Clearwater River Spring Chinook Salmon

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Background

The Clearwater River spring Chinook salmon program was established to provide mitigation for losses of spring Chinook salmon associated with the construction and operation of the four lower Snake River hydroelectric dams. Infrastructure for this program includes a rearing hatchery and three satellite facilities used for adult trapping and broodstock collection. The Clearwater Fish Hatchery is located on the North Fork Clearwater River in Ahsahka, Idaho and was completed in 1992. The Powell satellite facility is located on the upper Lochsa River and was completed in 1989. The Red River satellite is located on the upper Sour Fork Clearwater River and was completed in 1976 as part of the Columbia River Fisheries Development Program and was updated in 1986 as part of the LSRCP mitigation program. The Crooked River satellite facility is located on Crooked River in the South Fork Clearwater River and was completed in 1989. The relative locations of the hatchery and three satellite facilities are shown in Figure1. The Lower Snake River Compensation Plan (LSRCP) adult mitigation goal for the Clearwater Fish Hatchery is 11,900 adult Chinook salmon above Lower Granite Dam (LGD) and 47,600 adults available for downriver (Columbia and lower Snake rivers) harvest. The original smolt release goal of 1.4 million yearling smolts was based on a 0.87% smolt-to-adult survival rate applied to the LGD adult mitigation objective. The distribution of the release goal is 700,000 smolts at Red River, 335,000 smolts at Crooked River, and 335,000 smolts at Powell. However, the current juvenile release from Clearwater Fish Hatchery is 2.335 million smolts and 300,000 parr. The distribution of the actual release is 235,000 smolts at Clear Creek, 400,000 smolts to the lower Selway River, 400,000 smolts to Powell, 1.1 million smolts to Red River, 200,000 smolt transferred to the Nez Perce Tribal Hatchery, and 300,000 parr to the upper Selway River.

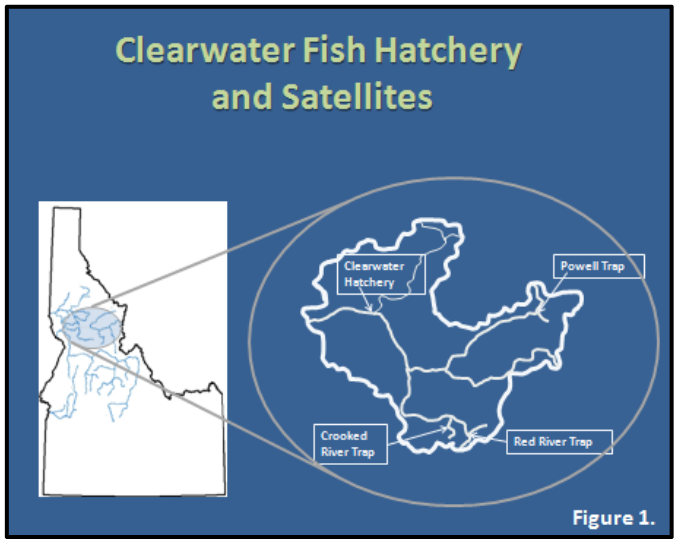


Figure 1.

Management and Monitoring/Evaluation Objectives

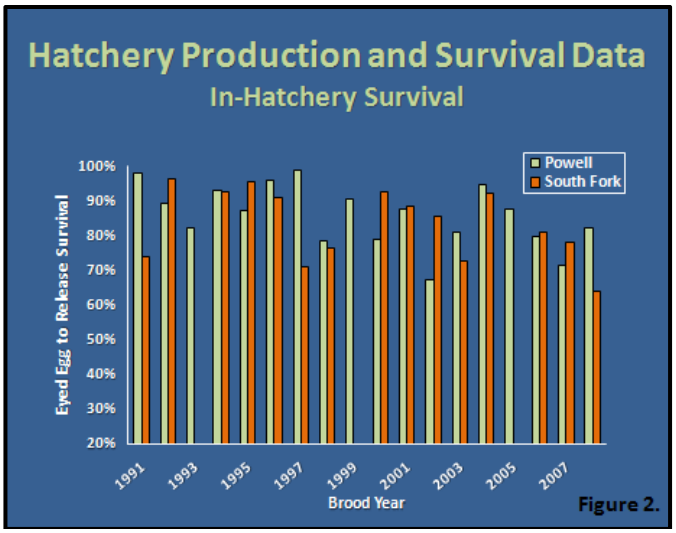
Statewide management objectives include restoring and maintaining natural populations of Chinook salmon in the Clearwater River. Management Objectives for the Clearwater Chinook salmon hatchery program are to meet the LSRCP adult mitigation objectives, to restore and maintain recreation and tribal Chinook salmon fisheries, and to minimize the impact of the hatchery program on the natural Chinook salmon production in the Clearwater River. Monitoring and evaluation (M&E) objectives for the Clearwater River program 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 activities in the Clearwater and South Fork Clearwater rivers are a cooperative effort between the Idaho Department of Fish and Game (IDFG), the Nez Perce Tribe (NPT), and the U.S. Fish and Wildlife Service.

Broodstock History

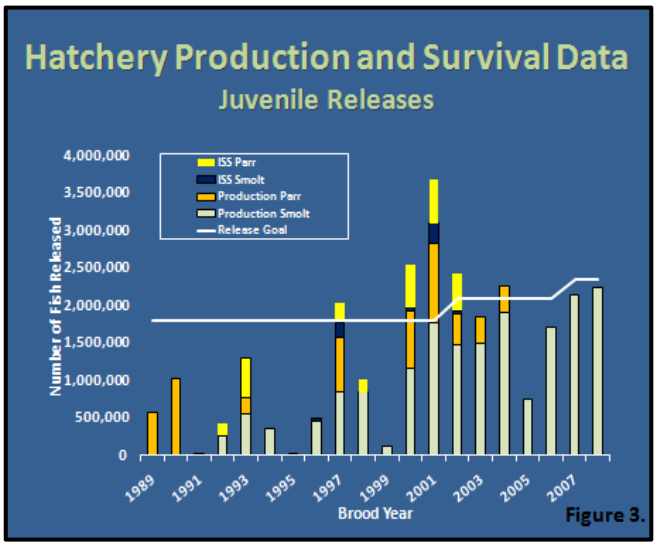
The construction of Lewiston Dam in 1927 on the Clearwater River four miles upstream of the mouth virtually eliminated natural populations of Chinook salmon. Adult passage improvements were made in the 1940's and the dam was removed in 1973. In addition, Harpster Dam was constructed on the South Fork Clearwater River (SFCR) in 1910 and blocked all passage of fish into the upper reaches of the South Fork Clearwater River. That dam was removed in 1963. Reintroduction efforts began in the 1950's and ramped up in the 1970's. These reintroductions consisted primarily of Rapid River stock but also included some Dworshak, Kooskia, Carson, and Cowlitz stocks. Since the mid 1990's, localized SFCR and Powell stocks have been collected at the satellite facilities. In years were there are not enough returns to meet production, backfilling occurs between the two stocks or from Rapid River Fish Hatchery. Because not all hatchery releases were differentially marked or tagged until brood year 1991, de facto integration/supplementation occurred in the Clearwater River until 1995. From 1995 to present, hatchery releases have been differentially marked and production broodstock have been segregated. From brood year 1991-2002, the Idaho Supplementation Study (ISS) research study was conducted in the Clearwater River basin 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. Since 2002, all hatchery production has utilized only segregated hatchery-origin broodstock. The natural populations of Chinook salmon in the Clearwater River are not part of the Snake River spring/summer ESU and are not included in the ESA listing.

In-Hatchery and Post Release Survival

Broodstock performance for the life of the hatchery has been good with mean prespawn mortality rates ranging from 5-12% for both males and females across both stocks. In-hatchery survival has been high across the history of the program with a mean survival of 85% (min- 64%, max-98%) (Figure 2).



Juvenile releases from Clearwater Fish Hatchery have fluctuated greatly over the history of the program from a low of 14,300 smolt/parr released from brood year 1991 to a high of over 3,680,000 smolt/parr released from brood year 2001 (Figure 3). Over the last ten years, managers have prioritized increasing the Chinook salmon smolt release numbers at Clearwater Hatchery in an effort to increase the number of adult returns. Some of the rearing space that was initially programmed for steelhead rearing has been prioritized for Chinook salmon. Prior to brood year 2002, a significant proportion of the total production at Clearwater Hatchery was composed of subyearling parr and presmolt releases. Low observed post-release survival rates from these releases prompted the discontinuation of this release strategy in favor of yearling smolts. One exception is a 300,000 parr release in the upper Selway River that is not accessible by ground transport in the spring to allow a smolt release.



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 from release to LGD

has ranged from 36-86% for the Powell stock and 37–74% for the SFCR stock at Red River and Crooked River. Survival of subyearling parr is considerably lower and has ranged from 0.06 – 12%.
Estimated survival of natural-origin smolts has ranged from 23 – 84% across the basin (Figures 4 and 5).

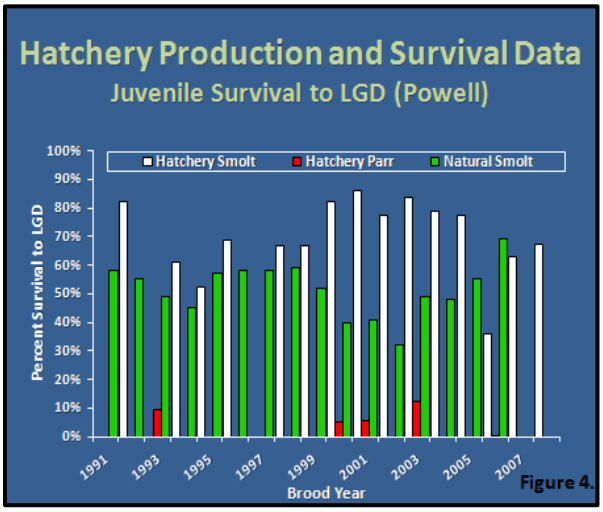


Figure 4.

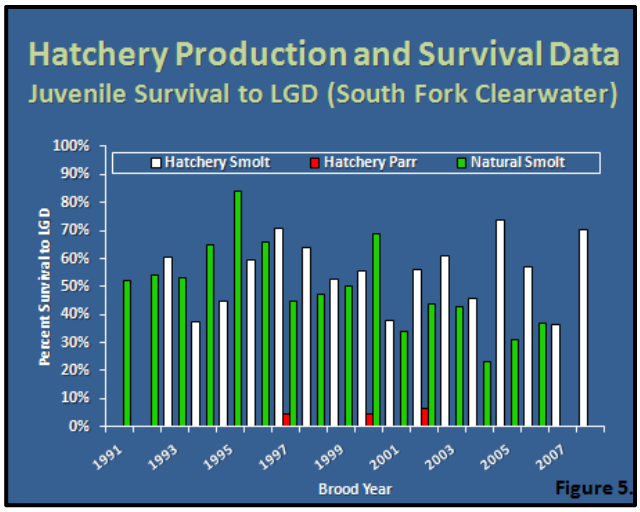


Figure 5.

The number of adults surviving annually to the Columbia River mouth 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, have ranged from 15 (1 adult, 14 jacks) fish in return year 1995 to 11,092 (9,864 adults, 1,228 jacks) in 2008 (Figure 6). The record return in 2008 for this program represents 18.6% of the total mitigation objective.

Adult returns to LGD ranged from 14 (1 adult, 13 jacks) fish in return year 1995 to 6,902 (5,680 adults, 1,222 jacks) in 200 (Figure 7). Across the life of the Clearwater Fish Hatchery program, the LSRCP mitigation goal at LGD has ever been reached.

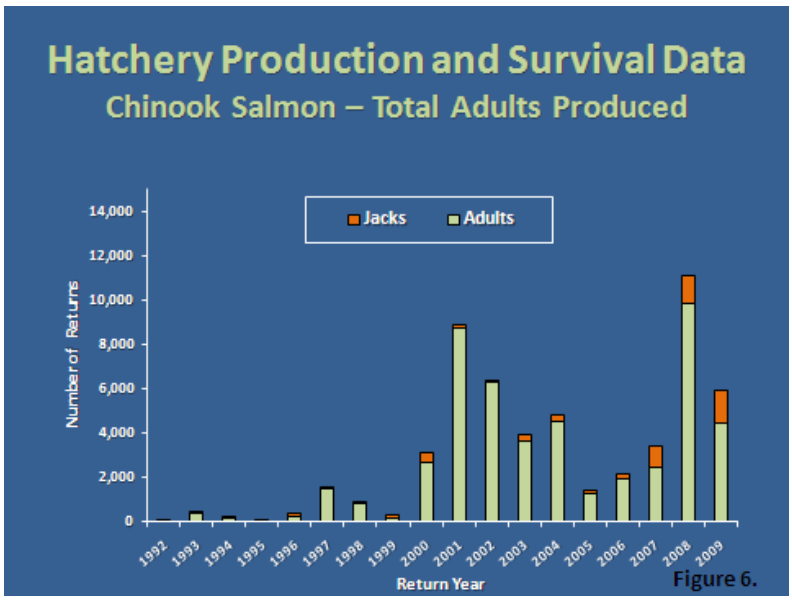


Figure 6.

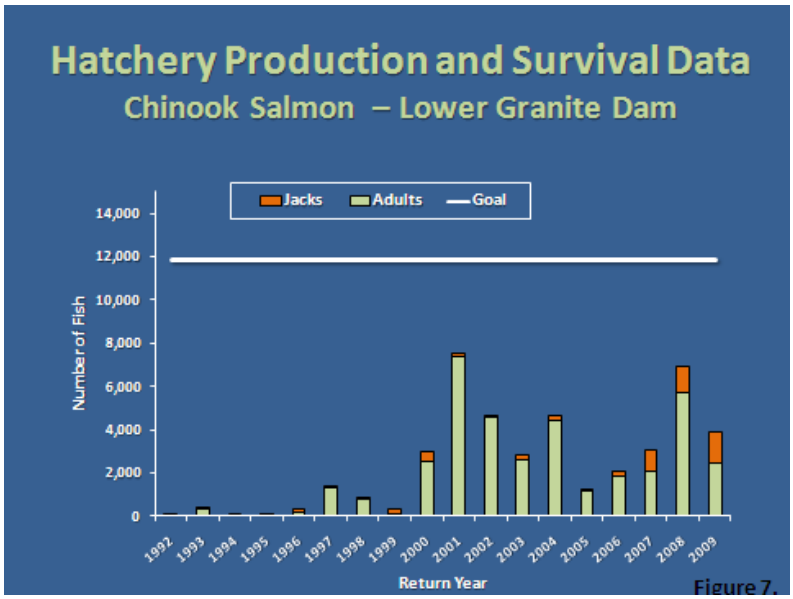


Figure 7.

Smolt-to-adult survival (SAS) and smolt-to-adult returns (SAR) rates were very low for brood years through the early-1990s and has ranged from (0.06-1.2%) over the entire history of the program (Figures 8 and 9). The modeled 0.87% SAR to LGD was only achieved in two years (Figure 9). It is important to note that the modeled 0.87% SAR is post downstream 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 1.2% for brood year 1997.

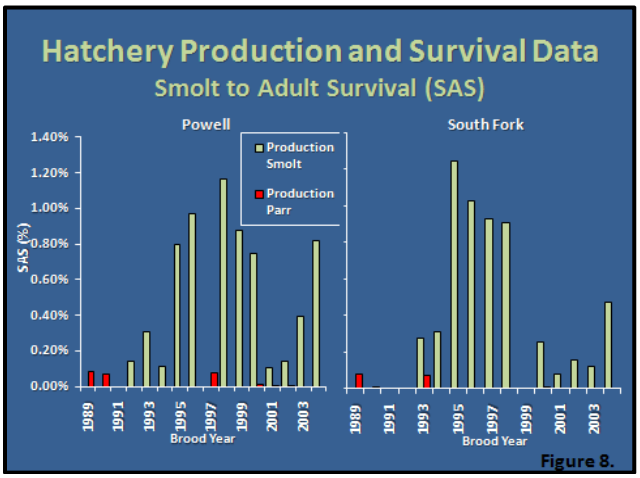


Figure 8.

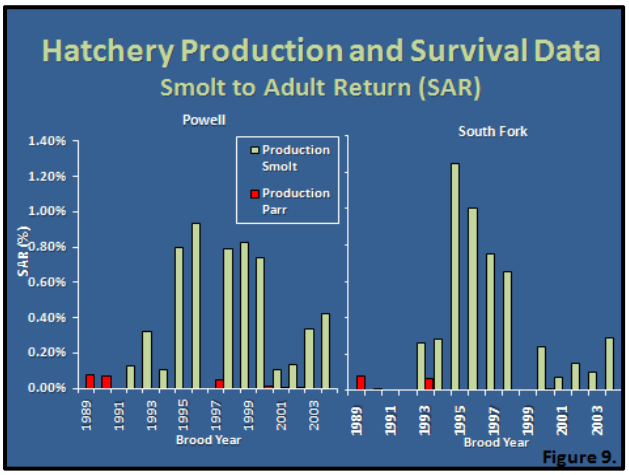


Figure 9.

Life History Characteristics of the Hatchery and Natural Populations

The average (1997-2009) cumulative adult run timing of hatchery- and natural-origin fish to the SFCR trap is similar (Figure 10). Run timing of hatchery-origin Chinook to the Powell Satellite facility is similar to that at the SFCR. The Powell Satellite trap is on Walton Creek, a small tributary to the Lochsa River. There is no natural population in Walton Creek so no comparison of natural-origin Chinook salmon run timing is provided for the Powell stock.

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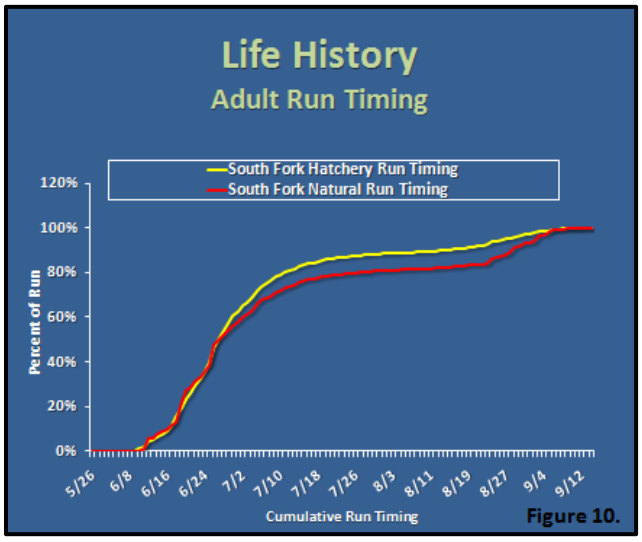
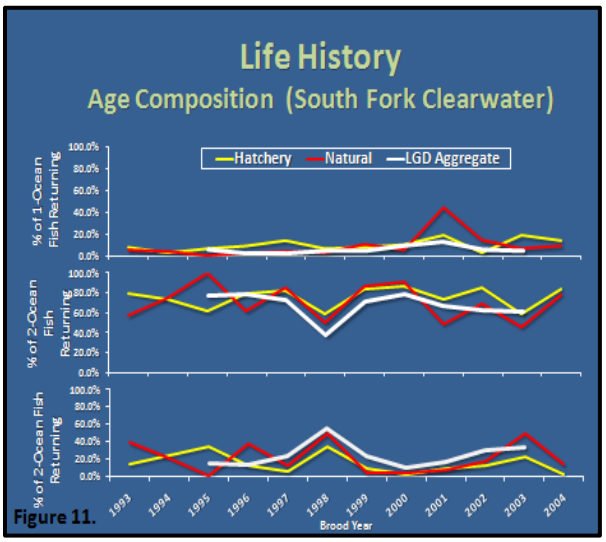
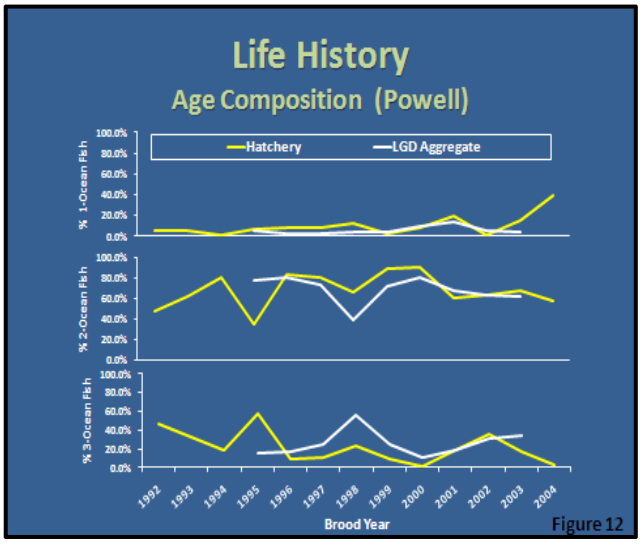


Figures 11 and 12 show the estimated age composition of the adult returns to the SFCR and Powell traps for brood years 1993-2004. Over this period, there were no significant trends in age composition for either the hatchery or natural populations in the SFCR. For the Powell stock, a significant increase in the proportion of age-3 hatchery fish was observed and was driven primarily by the brood year 2004 return. The aggregate natural-origin population at LGD is also shown in both Figure 11 and Figure 12 and shows synchrony with regards to annual fluctuations of the age compositions indicating that environmental conditions are likely a key driver for this life history metric. Similar to other hatchery programs, hatchery-origin adults from the SFCR and Powell return younger than the natural populations for most years.





Length-at-age of male and female hatchery-origin fish returning to Powell and both hatchery- and natural-origin male and female returns to the SFCR are displayed in Figures 13 and 14. No significant trends in length-at-age were detected for any of the age classes from either the SFCR or Powell hatchery stocks. However, regression slopes of all age/gender combinations for the SFSR hatchery stock were

negative. 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.

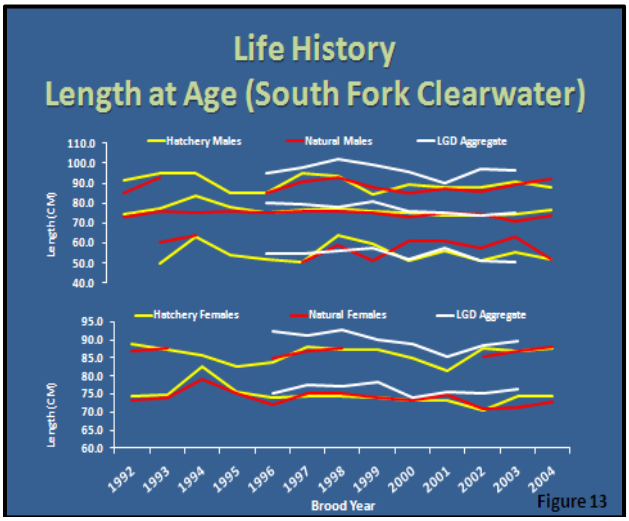


Figure 13

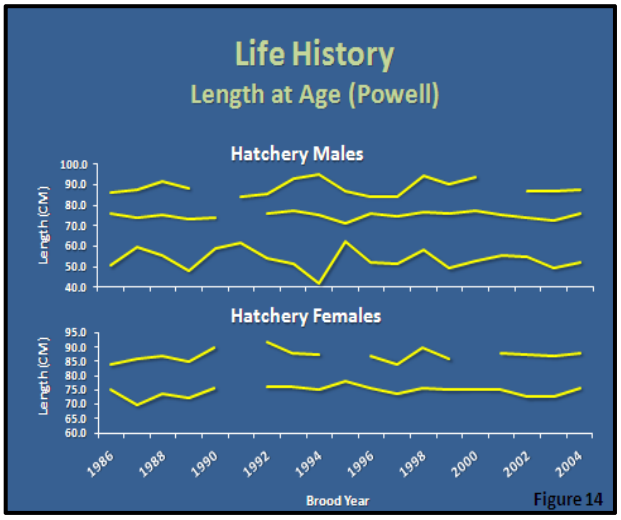


Figure 14

In addition to the above life history characteristics, we also looked at spawn timing and fecundity of hatchery-origin Clearwater River Chinook salmon over time. For brood years 1990-2006 no significant trend in mean spawn time was observed for either stock. Mean fecundity for Powell and SFCR stocks is 4,279 (range: 3,456-5,259) and 4,194 (range: 3,459-5,249) respectively. A significant negative trend in fecundity for the Powell stock was observed. Annual fluctuations in fecundity are generally associated with varying proportions of two and three ocean females in the adult return.

Contribution of Hatchery Fish to Fisheries

The estimated number of Chinook salmon harvested in the Columbia River and in the Snake River below LGD has ranged from zero in some years to 4,173 in 2008. The estimated harvest in 2008 represents an exploitation rate of 42%. Within Idaho, tribal fisheries have occurred on the Clearwater River sporadically throughout the history of the program though data available at the time of this report was very limited. Tribal harvest estimates have ranged from zero to 467 Chinook salmon (Figure 15). The first sport fishery since the inception of the hatchery program occurred in 1997 and with the exception of 1999, sport fisheries have occurred every year since then. The estimated number of fish harvested annually has ranged from zero (for fisheries in the Lochsa and SFCR) in 1997 to 7,033 fish in 2001 (Figure 15). For the period 1997-2010 average angler effort for recreational Chinook salmon fisheries in the Clearwater River drainage has averaged 90,343 angler hours per year (range: 7,227 - 307,681) not including effort for the fishery in the North Fork Clearwater River which is associated with production from Dworshak National Fish Hatchery. It should be noted that effort estimates provided above include effort associated with fish released from Kooskia and Nez Perce Tribal fish hatcheries due to the mixed stock nature of the fishery.

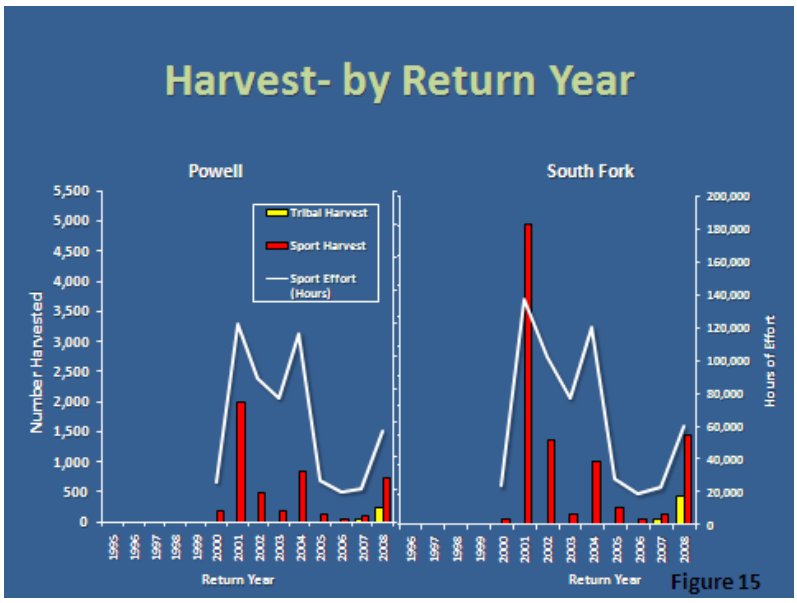


Figure 15

Stray rates observed for the Clearwater Fish Hatchery stocks have been higher than observed in other Chinook salmon hatchery programs in Idaho but are still less than 6% for most years. The above average stray rates observed in areas upstream of LGD are most likely associated with the release strategy used for most years in the program that included a significant proportion (up to 100% is some years) of the total production devoted to subyearling parr and presmolt releases. Since brood year 2004, 90% of the releases have been full term yearling smolts. Stray rates in the areas below LGD have ranged from 0.0-5.8% but were below 2% for most years. It should be noted that estimated stray rates are minimum estimates as recoveries of strays downriver are typically opportunistic at hatchery traps and on spawning grounds. There are other areas where strays might not be recovered throughout the basin, but overall straying is still expected to be very low.

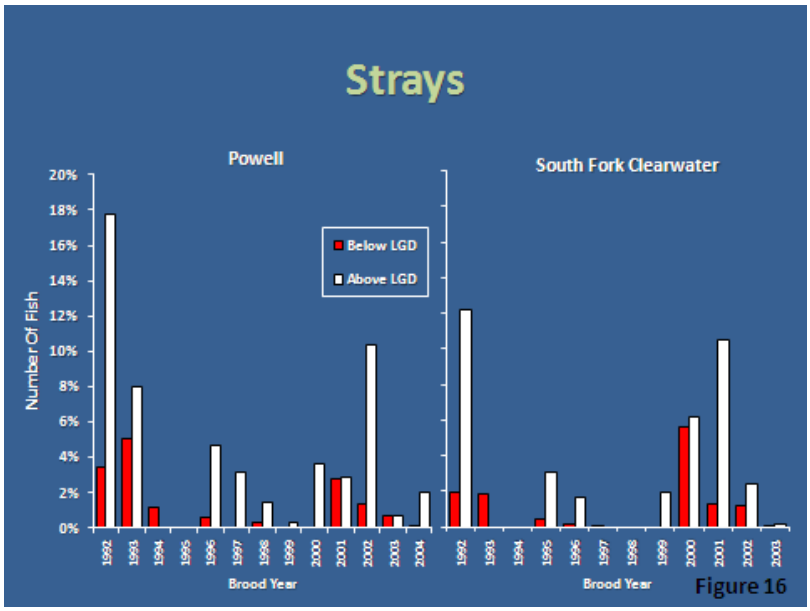


Figure 16

Determining the beneficial use of Clearwater Fish Hatchery Chinook salmon that escape fisheries and return to the satellite traps is a collaborative effort between IDFG and the tribes. The first priority for fish returning to hatchery traps is to meet broodstock needs with a representative take across the run. In addition, an 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 traps may also be transferred to the tribes for ceremonial and subsistence (C&S) use, given to food banks, or outplanted for natural spawning within the Clearwater basin.

Overall, disease has not been a major issue at the Clearwater Fish Hatchery and there have been few significant losses due to disease. Early on*, Ichthyophthirius multifiliis* (Ich) was more prevalent, but it has not been an issue since 2000. Similarly to other anadromous hatchery programs in Idaho, Clearwater Hatchery employs a culling program to reduce the incidence of Bacterial Kidney Disease (BKD). This culling method has proven to be so effective at limiting BKD at the Clearwater Fish Hatchery that medicated erythromycin feedings are no longer used.

Summary and Outlook for the Future

The Clearwater River program will continue to be managed to meet the management objectives outlined in this report. Efforts will continue to be made to restore and maintain sport and tribal fisheries. There has been significant rebuilding of these fisheries since 1997 but future fisheries will be highly dependent on post release survival. In general, we have observed consistently high survival during hatchery culture, highly variable post-release survival, poor survival of subyearling releases, and an upswing is post-release survival since the mid 1990s. To facilitate achieving the mitigation objective, the development of a summer run of Chinook salmon has been initiated in the SFCR with plans to expand this program to the Selway River. There is anecdotal evidence to suggest that wild populations in the Clearwater River contained a summer run life history. The hope of this program is to expand harvest opportunity and potentially increase survival rates for this hatchery program.

The outlook for M&E includes continued monitoring of hatchery production and productivity. 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. Future M&E plans also include continued monitoring of natural populations throughout the basin both above and below weirs where appropriate.

The Clearwater River Chinook salmon program will continue to support both harvest and conservation objectives, mitigate for lost sport and tribal fishing opportunity, and expand coordination efforts 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) processes.