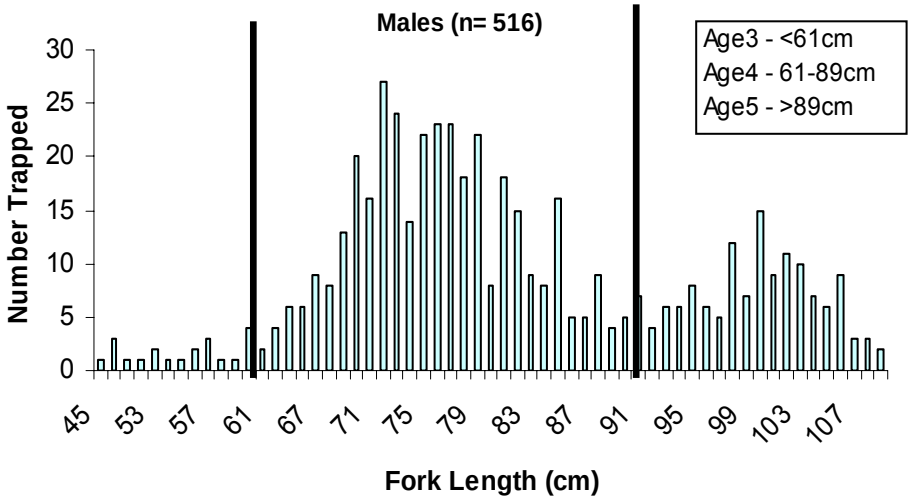


Figure 12. Length frequency and age class estimation of natural-origin Chinook salmon trapped at the Sawtooth Fish Hatchery weir in 2002. Dark vertical bars represent length cutoffs used for age determination

Table 14. Estimated age composition of natural-origin Chinook salmon trapped at the Sawtooth Fish Hatchery weir in 2002. Lengths are in centimeters and measured as fork length.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<61	21	4%
	4	61-89	354	69%
	5	>89	141	27%
Male Total			*516*	
Female	4	<86	170	49%
	5	≥86	177	51%
Female Total			*347*	
Total			**863**	

Sex Composition—Sex ratio of returning hatchery–origin adults (expressed as a percent of the 2002 return) was 40.0% males and 60.0% females including one-ocean jacks and 35.8% males and 64.2% females excluding one ocean jacks. The sex composition of natural-origin adults was 59.8% males and 40.2% females including one-ocean jacks and 58.8% males and 41.2% females excluding one ocean jacks

1997 Brood Year Reconstruction and SAR—In 2002, the last of the progeny from the 1997 broodstock returned to the Sawtooth Fish Hatchery. In 1997, 53 females were spawned resulting in the release of 223,240 smolts in April of 1999 (Table 15). From this smolt release, 1,904 adults were produced that either returned to the hatchery weir or contributed to harvest resulting in an overall SAR of 0.85% (Table 15 and Table 16).

Female-Progeny:Female-Parent Ratio—From the 53 females that were spawned in 1997, a total of 787 females returned to the Sawtooth Fish Hatchery weir in 2001 and 2002 resulting in a female-progeny:female-parent ratio of 14.8 (Table 16). In addition to the 787 females recovered at the weir, an estimated 66 brood year 1997 females were harvested in 2001 and 2002 resulting in a total female-progeny:female-parent ratio of 16.1 indicating the Sawtooth Fish Hatchery program was well above replacement for brood year 1997.

Table 15. Number of females spawned and survival of resultant progeny from egg to release at the Sawtooth Fish Hatchery for brood year 1997.

# of Females Spawned	Average Fecundity	# of Green Eggs	# of eyed Eggs	# of Smolts released	Green Egg to Release Survival
53	4,915	260,480	231,827	223,240	85.7%

Table 16. Estimated escapement and harvest of brood year 1997 hatchery-origin Chinook salmon adults from Sawtooth Fish Hatchery in 2000, 2001, and 2002. Numbers in parentheses represent the percentage of the total for the recovery type. Estimated harvest and strays are reported for the area downstream of Lower Granite Dam (Blw LGD) and upstream of Lower Granite Dam (Abv LGD) separately.

Recovery Type	Age-3 Recoveries in 2000	Age-4 Recoveries in 2001	Age-5 Recoveries in 2002	Total Brood Year Recoveries
Hatchery Weir	280 (15.7%)	1250 (70.2%)	250 (14.1%)	1780
Harvest (Blw LGD)	0 (0%)	100 (80.7%)	24 (19.3%)	124
Strays (Blw LGD)	0	0	0	0
Harvest (Abv LGD)	0	0	0	0
Strays (Abv LGD)	0	0	0	0
Total Recoveries	**280 (14.7%)**	**1350 (70.9%)**	**274(14.4%)**	**1,904**
Estimated # of Females[a]	0(0%)	624(73.1%)	229 (26.8%)	853
# of Females at Weir	0(0%)	578(73.4%)	209 (26.6%)	787

[a] The fraction of total recoveries estimated to be female is based on the sex ratio of age-4 and age-5 fish observed at the hatchery weir in 2001 and 2002 respectively. In 2001, 46.2% of the age-4 hatchery-origin fish were female. In 2002, 83.6% of the age-5 hatchery-origin fish were female.

Clearwater Fish Hatchery

All three of the Clearwater Fish Hatchery satellite trapping facilities were operated in 2002 and adult returns to each facility are described below. Since 1997 the broodstocks for the Red and Crooked River satellites have been combined. However, in an effort to track survival from each release group, adult returns to each facility are reported separately in this report.

Powell Satellite Facility

Adult Returns—Trapping of adult Chinook salmon at the Powell Satellite facility began on May 30 and continued until August 26 when the weir was taken out of operation. The first Chinook salmon was captured on June 11 and the last was captured on September 26. During the 2002 trapping period, 1,296 Chinook salmon were captured at the Powell trap. Additionally, 98 Chinook salmon were captured at a temporary weir on Crooked Fork Creek. This trap is operated by IDFG staff associated with the ISS study to monitor the natural production in Crooked Fork Creek and to intercept hatchery-origin strays. Adipose clipped fish captured at this trap are considered strays from the Powell release site and are transferred to the Powell holding ponds. The combined total of both traps was 1,394 Chinook salmon of which 1,337 were hatchery-origin and the remaining 57 were natural-origin.

Harvest of Powell Chinook salmon from the Pacific Ocean and Columbia River fisheries is estimated at 1,129 and the number of strays is estimated at eleven (Table 17). A sport fishery on the mainstem and middle fork Clearwater River occurred from April 20 through August 4 and on the Lochsa River from May 25 through August 5 in 2002. An estimated 488 Chinook salmon from the Powell facility were harvested from this fishery (IDFG unpublished data). In total, an estimated 2,977 fish contributed to the weir return and to fisheries in 2002 (Table 17).

Table 17. Estimated harvest and escapement of hatchery-origin Chinook salmon in 2002. Recoveries are from fish released from the Powell satellite facility.

Release Group/Site	Location and Recovery Type	Number CWTs Recovered	Expanded Estimate
	Ocean	0	0
Powell Satellite	Columbia River		
	Non-Treaty Sport	81	446
	Non-Treaty Commercial	79	335
	Treaty Net	95	313
	Treaty C&S	34	35
	Strays	6	11
	Idaho		
	Harvest		488
	Strays		12
	Powell Satellite Weir		1,337
Total			**2,977**

Run Timing—Arrival timing of adults to the Powell trap in 2002 resembles a bimodal distribution. The majority of adults retuned in the first mode from mid-June to mid-July and the second mode occurred during August (Figure 13). The majority of natural-origin fish arrived during the latter part of June. Median arrival date for hatchery-origin males and females occurred on 7/1 and 6/30 respectively.

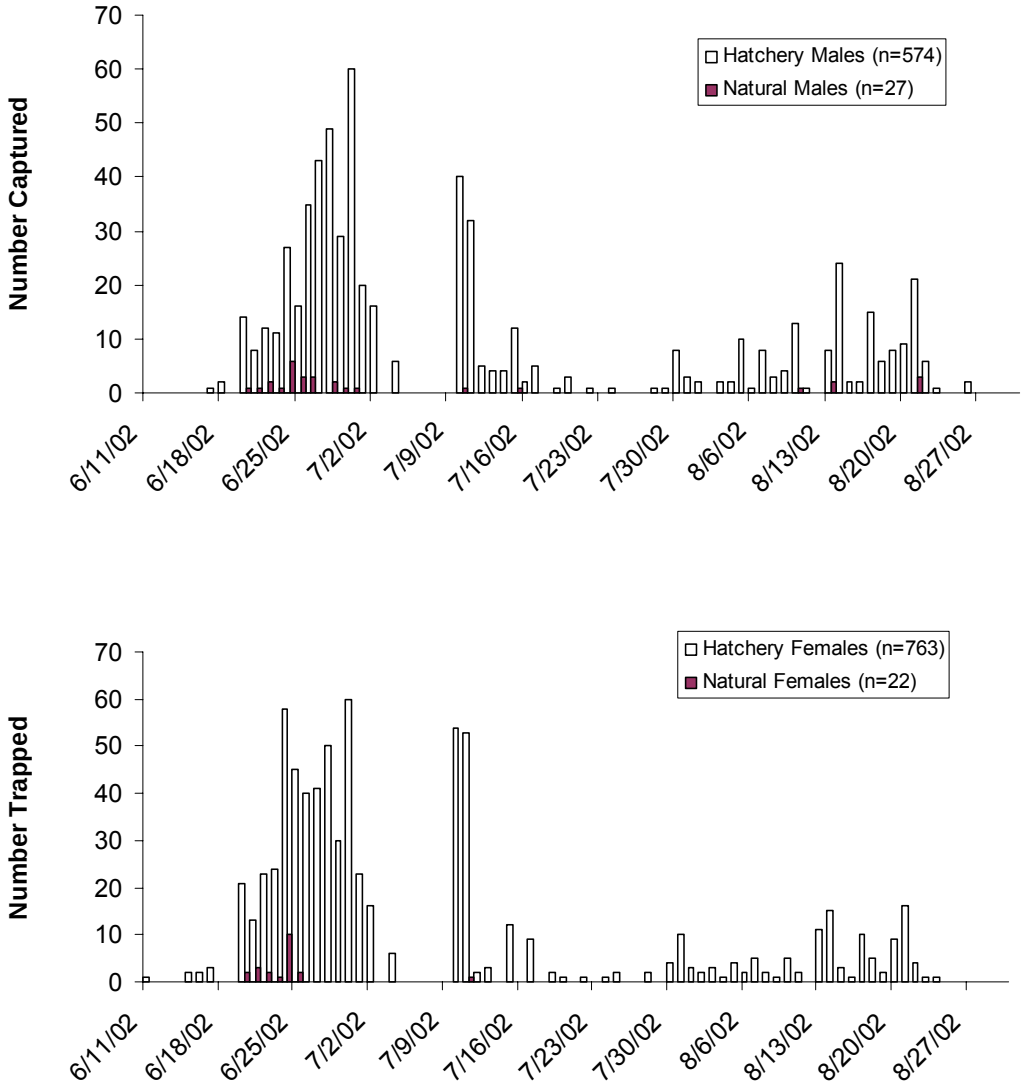


Figure 13. Run timing of hatchery- and natural-origin Chinook salmon at the Powell satellite facility in 2002. There were eight natural-origin fish for which gender was not determined.

Age Structure—Age classification of returning hatchery-origin adults was estimated using the computer program Rmix. Coded Wire tags were recovered from 763 (8 Age-3, 717 Age-4, and 38 Age-5) of the 1,337 hatchery-origin fish that returned to the Powell trap in 2002. Results from the Rmix analysis indicated that the male return was composed of 4.4% Age-3, 85.4% Age-4, and 25.2% Age-5 returns. The female return was composed of 93.1% Age-4 and 6.9% Age-5 fish (Table 18).

Table 18. Estimated age structure of hatchery-origin Chinook salmon that returned to Powell trap in 2002. Average length-at-age is based on fish recovered with CWTs. Fish lengths are in centimeters. SD = standard deviation. The "Number Represented" and associated confidence interval is based on the Rmix analysis.

Gender	Age	CWTs Recovered	Average Length (SD)	Number Represented (95% CI)	Percent of Return
Male	3	8	46.3(4.5)	25(+/-9)	4.4%
	4	247	78.0(4.5)	490(+/-27)	85.4%
	5	19	83.7(6.7)	59(+/-25)	25.2%
Male Total		*274*		*574*	*100.0%*
Female	4	470	75.3(3.4)	710(+/-20)	93.1%
	5	19	83.5(4.2)	53(+/-20)	6.9%
Female Total		*489*		*763*	*100.0%*
Total		**763**		**1337**	

Sex Composition—Sex composition of returning hatchery–origin adults expressed as a percent of the 2002 return was 42.9% males and 57.1% females including one-ocean jacks and 41.81% males and 58.2% females excluding one ocean jacks. The sex composition of natural-origin adults was 58% males and 42% females.

1997 Brood Year Reconstruction and SAR—In 2002, the last of the progeny from the 1997 broodstock returned to the Powell satellite facility. In 1998 and 1999, a total of 330,550 and 334,470 brood year 1997 presmolts and smolts, respectively, were released from the Powell facility. From these releases, 6,328 adults were produced that either returned to the hatchery weir or contributed to harvest resulting in an overall SAR of 0.95%. It should be noted that approximately half of the brood year 1997 release from Powell was a presmolt release and their survival compared to yearling smolt releases is very low. Of all brood year 1997 CWT recoveries, the presmolt release only accounted for 4.8% of the recoveries. The calculated SAR, not including the presmolt release, is 1.9%.

Female-Progeny:Female-Parent Ratio—From the 202 females that were spawned in 1997 (Table 19), 1,149 females returned to the Powell satellite facility in 2001 and 2002 resulting in a female-progeny to female-parent ratio of 5.7 (Table 20). In addition to the 1,149 females recovered at the weir, an estimated 1,809 brood year 1997 females were harvested in 2001 and 2002 resulting in a total of 2,958 females, and a female-progeny to female-parent ratio of 14.6 indicating the Powell stock was above replacement for brood year 1997.

Table 19. Number of females spawned and survival of resultant progeny from egg to release at the Powell satellite facility for brood year 1997.

# of Females Spawned	Average Fecundity	# of Green Eggs	# of eyed Eggs	# of Smolts released	Green Egg to Release Survival
202	4,272	863,657	788,519	665,036*	77.0%

*Includes 330,555 presmolts released in September of 1998

Table 20. Estimated escapement and harvest of brood year 1997 Chinook salmon from the Powell satellite facility in 2000, 2001, and 2002. Numbers in parentheses represent the percentage of the total for the recovery type. Estimated harvest and strays are reported for the area downstream of Lower Granite Dam (Blw LGD) and upstream of Lower Granite Dam (Abv LGD) separately.

Recovery Type	Age-3[a] Recoveries in 2000	Age-4[a] Recoveries in 2001	Age-5 Recoveries in 2002	Total Brood Year Recoveries
Hatchery Weir	300(11.4%)	2,210(84.3%)	112(4.3%)	2,622
Harvest (Blw LGD)	18(1.3%)	1,180(81.7%)	246(17%)	1,444
Strays (Blw LGD)	7	4	0	11
Harvest (Abv LGD)[b]	2	2,079	76	2,157
Strays (Abv LGD)	18	69	7	94
Total Recoveries	345(5.5%)	5,542(87.5%)	441(7.0%)	6,328
Estimated # of Females[c]	0(0%)	2,749(92.9%)	209(7.1%)	2,958
# of Females at Weir	0(0%)	1,096(95.4%)	53(4.6%)	1,149

[a] Age composition for Age-3 and Age-4 fish weir returns was taken from McGhee and Huntzenbiler 2003 and George and Shockman 2002.

[b] Idaho harvest data is from Barrett 2005, and IDFG unpublished data.

[c] The fraction of total recoveries estimated to be female is based on the sex ratio of age-4 and age-5 fish observed at the hatchery weir in 2001 and 2002 respectively. In 2001, 49.6% of the age-4 hatchery-origin fish were female. In 2002, 47.3% of the age-5 hatchery-origin fish were female.

Red River Satellite

Adult Returns—Trapping of adult Chinook salmon at the Red River Satellite facility began on March 6 and continued until August 30 when the weir was taken out of operation. The first Chinook salmon was captured on June 13 and the last was captured on August 30. During the 2002 trapping period, 623 Chinook salmon were captured at the Red River trap including 521 hatchery-origin and 102 natural-origin adults.

Harvest of Red River Chinook salmon from ocean and Columbia River fisheries is estimated at 397 and an additional eight fish were recovered as strays. A sport fishery on the mainstem Clearwater and South Fork Clearwater Rivers occurred from April 29 to August 4, 2002. Contribution of South Fork Clearwater stock fish was estimated at 1,411 and of those, 404 were from the Red River release based on CWT recoveries at the adult traps. In total, an estimated 1,330 fish released from Red River contributed to the weir return and to fisheries in 2002 (Table 21).

Table 21. Estimated harvest and escapement of hatchery-origin Chinook salmon in 2002. Recoveries are from fish released from Red River satellite facility.

Release Group/Site	Location and Recovery Type	Number CWTs Recovered	Expanded Estimate
	Ocean	0	0
Red River Pond	Columbia River		
	Non-Treaty Sport	6	244
	Non-Treaty Commercial	2	35
	Treaty Net	5	103
	Treaty C&S	2	15
	Strays	1	8
	Idaho		
	Harvest		404
	Strays		0
	Red River Trap	16	521
Total			**1,330**

Run Timing—Adults returning to the Red River trap arrived primarily in a single mode during June and July with a much smaller second mode towards the end of August (Figure 14). The median arrival date for both hatchery- and natural-origin males occurred on 6/28. The median arrival date for hatchery- and natural-origin females occurred on 6/27 and 6/30, respectively.

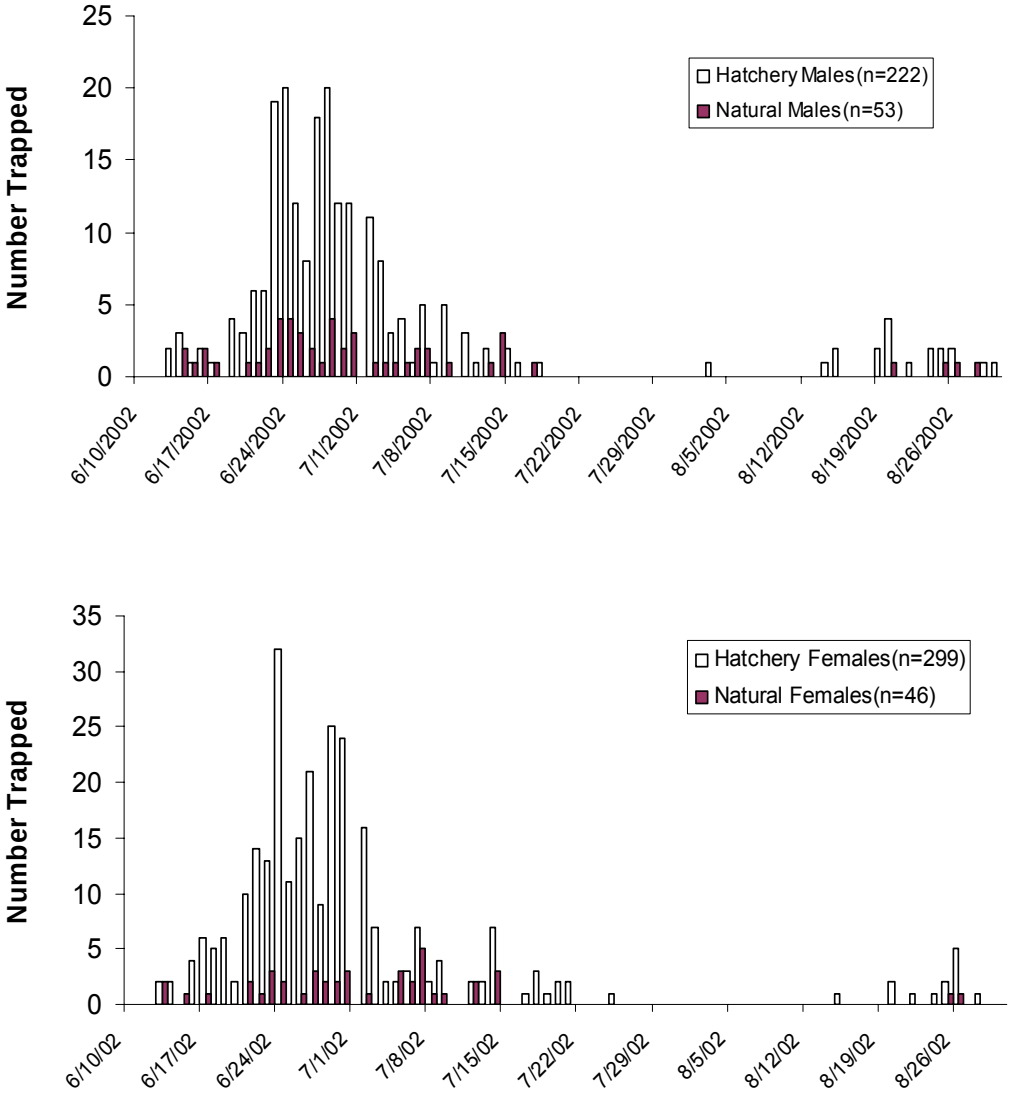


Figure 14. Run timing of hatchery- and natural- origin Chinook salmon at the Red River satellite facility in 2002. Gender was not determined for three natural-origin adults.

Age Structure—Age classification of returning hatchery-origin adults was estimated based on a visual examination of length frequency data from the combined Red and Crooked river trapping data and is shown in Figure 15 and Table 22 below. Based on these length criteria, the male return was composed of 1.4% one-ocean, 87.5% two-ocean, and 11.1% three-ocean fish. The female return was composed of 0.4% one-ocean, 89.6% two-ocean, and 11% three-ocean (Table 22).

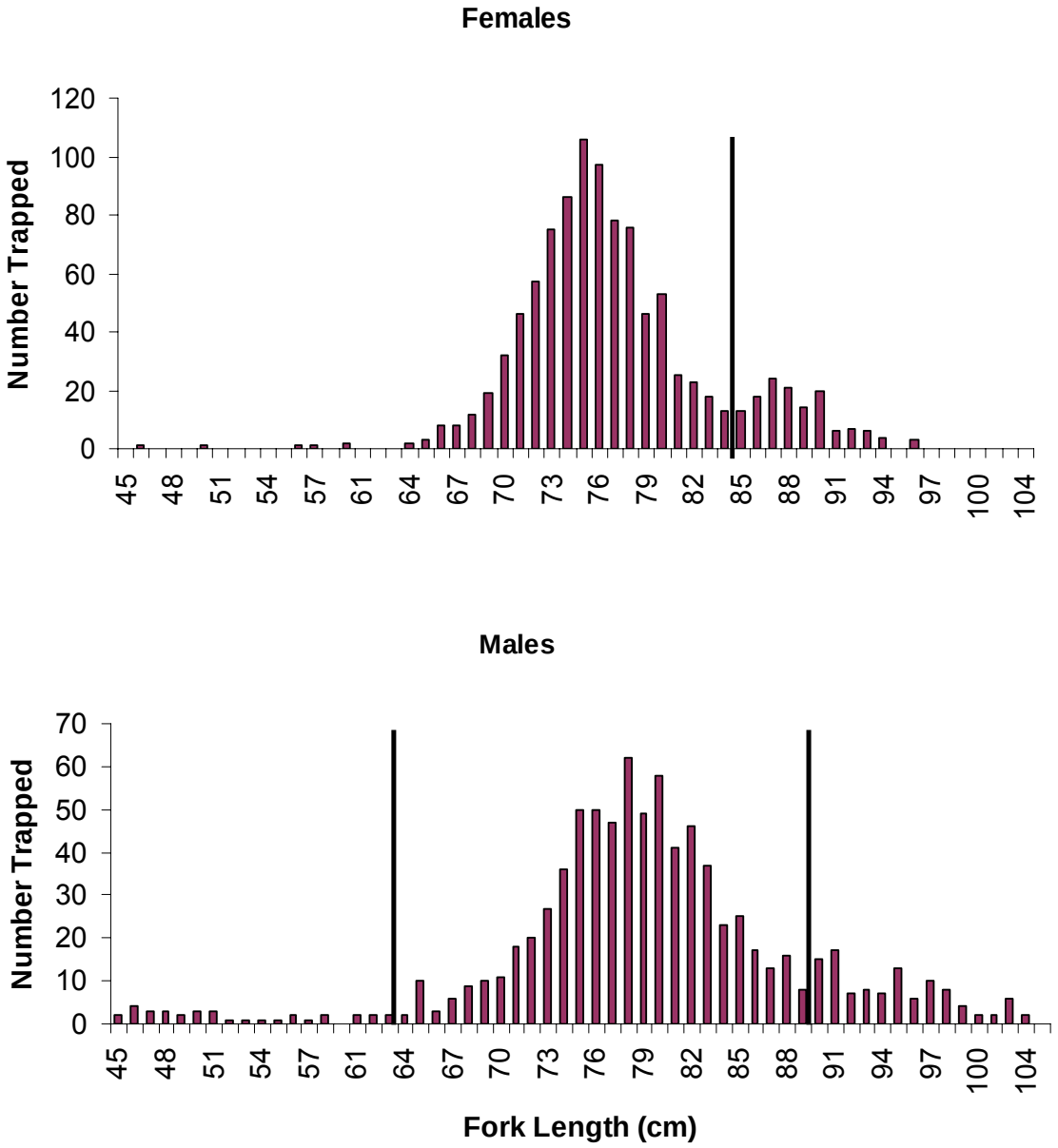


Figure 15. Length frequency and age class estimation of hatchery-origin Chinook salmon trapped at the Red and Crooked River satellites in 2002. Dark vertical bars represent length cutoffs used for age determination.

Table 22. Estimated age composition of hatchery-origin Chinook salmon trapped at the Red River Satellite in 2002. Lengths are in centimeters and measured as fork length.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<64	3	1.4%
	4	64-89	194	87.5%
	5	>89	25	11.1%
Male Total			*222*	*100%*
Female	3	<64	1	0.4%
	4	64-84	268	89.6%
	5	>84	30	11.0%
Female Total			*299*	*100%*
Total			**521**	

Due to the low number of returning natural-origin adults in 2002, age classification was based on the same length criteria used for the hatchery-origin adults. Based on these length criteria, the male return was composed of 2.0% one-ocean, 70.6% two-ocean, and 27.4% three-ocean fish. The female return was composed of 2.3% one-ocean, 79.1% two-ocean and 18.6% three-ocean (Table 23).

Table 23. Estimated age composition of natural-origin Chinook salmon trapped at the Red River Satellite in 2002. Lengths are in centimeters and measured as fork length.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<64	1	2.0%
	4	64-89	37	70.6%
	5	>89	15	27.4%
Male Total			*53*	*100%*
Female				
	3	<64	1	2.3%
	4	64-84	36	79.1%
	5	>84	9	18.6%
Female Total			*46*	*100%*
Total			99*	

* A total of 102 natural origin adults were trapped but gender for three adults was not determined.

Sex Composition—Sex composition of returning hatchery–origin adults expressed as a percent of the 2002 return was 42.6% males and 57.3% females (Table 22). The sex composition of natural-origin adults was 56.4% males and 43.7% females (Table 23).

1997 Brood Year Run Reconstruction and SAR— For the brood year 1997 releases in Red River, no fish were tagged with coded wire. Therefore, no estimate of harvest was generated for the mixed stock fisheries that occurred in the Pacific Ocean, and Columbia and Snake Rivers in 2000, 2001, and 2002. However, estimates of harvest are included for the

terminal fisheries that occurred in the South Fork Clearwater River. Harvest for each of the Red and Crooked River satellites is partitioned based on relative escapement to each weir. Smolt-to-adult survival and female-progeny:female-parent relationships reflect only the number of adults that returned to the weir and the estimated number harvested in the terminal fishery and therefore should be considered a minimum estimate.

From the 360,983 and 66,114 brood year smolts and presmolts, respectively, released from the Red River satellite facility, 1,477 adults returned to Red River weir in 2000, 2001 and 2002. Additionally, an estimated 1,664 fish were harvested in the terminal fishery resulting in 3,141 fish and an overall SAR of 0.74%. This estimate is biased low because it does not take into account overwinter mortality associated with the presmolt release. Without including the presmolt release, the SAR is 0.87%.

Female-Progeny:Female-Parent Ratio—From the estimated 145 females spawned in 1997 used to create the presmolt and smolt releases in 1998 and 1999 respectively, a total of 554 females returned to the weir resulting in a female-progeny to female-parent ratio of 3.8. In addition to the 554 females recovered at the weir, an estimated 708 brood year 1997 females were harvested in 2001 and 2002 resulting in 1,262 females, and a female-progeny to female-parent ratio of 8.7 indicating, the Red River stock was above replacement that for brood year 1997 (Table 24 and 25).

Table 24. Number of females spawned and survival of resultant progeny from egg to release at the Red River satellite facility for brood year 1997.

# of Females Spawned	Average Fecundity	# of Green Eggs	# of eyed Eggs	# of Smolts Released	Green Egg to Release Survival
145	3,936	566,784	487,832	427,097*	75.4%

* Includes 66,114 presmolts released in September of 1998.

Table 25. Estimated escapement and harvest of brood year 1997 Chinook salmon adults from the Red River satellite facility in 2000, 2001, and 2002. Numbers in parentheses represent the percentage of the total for that recovery type. Estimated harvest only includes the terminal fishery on the Middle and South Fork Clearwater River.

Recovery Type	Age-3[a] Recoveries in 2000	Age-4[a] Recoveries in 2001	Age-5 Recoveries in 2002	Total Brood Year Recoveries
Hatchery Weir	178(12%)	1244(84%)	55 (4%)	1,477
Terminal Harvest	0	1,601(96.2%)	63(3.8%)	1,664
Total Recoveries	178(5.6%)	2,845(90.6%)	118(3.8%)	3,141
Estimated # of Females[b]	0	1,198(94.9%)	64(5.1%)	1,262
# of Females at Weir	0	524(94.6%)	30(5.4%)	554

[a] Age composition for age-3 and age-4 weir returns was taken from McGehee and Huntzenbiler 2003, and George and Shockman 2002.

[b] The fraction of total recoveries estimated to be female is based on the sex ratio of age-4 and age-5 fish observed at the hatchery weir in 2001 and 2002 respectively. In 2001, 42.1% of the age-4 hatchery fish were females. In 2002, 54.5% of the age-5 hatchery-origin fish were females.

Crooked River Satellite

Adult Returns—Trapping of adult Chinook salmon at the Red River Satellite facility began on March 30 and continued until August 31 when the weir was taken out of operation. The first Chinook salmon was captured on June 10 and the last was captured on August 31. During the 2002 trapping period, 1,336 Chinook salmon were captured including 1,155 hatchery-origin and 181 were natural-origin adults.

Harvest of Crooked River Chinook salmon from ocean and Columbia River fisheries is estimated at 294. A sport fishery on the South Fork Clearwater River occurred from April 20 to August 4, 2002. Harvest of fish released from the Crooked River facility is estimated at 1,006 fish. In total, an estimated 2,455 fish returned to the weir or contributed to fisheries in 2002 (Table 26).

Table 26. Estimated harvest and escapement of hatchery-origin Chinook salmon in 2002. Recoveries are from fish released from Crooked River satellite facility.

Release Group/Site	Location and Recovery Type	Number CWTs Recovered	Expanded Estimate
	Ocean	0	0
Crooked River	Columbia River		
	Non-Treaty Sport	1	105
	Non-Treaty Commercial	0	0
	Treaty Net	3	170
	Treaty C&S	1	19
	Strays	0	0
	Idaho		
	Harvest		1,006
	Strays		0
	Crooked River Trap		1,155
Total			**2,455**

Run Timing—Adults returning to the Crooked River trap arrived primarily in a single mode from mid-June to late July with a much smaller second mode towards the end of August (Figure 16). The median arrival date for hatchery- and natural-origin males occurred on 6/28 and 6/30 respectively. The median arrival date for hatchery- and natural-origin females occurred on 6/29 and 7/3 respectively.

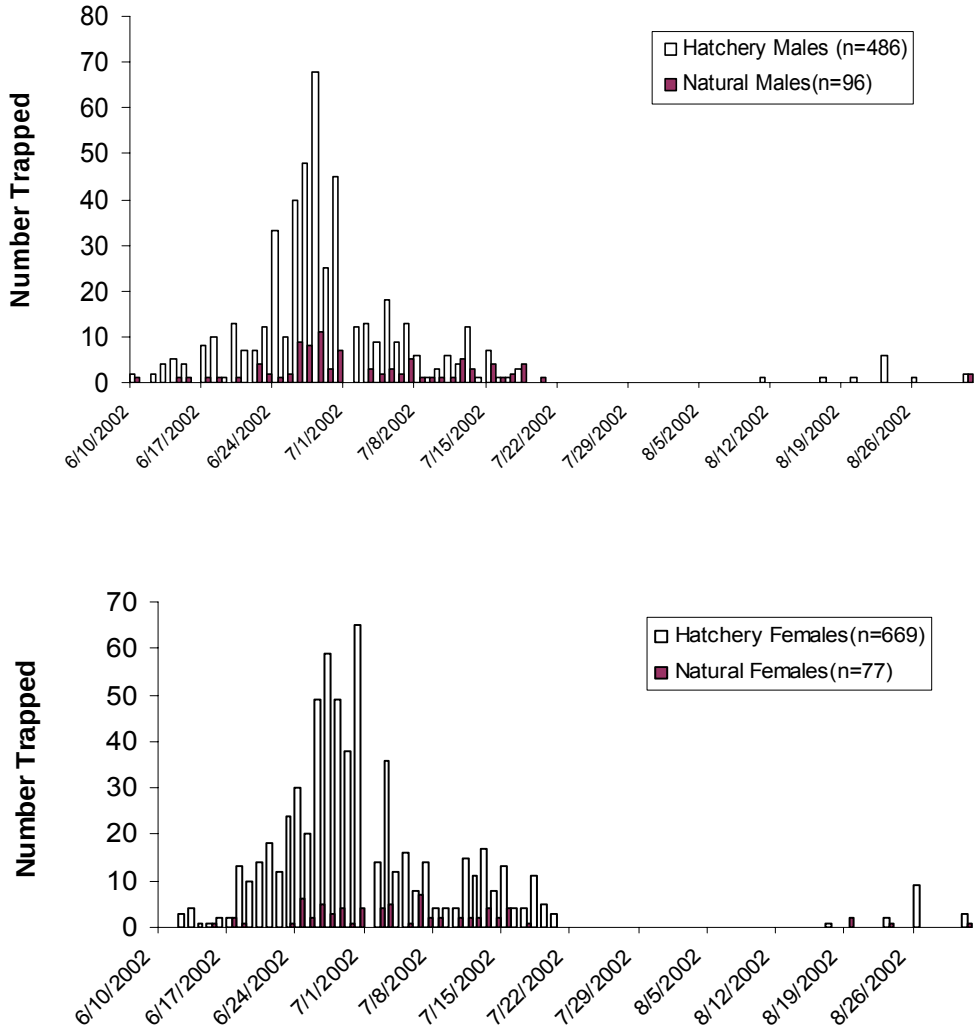


Figure 16. Run timing of hatchery- and natural origin Chinook salmon at the Crooked River satellite facility in 2002. Gender for eight natural origin adults was not determined.

Age Structure—Age classification of returning hatchery-origin adults was estimated based on a visual estimation of the length frequency data from the combined Red and Crooked river trapping data and is shown in Figure 15 and Table 27. Based on these length criteria, the male return was composed of 3.8% one-ocean, 85.3% two-ocean, and 10.9% three-ocean fish. The female return was composed of 0.5% one-ocean, 87.2% two-ocean and 12.3% three-ocean.

Table 27. Estimated age composition of hatchery-origin Chinook salmon trapped at the Crooked River satellite in 2002. Lengths are in centimeters and measured as fork length.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<64	18	3.8%
	4	64-89	415	85.3%
	5	>89	53	10.9%
Male Total			*486*	*100%*
Female	3	<64	3	0.5%
	4	64-84	584	87.2%
	5	>84	82	12.3%
Female Total			*669*	*100.0%*
Total			**1,155**	

Due to the low number of returning natural-origin adults in 2002, age classification was based on the same length criteria used for the hatchery-origin adults. Based on these length criteria, the male return was composed of 13.8% one-ocean, 68.1% two-ocean, and 18.1% three-ocean fish. The female return was composed of 1.4% one-ocean, 64.4% two-ocean and 34.2% three-ocean (Table 28).

Table 28. Estimated age composition of natural-origin Chinook salmon trapped at the Crooked River Trap in 2002. Lengths are in centimeters and measured as fork length.

Gender	Age	Length Criteria	Number Trapped	Percent of Return
Male	3	<64	13	13.8%
	4	64-89	65	68.1%
	5	>89	18	18.1%
Male Total			*96*	*100%*
Female	3	<64	1	1.4%
	4	64-84	50	64.4%
	5	>84	26	34.2%
Female Total			*77*	
Total			173[a]	

[a] Gender was not determined for eight natural-origin adults trapped at Crooked River in 2002.

Sex Composition—Sex composition of returning hatchery–origin adults expressed as a percent of the 2002 return was 42.1% males and 57.9% females (Table 27). The sex composition of natural-origin adults was 55.5% males and 44.4% females (Table 28).

1997 Brood Year Run Reconstruction and SAR— For the brood year 1997 release in Crooked River, no fish were tagged with coded wire. Therefore, no estimate of harvest was generated for the mixed stock fisheries that occurred in the Pacific Ocean, and Columbia and Snake Rivers in 2000, 2001, and 2002. However, estimates of harvest are included for the terminal fisheries that occurred in the South Fork Clearwater River. Harvest for each of the Red

and Crooked river satellites was partitioned based on relative escapement to each weir. Smolt-to-adult survival and female-progeny:female-parent relationships only reflect the number of adults that returned to the weir and the estimated number harvested in the terminal fishery and should be considered a minimum estimate.

From the 600,981 and 162,119 brood year smolts and presmolts, respectively, released from the Crooked River satellite facility, 2,467 adults returned to Crooked River weir in 2000, 2001 and 2002 (Table 30). Additionally, an estimated 2,577 fish were harvested in the terminal fishery resulting in 5,044 fish and an overall SAR of 0.66%. This estimate is biased low because it does not take into account the overwinter mortality associated with the presmolt release. Without including the presmolt release, the SAR would be 0.84%.

Female-Progeny:Female-Parent Ratio—From the 257 females spawned in 1997 used to create the presmolt and smolt releases in 1998 and 1999 respectively, 873 females returned to the weir resulting in a female-progeny to female-parent ratio of 3.4. In addition, an estimated 1,114 brood year 1997 females were harvested in 2001 and 2002 for a total of 1,987 females and an overall female-progeny to female-parent ratio of 7.7 indicating that the Crooked River program was above replacement for brood year 1997 (Table 29 and Table 30).

Table 29. Number of females spawned and survival of resultant progeny from egg to release for the Crooked River satellite facility, brood year 1997.

# of Females Spawned	Average Fecundity	# of Green Eggs	# of eyed Eggs	# of Smolts released	Green Egg to Release Survival
257	3,936	1,012,068	889,203	763,100*	75.4%

* Includes 162,119 presmolts released in September of 1998.

Table 30. Estimated escapement and harvest of brood year 1997 Chinook salmon from the Crooked River satellite facility in 2000, 2001, and 2002. Numbers in parentheses represent the percentage of the total for that recovery type. Estimated harvest only includes the terminal fishery.

Recovery Type	Age-3 Recoveries in 2000[a]	Age-4 Recoveries in 2001[a]	Age-5 Recoveries in 2002	Total Brood Year Recoveries
Hatchery Weir	454 (18.4%)	1,878 (76.1%)	135 (5.5%)	2,467
Terminal Harvest	0	2,421(93.9%)	156(6.1)	2,577
Total Recoveries	454 (9%)	4,299(85.2%)	291(5.8%)	5,044
Estimated # of Females[b]	0(0%)	1,810(91.1%)	177 (8.9%)	1,987
# of Females at Weir	0	791(90.1%)	82(8.9%)	873

[a] Age composition for age-3 and age-4 fish is from McGhee and Huntzenbiler 2003 and George and Shockman 2002.

[b] The fraction of total recoveries estimated to be female is based on the sex ratio of age-4 and age-5 fish observed at the hatchery weir in 2001 and 2002 respectively. In 2001, 42.1% of the age-4 hatchery fish were females. In 2002, 60.7% of the age-5 hatchery-origin fish were females.

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