South Fork Salmon River Summer Chinook Salmon

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Background

The South Fork Salmon River (SFSR) summer Chinook salmon mitigation program was established to provide in-kind mitigation for summer run Chinook salmon losses associated with construction and operation of the four lower Snake River hydroelectric dams. The McCall Fish Hatchery, which is responsible for all the incubation and rearing for this program, is located on banks of the Payette River approximately one half mile below the outlet of Payette Lake in McCall, Idaho. Construction of this hatchery and the associated satellite facility was completed in 1980. The satellite facility is located on the mainstem SFSR approximately 113km upstream from the confluence with the Salmon River. All adult trapping and spawning for this program occurs at this facility. In 2007 a permanent concrete sill and catwalk were constructed at this site that allows for trapping the entire adult return. Prior to 2007, a removable picket weir was used to divert fish into the trap but lacked the structural integrity to efficiently trap throughout the adult migration. The relative locations of both the hatchery and satellite facility are shown in Figure 1. The Lower Snake River Compensation Plan (LSRCP) adult mitigation goal for the McCall Fish Hatchery is 8,000 adult Chinook salmon above Lower Granite Dam (LGD) and 32,000 adults available for downriver (Columbia and lower Snake rivers) commercial and sport harvest. The release goal is 1 million smolts and is based on a 0.80% smolt-to-adult survival rate applied to the LGD mitigation objective of 8,000 adults. All smolts are transported from the McCall Fish Hatchery and released directly into the upper SFSR at Knox Bridge (RKm 115).

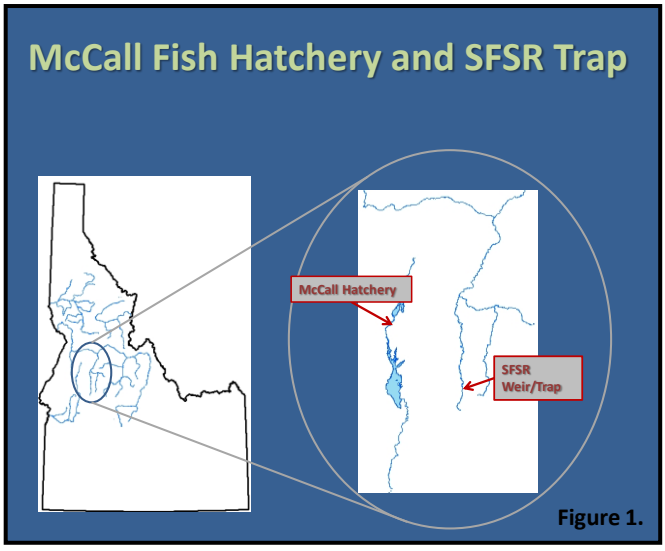

Figure 1.

Management and Monitoring/Evaluation Objectives

Management Objectives for the SFSR Chinook salmon program are to meet the LSRCP adult mitigation objectives, to restore and maintain natural populations of Chinook salmon in the SFSR, to restore and maintain recreation and tribal Chinook salmon fisheries, and to minimize the impact of the hatchery

program on the natural Chinook salmon populations in the SFSR. Monitoring and evaluation (M&E) objectives for the SFSR include monitoring production, productivity, and life history characteristics of hatchery and natural populations and to evaluate broodstock and rearing strategies to increase and maximize adult returns. M&E activity on the SFSR is a cooperative effort between the Idaho Department of Fish and Game (IDFG) and the Nez Perce Tribe (NPT).

Broodstock History

Initial broodstock for the SFSR program was collected at Little Goose and Lower Granite dams from 1974 to 1979. In 1980 broodstock was collected at both Lower Granite Dam and the upper SFSR. Since 1981, broodstock collection has been exclusively from adults collected at the SFRS satellite facility. Because mass marking was not initiated until brood year 1991, the origin of adult returns (hatchery or natural) could not be distinguished until 1995. Prior to 1995 the program was operated as a de facto integration/supplementation program with both hatchery- and natural-origin adults incorporated into the broodstock and also released above the weir to spawn naturally. From 1995 to 2002 the majority of releases from this facility have been produced from segregated hatchery-origin adults. For brood years 1991-2002, the Idaho Supplementation Study (ISS) research study was conducted at McCall Fish Hatchery to assess the utility of using supplementation as a tool to increase the number of returning adults. Broodstock for this supplementation research included both hatchery and natural adults and accounted for approximately 15-20% of the hatchery production capacity. Between 2002 and 2009 all hatchery production has utilized only segregated hatchery-origin broodstock. Beginning in 2010, an integrated stepping-stone broodstock protocol was implemented for this program.

Status of Natural Population

The natural populations of Chinook salmon in the SFSR were listed as threatened in 1992 and the hatchery population was added to the listing in 2005. The natural population of Chinook salmon in the SFSR mainstem is part of the SFSR Major Population Group (MPG) which is composed of four independent populations. From 1982 to 2009, the estimated natural adult abundance in the SFSR mainstem has ranged from 100 to 2,380 fish (Figure 5). The Interior Columbia Technical Recovery Team (ICTRT) 2005 status assessment of the SFSR natural population indicates the population is not viable, is at a high risk for abundance and productivity and is at moderate risk for spatial structure and diversity.

In-Hatchery and Post Release Survival

Broodstock performance over the life of the hatchery program has been good with levels of prespawn mortality for both males and females consistently below 20%. Exceptions to this were in 2003 when about 46% of the female broodstock was lost and in 2008 when 34% of the females and 30% of the males died prespawn. These outliers are associated with elevated water temperature or high turbidity events during late summer. In-hatchery survival has been high across the history of the program. For all years, eyed egg-to-release survival has exceeded 70% and in several years has been greater than 90% (Figure 2).

The number of juveniles released from McCall Fish Hatchery has fluctuated over the history of the program (0.12 - 1.2M) but since 1983, the production target of 1 million juveniles has been achieved in all but six years, and in every year since 1997 (Figure 3).

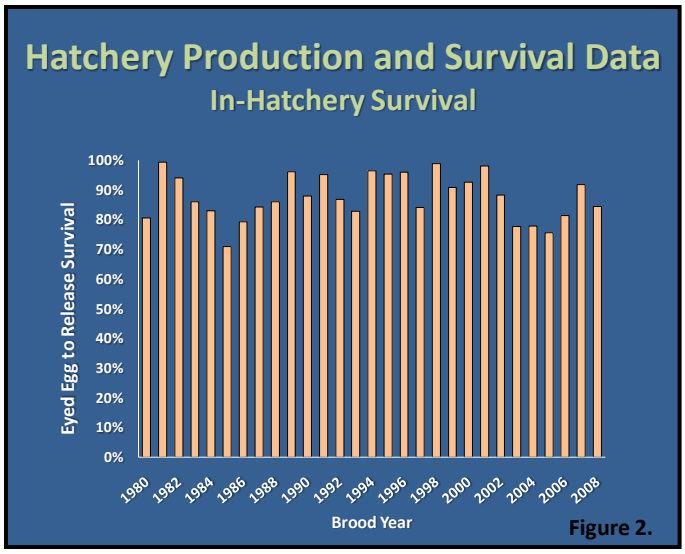

Figure 2.

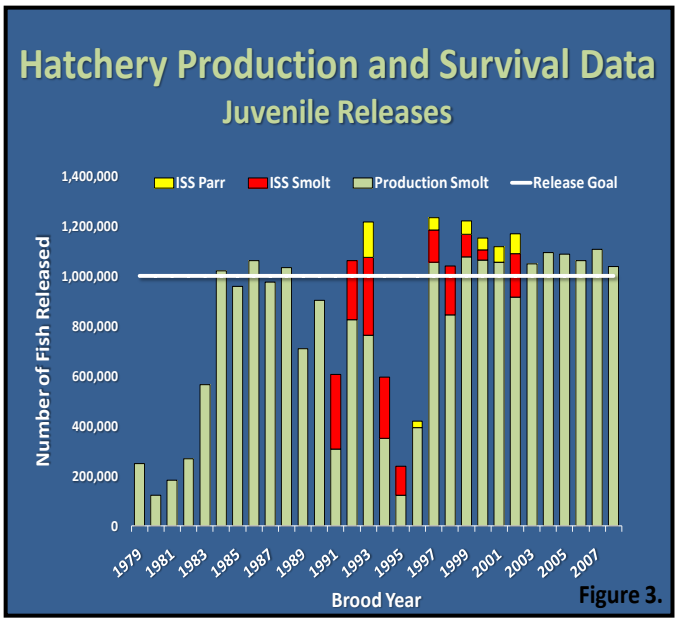

Figure 3.

Passive Integrated Transponder (PIT) tags have been used to estimate survival from release to LGD for this program since the early 1990s. Estimated survival for hatchery-origin juveniles released in the upper SFSR has fluctuated from 40 – 68% while natural-origin smolts have fluctuated from 35 – 61% (Figure 4). Survival of hatchery-origin parr has ranged from 4 – 14% (Figure 4). This is higher than normally observed for parr releases from other hatchery programs and is likely associated with a three month acclimation period for the parr releases in the upper SFSR. Regardless, due to the low return rates from subyearling releases, IDFG has generally moved away from this release strategy.

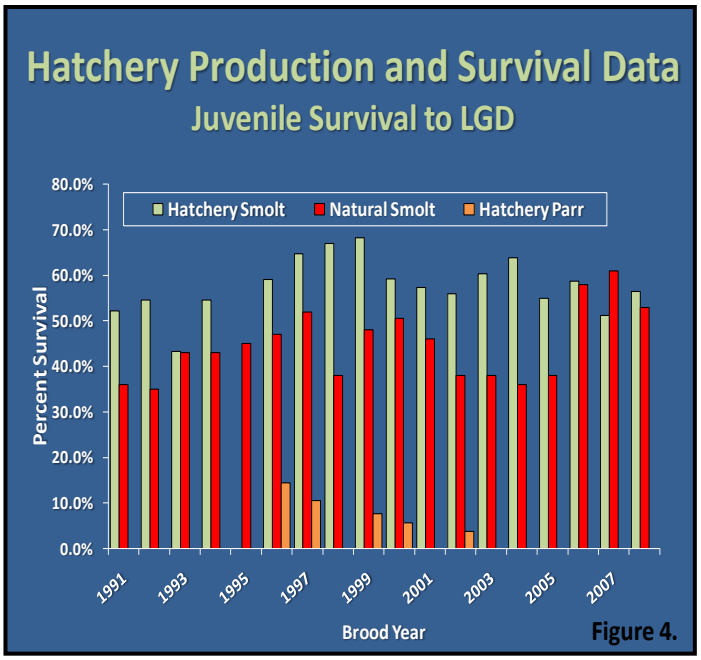

Figure 4.

The number of adults produced annually for this hatchery program has been highly variable across the history of the program. Estimates of the total number of adults back to the Columbia River mouth, by return year, has fluctuated from a low of 80 (80 adults, 0 jacks) fish in return year 1981 to a high of 19,378 (18,134 adults, 1,244 jacks) fish in 2001. The record return in 2001 represents approximately 50% of the total mitigation goal. Harvest rates of summer Chinook salmon from this hatchery program in the Columbia and lower Snake rivers have generally been very low most likely due to the adult migration timing through the Columbia and Snake rivers. For this reason, the adult returns to LGD are very similar to the total adults produced for any year. Adult returns to LGD ranged from a low of 80 (80 adults, 0 jacks) fish in return year 1981 to a high of 18,039 (16,819 adults, 1,220 jacks) fish in 2001 (Figure 5). Also shown in Figure 5 are the natural returns to the upper SFSR which reflects synchrony in survival between the hatchery and natural populations for most years. Across the life of the McCall Fish Hatchery program, the total LSRCP mitigation goal has never been achieved while the project area goal of 8,000 adults to LGD has been met seven times, all of which occurred in the last ten years (Figure 5).

Similar to annual adult return numbers, highly variable smolt-to-adult survival (SAS) and smolt-to-adult return (SAR) rates have been observed over the history of the program. SARs to LGD are shown in Figure 6 and have ranged from 0.004 -2.0%. Similarly, smolt-to-adult survival rates to the Columbia River mouth have ranged from 0.004 – 2.2%. Fluctuations in survival for the aggregate natural-origin returns to LGD are similar to the SFSR hatchery population but are consistently higher that the hatchery population (Figure 6). The modeled 0.8% SAR necessary to meet to LGD escapement objective has been achieved in eight years. While this gives the appearance that the mitigation goal has been reached in these years, the modeled 0.8% SAR is a post harvest estimated and is based on the assumption there would be a 4:1 catch to escapement ratio to LGD. The SAS necessary to achieve the total mitigation goal is 4.0% and the highest observed SAS was 2.2% for brood year 1997.

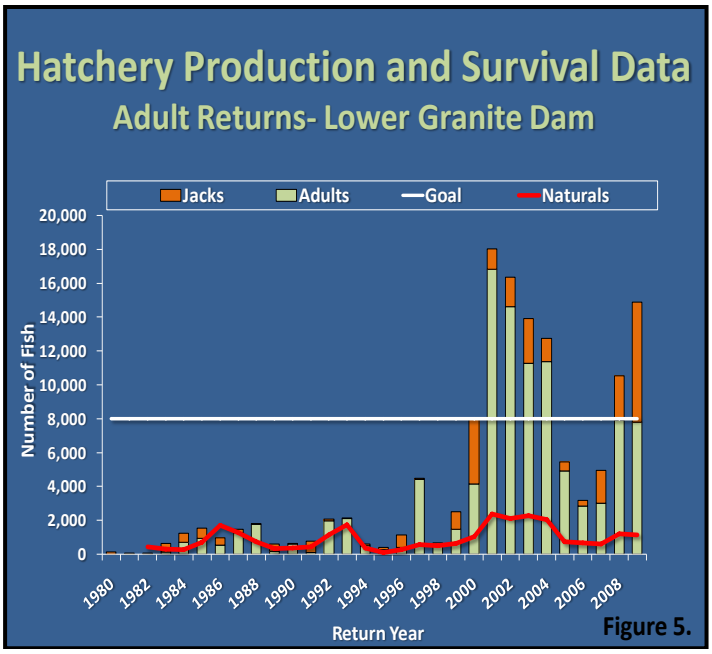

Figure 5.

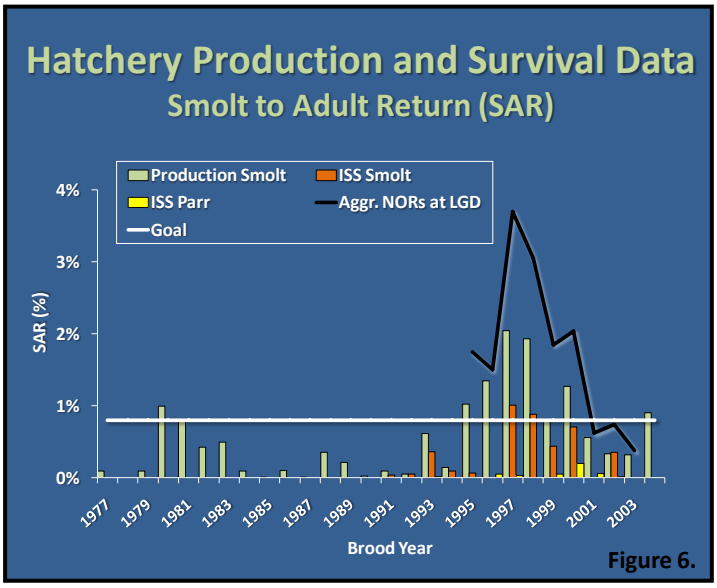

Figure 6.

Life History Characteristics of the Hatchery and Natural Populations

The average (1997-2009) cumulative adult run timing for hatchery- and natural-origin fish to the SFSR adult trap is similar (Figure 7). The median arrival date to the trap varies between years but within years remains similar between the hatchery and natural fish. Figure 8 shows the estimated age composition of hatchery- and natural-origin adult returns over the life of the program. Prior to brood year 1991, age composition data for the natural population is limited. Likewise, prior to brood year 1991, the number of hatchery-origin returns was very low in some years which may have influenced some of the large fluctuations in the estimated age composition of the hatchery population (i.e. small sample sizes). Over

the entire time series for the hatchery population there appears to be a decrease in the proportion returning as jacks, an increase in the proportion returning as 2-ocean adults, and a slight decrease in the proportions returning as 3-ocean adults. Since brood year 1991, there is no significant trend in the hatchery or natural age composition. No significant trends in the age composition of the aggregate return of natural fish to LGD were observed for brood years 1995-2003. It is important to note that for most brood years, the hatchery population returned younger than either the SFSR natural population or the aggregate natural population at LGD.

Length-at-age for both the hatchery- and natural-origin male and female returns to the SFSR is displayed in Figure 9. For brood years 1979-2004, no significant trends in length-at-age for the hatchery population were observed with the exception of the age-4 males which showed a positive slope of 0.14cm/yr. For brood years 1991-2004, regression slopes were negative for all age/gender combinations for the natural population in the SFSR but the only significant trend was for the age-4 males which showed a negative slope of 0.30 cm/yr. For the aggregate natural-origin population at LGD, regression slopes for length-at-age were negative for all age/gender combinations and were significant for age-4 males and age-5 females. Annual variations in length-at-age for the hatchery and natural populations are similar over time and are presumably driven, in large part, by environmental conditions.

In addition to the above life history characteristics, we also looked at spawn timing and fecundity of hatchery-origin SFSR Chinook salmon over time and found no significant trends in either metric over the life of the program. The median spawn date across all years is August 27 (range: Aug 20- Sep 2) with no significant trend. Fecundity has ranged from 3,684 to 5,401. The observed fluctuations were likely a result of the varying proportions of two and three ocean females in the adult returns.

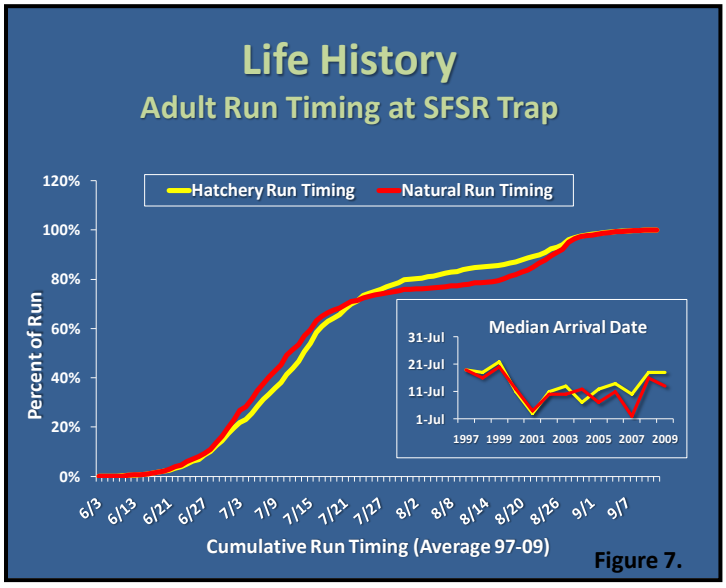

Figure 7.

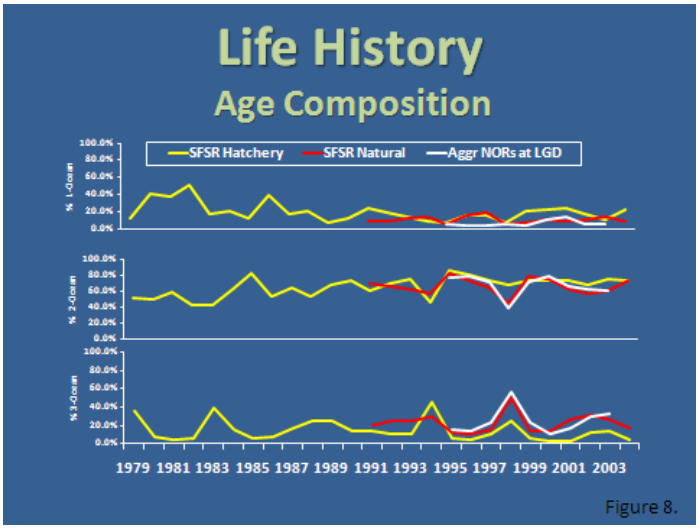

Figure 8.

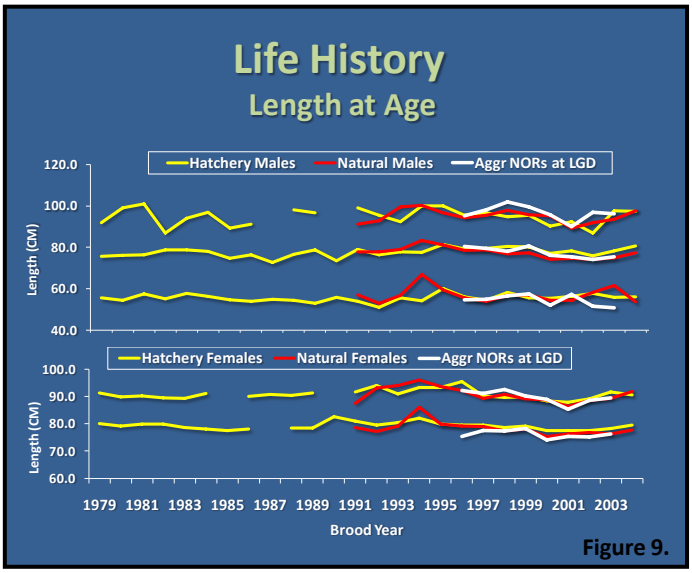

Figure 9.

Contribution of Hatchery Fish to Fisheries

As mentioned earlier, due to the later run timing of McCall Fish Hatchery origin Chinook salmon through the Columbia and lower Snake rivers, little downriver harvest has occurred on this stock in recent years. Harvest estimates from fisheries below LGD have fluctuated from zero fish in some years to a high of 1,383 fish in 2004 (Figure 10). The first sport fishery in the SFSR targeting fish produced by this program occurred in 1997. There were no sport fisheries in 1998 or 1999 but there have been sport fisheries every year since 2000. Sport fishery harvest has ranged from a low of 364 fish in 2006 to a high of 6,847 fish in 2002 and angler effort exceeded 80,000 hours in 2003 (Figure 10). Some level of tribal harvest has occurred on the SFSR in most years since 1987. Tribal harvest estimates have ranged from zero to 1,630 Chinook salmon (Figure 10).

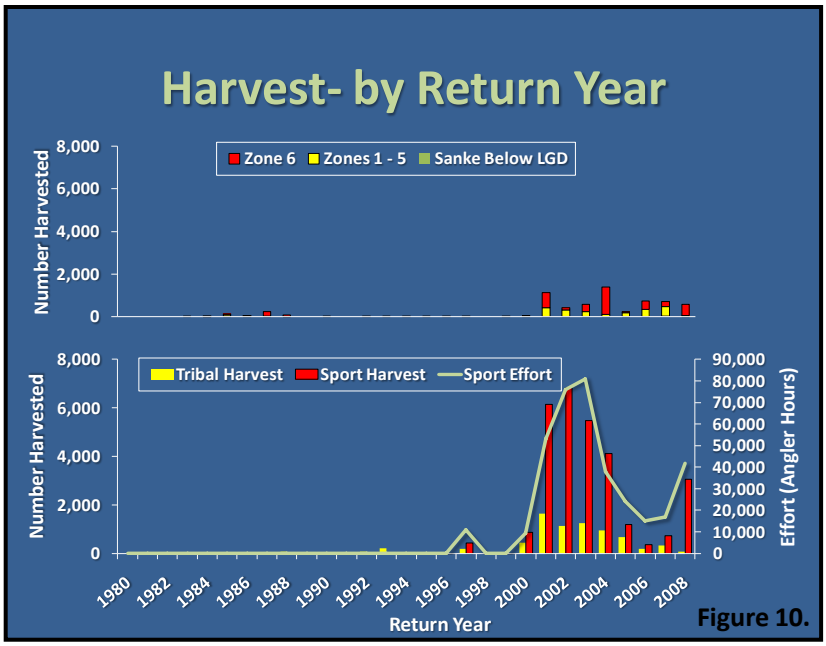

Figure 10.

Observed straying has been minimal for the SFSR hatchery stock. In many years, no strays have been recovered above or below LGD and the highest percentage of strays for any year was 2.7% in 1983. The next closest year is 1988 with a stray rate of 1.3%. One important note is that estimates of straying are minimum estimates as stray recoveries downriver are typically opportunistic at hatchery traps and on spawning grounds. There are many areas where strays might not be recovered throughout the basin, but overall straying is still expected to be very low.

Determining the beneficial use of McCall Fish Hatchery origin Chinook salmon that escape fisheries and return to the SFSR trap is a collaborative effort between IDFG and the tribes. The first priority of returning fish is to meet broodstock needs with a representative take across the run. In addition, we make an effort to maximize harvest opportunity for both sport and tribal fisheries by recycling fish through the fisheries when deemed appropriate. Also, fish from the traps can be transferred to the tribes for ceremonial and subsistence (C&S) use, given to local food banks, or outplanted for natural spawning within the SFSR basin.

Overall, disease has not been an issue at the McCall Fish Hatchery and there have been no significant losses due to disease.

Summary and Outlook for the Future

The SFSR program will continue to be managed to meet the management objectives outlined in this report. In an effort to restore and maintain the natural population, an integrated supplementation approach was initiated in 2010. Because the natural population in the SFSR is not large enough to fully integrate a one million smolt program, managers have implemented a stepping-stone approach that includes maintaining two broodstocks (integrated and segregated). Returns from the integrated brood will be used to supplement the natural-origin population above the hatchery weir and produce the next generation of integrated broodstock. Weir and broodstock management will be based on a sliding scale approach. During times of low natural-origin abundance, guidelines will be relaxed to allow for more hatchery influence in both the hatchery and natural environments. As natural-origin adult returns increase, the proportionate influence from natural fish in the hatchery and on the spawning grounds will

also increase. Efforts to restore and maintain sport and tribal fisheries will continue. There has been significant rebuilding of these fisheries since 2000 but future fisheries will be highly dependent on post release survival. Over the history of the program we have observed consistently high survival during hatchery culture, highly variable post-release survival with poor survival of subyearling releases, and a general upswing is post-release survival since the mid-1990s.

The outlook for M&E includes continued monitoring of hatchery production and productivity and contribution to sport, tribal, and commercial fisheries. This will be accomplished using a variety of tools including the continued use of Coded Wire Tags (CWT) and PIT tags and the implementation of Parental Based Tagging (PBT). PIT tags have been, and will continue to be used to estimate adult survivals back to LGD, monitor returns for in-season fisheries management, and to look at migration timing and inter-dam conversion rates. PBT, along with CWTs, will be used to monitor catch contribution and stock identification. The continued effort to monitor the status and trends of the natural populations in the SFSR is a collaborative effort between the IDFG and the NPT

The SFSR Chinook salmon program will continue to support both harvest and conservation objectives, mitigation for lost sport and tribal fishing opportunity, and expanded coordination between state, tribal, and federal managers. Through the development of a Hatchery Genetic Management Plan (HGMP), managers are incorporating both current and emerging science and have incorporated suggestions generated through the Hatchery Scientific Review Group (HSRG) and Hatchery Review Team (HRT) review processes.