Upper Salmon River Spring Chinook Salmon

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Background

The upper Salmon River (USR) spring Chinook salmon program was established to provide in-kind mitigation for losses of spring run Chinook salmon associated with the construction and operation of the four lower Snake River hydroelectric dams. The Sawtooth Fish Hatchery is located on the Salmon River approximately seven miles upstream from the town of Stanley, Idaho. All adult trapping, spawning, incubation and rearing occurs at this facility. Construction of the hatchery was completed in 1985. A satellite facility associated with the Sawtooth Fish Hatchery is located on the East Fork Salmon River and was completed in 1984. Currently, this facility is used to monitor adult abundance of the natural population and no broodstock is collected at this site. 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 USR spring Chinook salmon hatchery program is 19,400 adult Chinook salmon above Lower Granite Dam (LGD) and 77,000 adults available for downriver (Columbia and lower Snake rivers) sport and commercial harvest. The original release target of 2.3 million yearling smolts was based on an assumed 0.87% smolt-to-adult survival rate applied to the LGD mitigation objective. The original release strategy included 700,000 smolts released at the East Fork Satellite Facility, 300,000 smolts released into Valley Creek, and 1.3 million smolts to be released at the Sawtooth Fish Hatchery. However, due to limitations with well water availability and ice thickness in outdoor rearing containers during the winter months, the actual facility capacity was adjusted down to 1.7 million yearling smolts. Currently, the release strategy is for 1.5 million smolts released directly into the Salmon River at Sawtooth Fish Hatchery and 200,000 smolts released into the Yankee Fork as part of the Shoshone Bannock Tribe supplementation program.

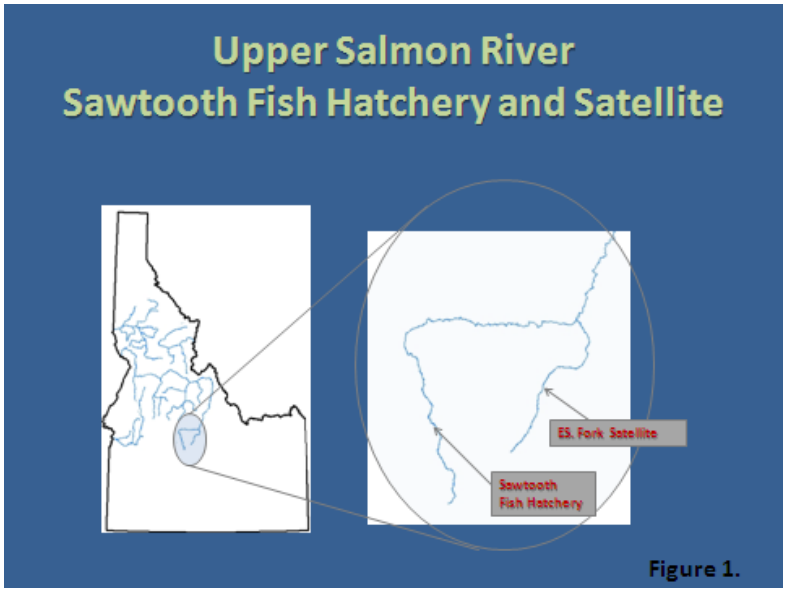


Figure 1.

Management and Monitoring/Evaluation Objectives

Management objectives for the USR Chinook salmon program are to meet the LSRCP adult mitigation objectives, to restore and maintain natural populations of Chinook salmon in the USR, to restore and maintain recreation and tribal Chinook salmon fisheries, and to minimize the impact of the hatchery program on the natural Chinook salmon production in the USR. Monitoring and evaluation (M&E) objectives for the USR 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.

Broodstock History

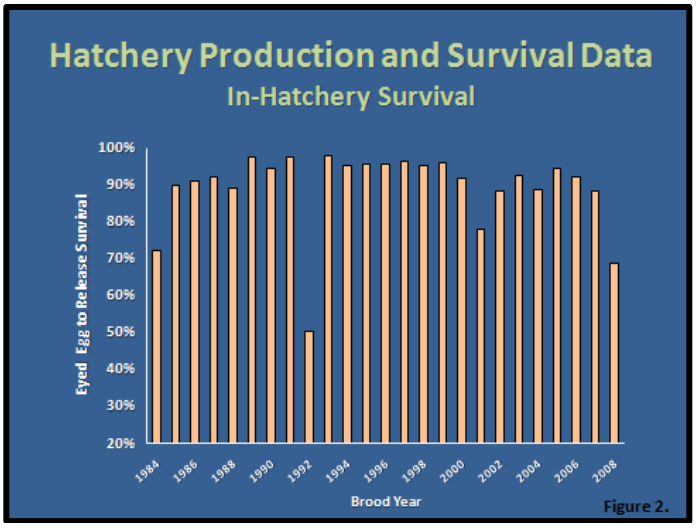
Initial broodstock for the USR program was collected at a temporary weir in the USR from 1981 to 1984. It was estimated that approximately 50% of the two-ocean broodstock collected in 1981 were from the release of Rapid River hatchery smolts in 1979. A similar proportion of the three-ocean returns in 1982 are assumed to be from the same hatchery release. Since 1983, all broodstock have been of USR origin. 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 a de facto integration/supplementation program with both hatchery- and natural-origin adults being 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. From brood year 1991-2002, the Idaho Salmon Supplementation (ISS) research study was conducted at Sawtooth 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 10% of the hatchery production capacity. Between 2002 and 2009 all hatchery production has utilized only segregated hatchery-origin broodstock. Beginning in 2010, an integrated supplementation protocol was implemented for this program.

Status of Natural Population

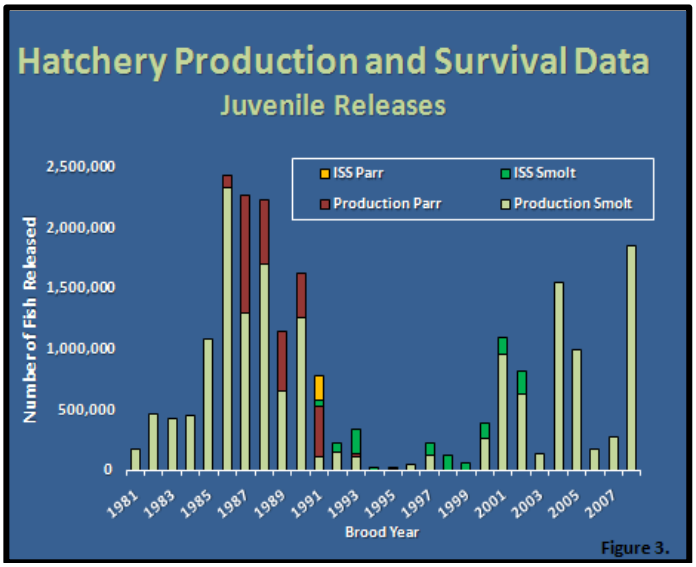
The natural population of Chinook salmon in the USR was listed as threatened in 1992 and the hatchery population was added to the listing in 2005. From 1991 to 2009, the estimated natural-origin adult abundance in the USR mainstem population has ranged from 18 to 1,431 fish. The upper Salmon River mainstem population is one of nine independent populations within the upper Salmon River Major Population Group (MPG) and is classified as a “large” population based on historic habitat potential. The Interior Columbia Technical Recovery Team (ICTRT) concluded that the USR natural population is not currently viable, is at a high risk for abundance and productivity measures and is at moderate risk for spatial structure and diversity.

In-Hatchery and Post Release Survival

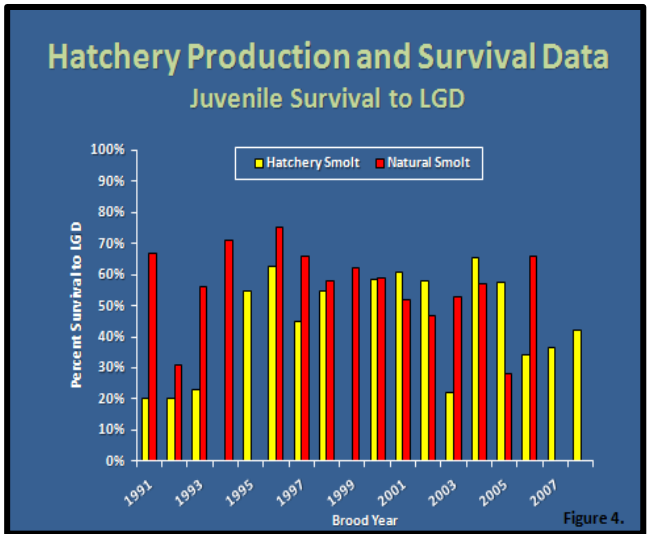
Broodstock performance over the life of the hatchery program has been good with levels of prespawn mortality for both males and females consistently below 20%. Exceptions to this were in 2006 when approximately 60% of the broodstock was lost due to an *Ichthyophthirius multifilis* (Ich) outbreak. With one exception, juvenile in-hatchery survival has been high across all years of the program. In 1992, a bacterial outbreak caused high mortality. For all remaining years, eyed egg-to-release survival was greater than 70% and for most years was near 90% (Figure 2).



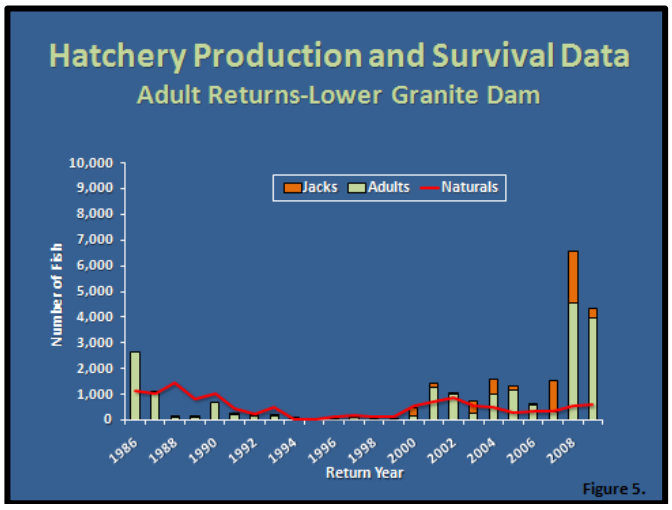
The number of juveniles released from Sawtooth Fish Hatchery has fluctuated dramatically over the history of the program from a low of 5,000 smolts released in 1997 (BY 1995) to 2,430,000 smolts and subyearling parr released in 1986 (Figure 3). While parr releases occurred for this program through the early 1990s, low observed post-release survival rates prompted the discontinuation of this release strategy.



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 yearling smolts released in the USR has fluctuated from 20-65% while the survival of natural-origin smolts has ranged from 30–75% (Figure 4).

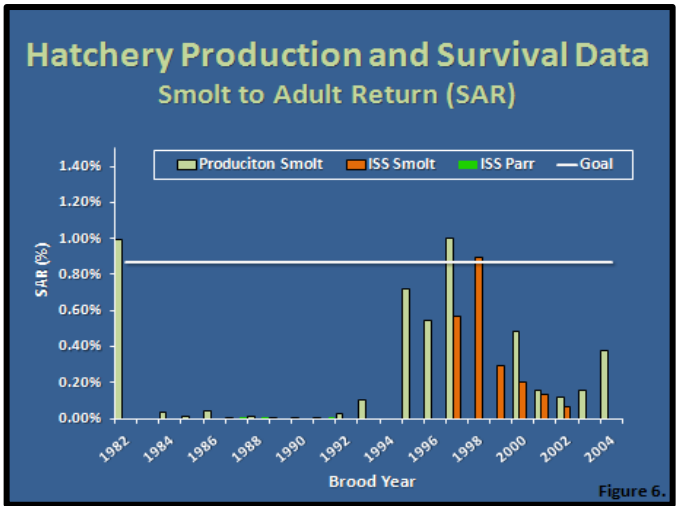


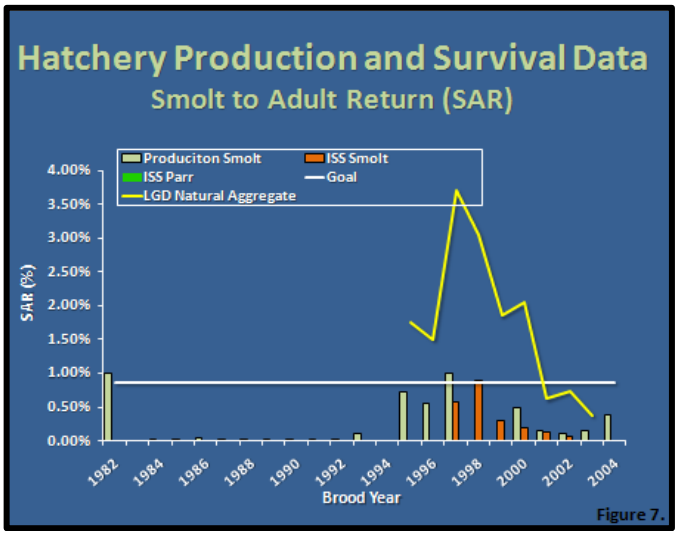
The estimated number of adults surviving to the Columbia River mouth annually from this program is less than 2,000 for most years and has fluctuated from 15 (7 adults, 8 jacks) fish in return year 1995 to 7,141 (4,869 adults, 2,272 jacks) fish in 2008. Run timing of Sawtooth Fish Hatchery adults through the lower Columbia and Snake rivers is later than most of the spring run Chinook salmon stocks, which has contributed to low observed harvest rates. Estimated adult returns to LGD have ranged from 15 (7 adults, 8 jacks) fish in return year 1995 to 6,558 (4,570 adults, 1,988 jacks) fish in 2008 (Figure 5). This hatchery program has never achieved either the LGD or total mitigation objectives. Also shown in Figure 5 are the natural returns to the upper USR which reflects synchrony between the hatchery and natural populations for most years.



Smolt-to-adult survival (SAS) and smolt-to-adult return (SAR) rates were very low for brood years through the early-1990s and have ranged from (0.001-1.1%) over the entire history of the program (Figure 6). The modeled 0.87% SAR to LGD has only been achieved in two years. It is important to note that the modeled 0.87% SAR is post downstream (below LGD) harvest 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 4.35%. To date, the highest observed SAS for this program is 1.1% for brood year 1997. Figure 7 shows SARs of the hatchery population overlaid with the SARs of the aggregate return of natural-origin Chinook salmon at LGD and reveals synchrony between the two.





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 Sawtooth Fish Hatchery adult trap is similar. The median arrival date to the trap varies between years but within years is similar for the hatchery and natural fish (Figure 8).

The estimated age composition of the hatchery and natural populations in the USR and the aggregate natural population at LGD are displayed in Figure 9. Prior to brood year 1991, age composition data for the natural population in the USR is limited. Prior to brood year 1995, the number of hatchery-origin returns in the USR was very low in most years which likely influenced some of the large fluctuations in the estimated age composition of the hatchery population (i.e. small sample sizes). For the natural population in the upper Salmon River, data for brood years 1991-2004 is presented and for the

aggregate natural-origin returns at LGD, data for brood years 1995-2003 is presented. Overall, there appears to be a high degree of synchrony between the USR and LGD natural populations. As observed in other hatchery stocks, the hatchery population returns at a younger age than the natural population for most years. Over the period 1984-2004 there was a significant increase in the age-3 component of the hatchery return but no significant change for the age-4 or age-5 components. For brood years 1996-2004, there were no significant trends for any of the age classes in the hatchery population. For the period 1991-2004 there were no significant trends for any of the age classes in the USR natural population. Likewise, there were no significant trends for the aggregate natural population at LGD for brood years 1995-2003.

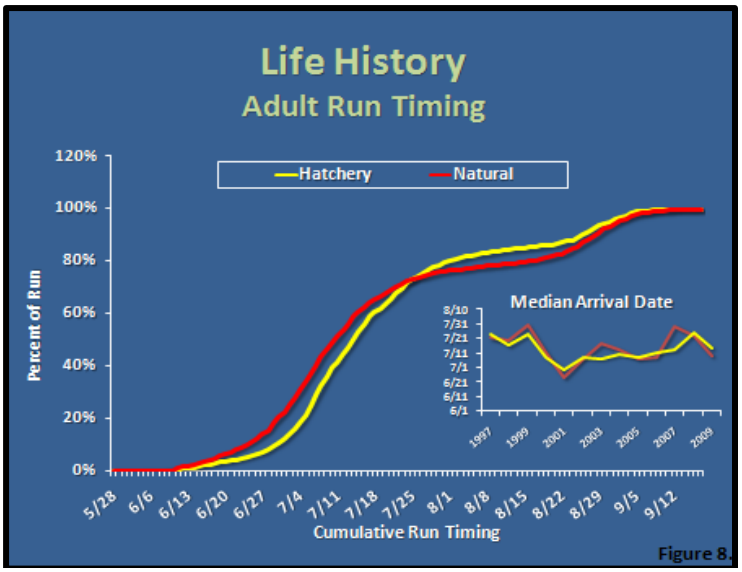


Figure 8.

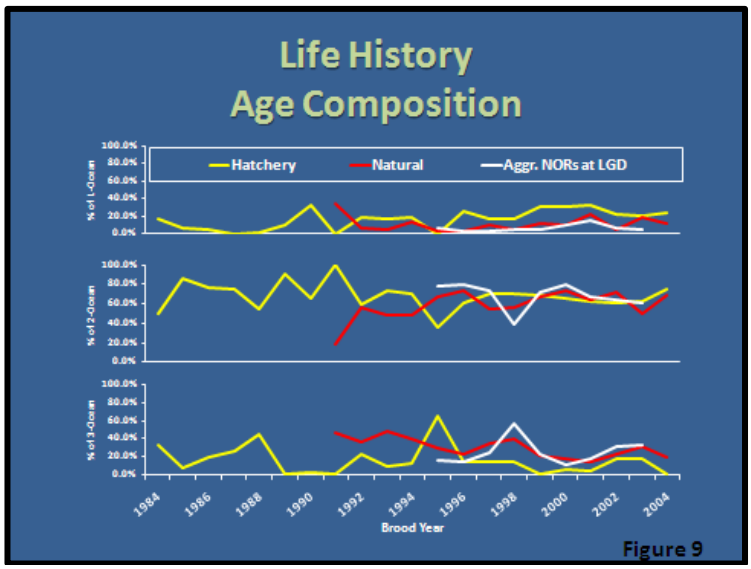


Figure 9

Average length-at-age (age-3, age-4, and age-5) for the hatchery- and natural-origin populations in the USR and the aggregate natural population at LGD is displayed in Figure 10. Similar to the age

composition data, prior to brood year 1995 the number of hatchery-origin returns in the USR was very low in most years which likely influenced some of the large fluctuations in the length-at-age estimates of the hatchery population (i.e. small sample sizes). Overall, length-at-age was similar for hatchery- and natural-origin fish. For brood years 1996-2004, there were no significant trends for the hatchery and natural populations in the USR with the exception of the age-5 hatchery males that showed a significant increase in length. 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.

The median spawn date of the hatchery population for the period 1981-2007 is August 24th (min= Aug 18, max= Sep 2) with no significant trend. Mean fecundity of hatchery-origin females for the period 1981-2009 is 5,012 (min= 3,688, max= 6,388) with no significant trend. Annual fluctuations in fecundity are generally associated with age composition, particularly for years when few hatchery females returned to Sawtooth Fish Hatchery.

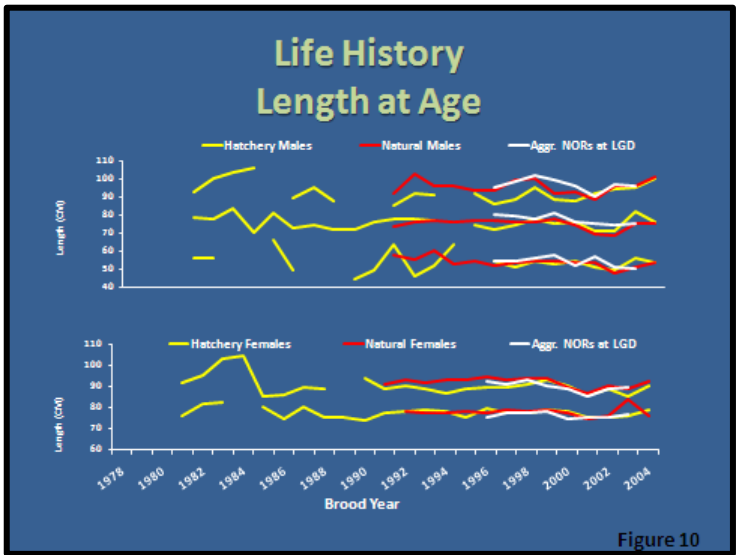
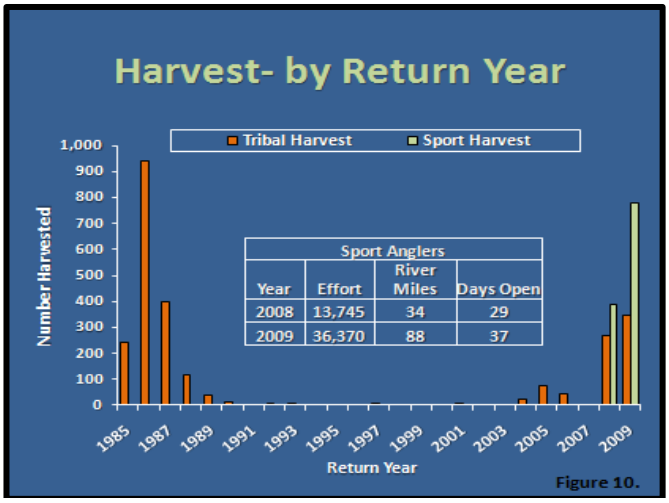


Figure 10

Contribution of Hatchery Fish to Fisheries

Estimated harvest of hatchery-origin Chinook salmon downstream of LGD from this program has ranged from zero in some years to 279 in 2008. In more recent years, the later migration timing of Sawtooth Chinook salmon through the Columbian and Snake rivers has contributed to lower harvest rates than observed for other earlier migrating spring run Chinook salmon hatchery fish from Idaho In 2007, 158 hatchery-origin Chinook salmon from Sawtooth Fish Hatchery were harvested downstream of LGD. Prior to 2007, the highest harvest estimate downstream of LGD was 142 fish in 1986. Within Idaho, numerous tribal fisheries have occurred on the USR since the mid 1980's and tribal harvest estimates have ranged from zero to 941 Chinook salmon (Figure 10). Only two sport fisheries have occurred on the USR since the inceptions of the program, one in 2008 and one in 2009



In 2008, Idaho sport anglers fished for 13,745 hours and harvested 388 fish. In 2009, Idaho sport anglers fished for 36,370 hours to harvest 779 fish (Figure 10).

Straying has been minimal for the USR hatchery stock. In most years, no strays have been recovered above or below LGD and the highest percentage of strays for any year was 0.59% in 1999. Estimates of strays are considered minimum as stray recoveries downriver are typically opportunistic at hatchery traps and on spawning grounds. There are areas where strays might not be recovered throughout the basin, but overall straying is still expected to be very low based on a long history of CWT recovery information.

Determining the beneficial use of hatchery-origin Chinook salmon from Sawtooth Fish Hatchery that return to the hatchery trap is a collaborative effort between IDFG and the tribes. The first priority for returning fish is to meet broodstock needs that include fish trapped across the entire run. In addition, considerable effort is made to maximize harvest opportunity for both sport and tribal fisheries by recycling fish through the fisheries when deemed appropriate. Fish from the trap can also be transferred to the tribes for ceremonial and subsistence (C&S) use, donated to food banks, or outplanted for natural spawning within the USR basin.

Overall, disease has not been a major issue at Sawtooth Fish Hatchery. As mentioned earlier, Ich resulted in a 60% loss of the broodstock in 2006. Ich is a more recent issue at Sawtooth Fish Hatchery and currently, adults being held for broodstock are treated with formalin three to seven times per week based on the water temperature. Whirling disease has been a concern at Sawtooth since a positive testing in the mid 1980's. As a precaution, fry are moved outside on river water later in the rearing cycle so that they are larger. Sawtooth Fish Hatchery uses Enzyme-Linked Immunosorbent Assay (ELISA) testing to cull females from the broodstock to reduce the incidence of Bacterial Kidney Disease (BKD). This culling method has proven to be very effective at limiting BKD at the Sawtooth Fish Hatchery.

Summary and Outlook for the Future

The USR 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 USR is not large enough to fully

integrate a 1.7 million smolt program, managers will maintain two broodstocks (integrated and segregated). Returns form 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. In recent years there has been some progress in rebuilding fisheries 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. Efforts to monitor the status and trends of the natural population in the USR will also continue.

The USR Chinook salmon program will continue to support both harvest and conservation objectives, continue to mitigate for lost sport and tribal fishing opportunity, and expand 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 are incorporating suggestions generated through the Hatchery Scientific Review Group (HSRG) and Hatchery Review Team (HRT) review processes.