Grande Ronde Basin Spring Chinook Salmon Hatchery Review: Introduction and The Early Years

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INTRODUCTION AND BACKGROUND

This paper provides background information, program development history, and assessment of early program performance of the Grande Ronde basin spring Chinook salmon Lower Snake River Compensation Plan (LSRCP) hatchery program. We cover the period from initiation of the program in the late 1970s through the late 1990s, when significant hatchery reform measures were implemented in response to ESA listing and other policy influences. Separate papers are presented that review the recent performance of the Upper Grande Ronde River, Catherine Creek and the Lostine River Spring Chinook hatchery programs.

The Grande Ronde basin historically supported diverse and robust populations of Chinook salmon *Oncorhynchus tshawytscha*. Abundant runs supported tribal and recreational fisheries throughout the basin. The recreational fisheries closed in the mid-1970s due to the depressed status of the populations and limited tribal fishing occurred from the mid-1970s - 1990s.

The Grande Ronde basin is located in Northeast Oregon, originating in the Wallowa and Blue mountains. The river flows 340 km from the headwaters to the confluence with the Snake River at rkm 271. Historically the primary production areas included the Wenaha, Minam, Lostine, Wallowa and the Upper Grande Ronde rivers and Lookingglass and Catherine creeks (Figure 1).

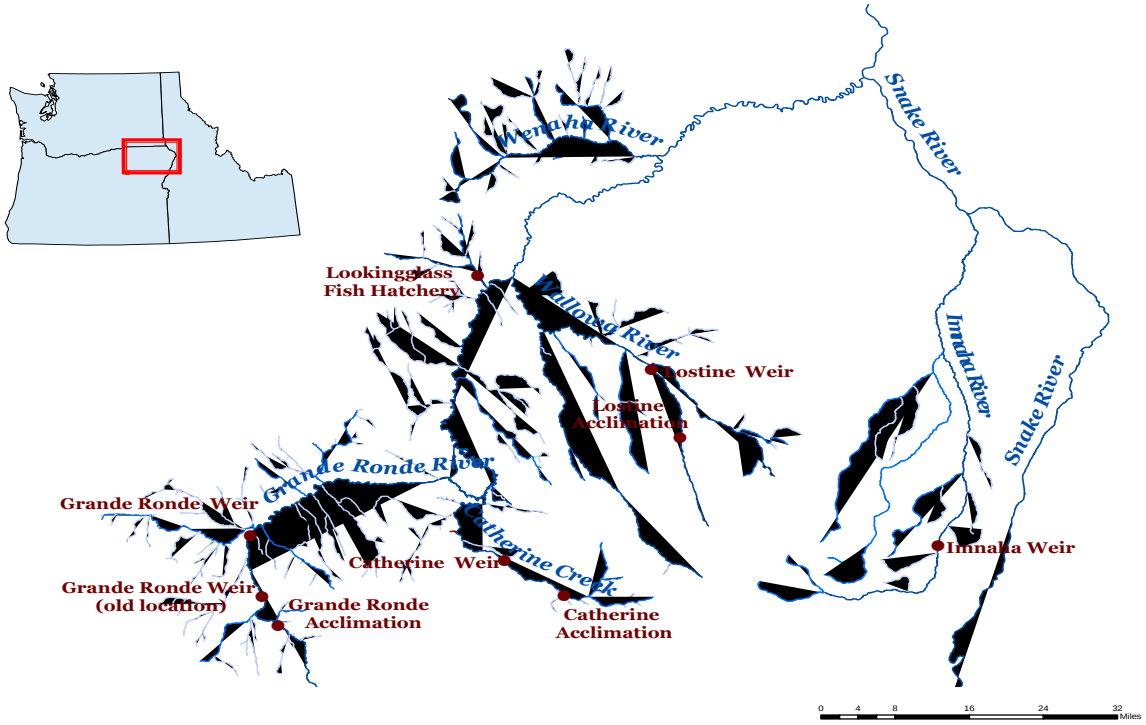

Figure 1. Map of the Grande Ronde River basin including major spring Chinook salmon production areas and hatchery facilities.

Table 1. Lower Snake River Compensation Plan mitigation goals for Oregon's spring Chinook salmon in the Grande Ronde River basin. Adult and survival goals are expressed for returns to the compensation area and total catch plus escapement.

Category	Goal
Compensation Area	
Annual smolt goal	900,000 Smolts
Annual pounds of production	45,000 lbs.
Annual adult goal	5,820 Adults
Brood year smolt–to-adult return rate (SAR)	0.65%
Total Catch and Escapement	
Annual adult goal	29,100
Brood year smolt-to-adult survival rate (SAS)	3.25%

The Grande Ronde Basin LSRCP spring Chinook salmon program was established in the late 1970s in response to the severe declines that occurred in the mid-1970s and the depressed status of all populations in the basin. Annual adult mitigation, broodyear specific smolt-to-adult return and total survival rates, and annual smolt production goals were established to compensate for the estimated annual loss of 48% of the basin adult production.

The adult and smolt-to-adult return goals for the compensation area represent the required performance to the area above Lower Granite Dam. The total annual adult and smolt-to-adult survival rate goals were determined based on an assumed four-to-one catch to escapement ratio that existed prior to construction of the four Lower Snake River Dams.

Prior to the development of the program, the Oregon Department of Fish and Wildlife developed six management objectives to guide implementation of the program including; 1) establish adequate broodstock to meet annual production needs; 2) restore and maintain natural spawning populations of spring Chinook salmon in the Grande Ronde Basin; 3) reestablish historic tribal and recreational fisheries; 4) establish an annual return of 5,820 hatchery fish; 5) maintain endemic wild populations of spring Chinook salmon in the Minam and Wenaha rivers; and 6) minimize impacts of the hatchery program on resident stocks of game fish**.** These objectives guided implementation of the program for about the first 15 years. Lookingglass Fish Hatchery (LFH) was constructed in 1982 and serves as the central production facility for the program. The hatchery is located on Lookingglass Creek at rkm 3.7 (Figure 1). The program operations were initially simple with adult broodstock collected and spawned at LFH, incubation and rearing to smolt at LFH and smolt releases into Lookingglass Creek or at sites in tributaries elsewhere in the basin (Figure 2).

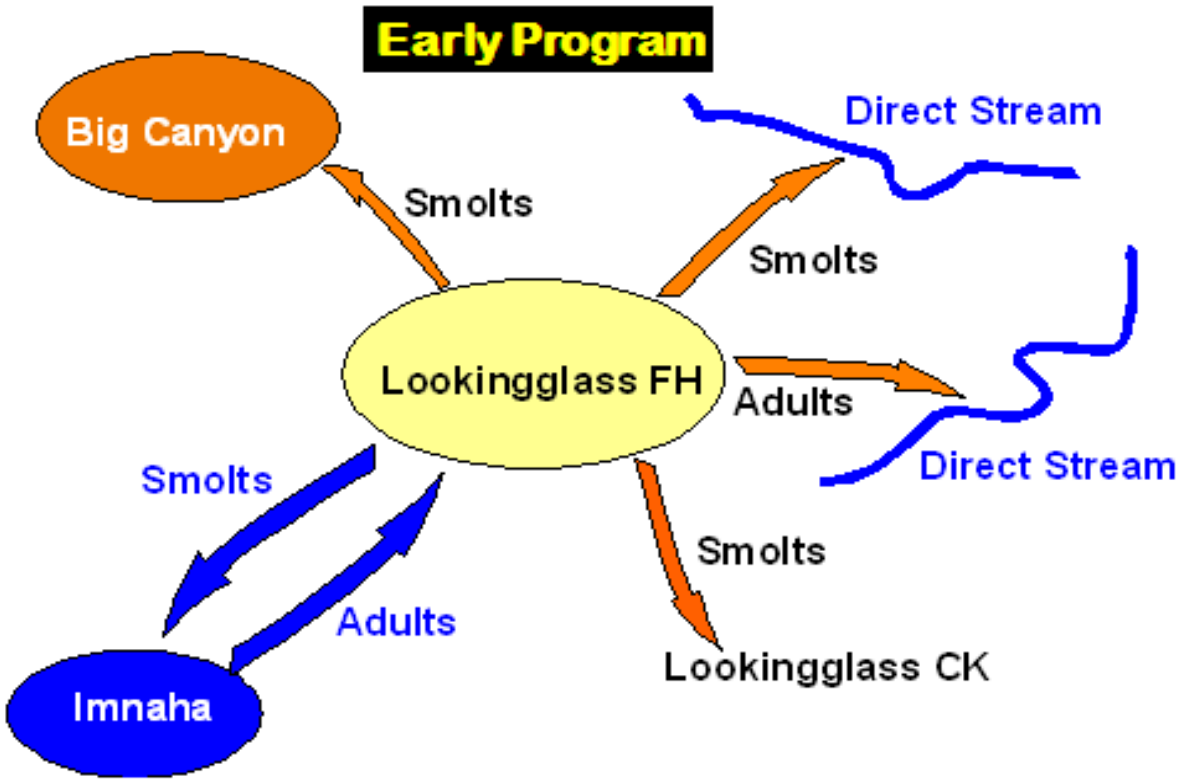

Figure 2. Diagram of initial hatchery program operations for spring Chinook salmon in the Grande Ronde basin.

A comprehensive research, monitoring, and evaluation (RM&E) program was initiated in 1984. The primary objectives for the RM&E included; 1) document and assess fish culture and hatchery operation practices; 2) determine optimum rearing and release strategies that will produce maximum survival to adult; 3) determine total catch and escapement and assess if adult production meets mitigation goals; and 4) determine the success of maintaining genetic integrity of endemic wild spring Chinook salmon in the Minam and Wenaha rivers.

PROGRAM ASSESSMENT

When considering options for broodstock sources in the late 1970s, managers believed, there were too few natural-origin fish available in the basin to meet broodstock needs. To initiate broodstock development, 1978 brood year Rapid River stock smolts were released into Lookingglass Creek. The use of Rapid River stock was discontinued from the 1980-84 brood years due to disease and availability. Carson stock, imported from the Willamette River Hatchery Program, was used in the interim until the 1985 brood year when Rapid River stock was brought into use again. Rapid River stock was used through the 1999 brood year when it was phased out.

Table 2. History of spring Chinook salmon broodstock sources used in the Grande Ronde basin spring Chinook hatchery program, 1978-1997 brood years.

Brood year	Stock Source
1978	Rapid River
1980-84	Carson / Willamette Hatchery
1985-87	Carson/ Lookingglass Hatchery Rapid River Idaho
1988	Rapid River / Idaho
1989	Carson/ Lookingglass Hatchery Rapid River Idaho
1990-99	Rapid River/ Lookingglass Hatchery

Lookingglass Fish Hatchery produced and released presmolts and smolts in the early production years. Total production from LFH met the production goal of 900,000 for most brood years from 1983-1992 (Figure 3).

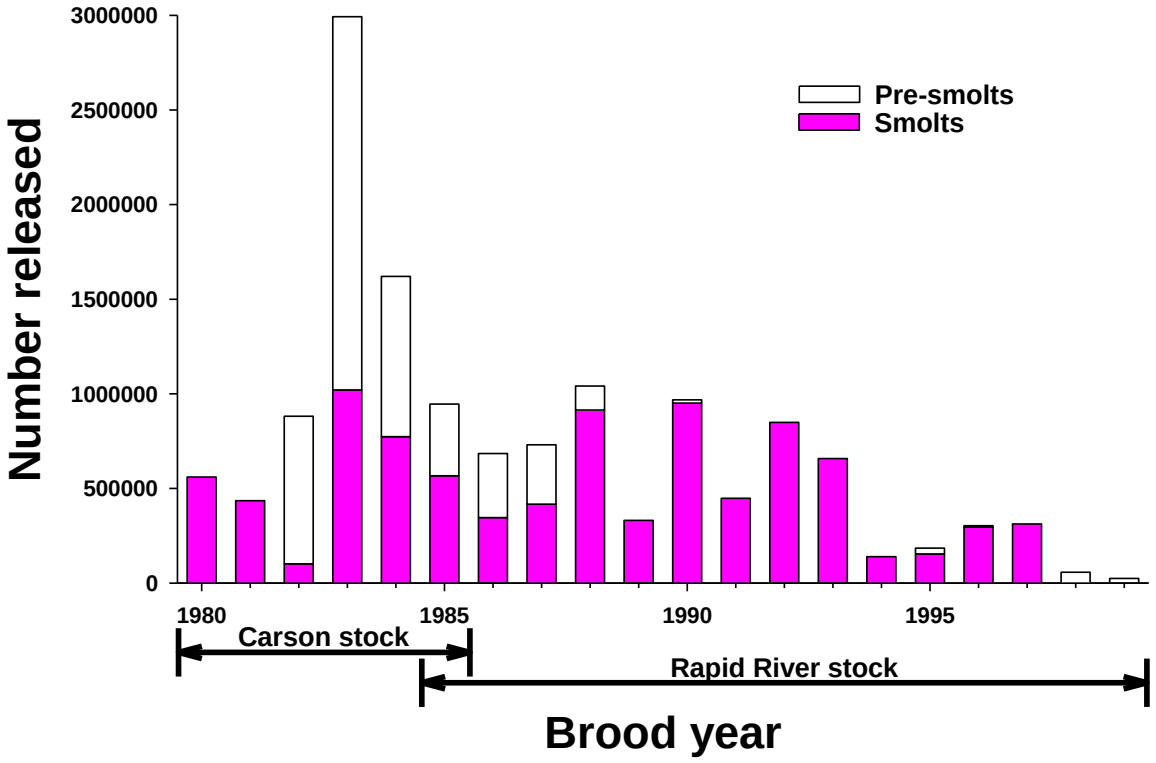

Figure 3. Releases of Carson and Rapid River stock hatchery spring Chinook salmon in the Grande Ronde River basin, 1980-1999 brood years.

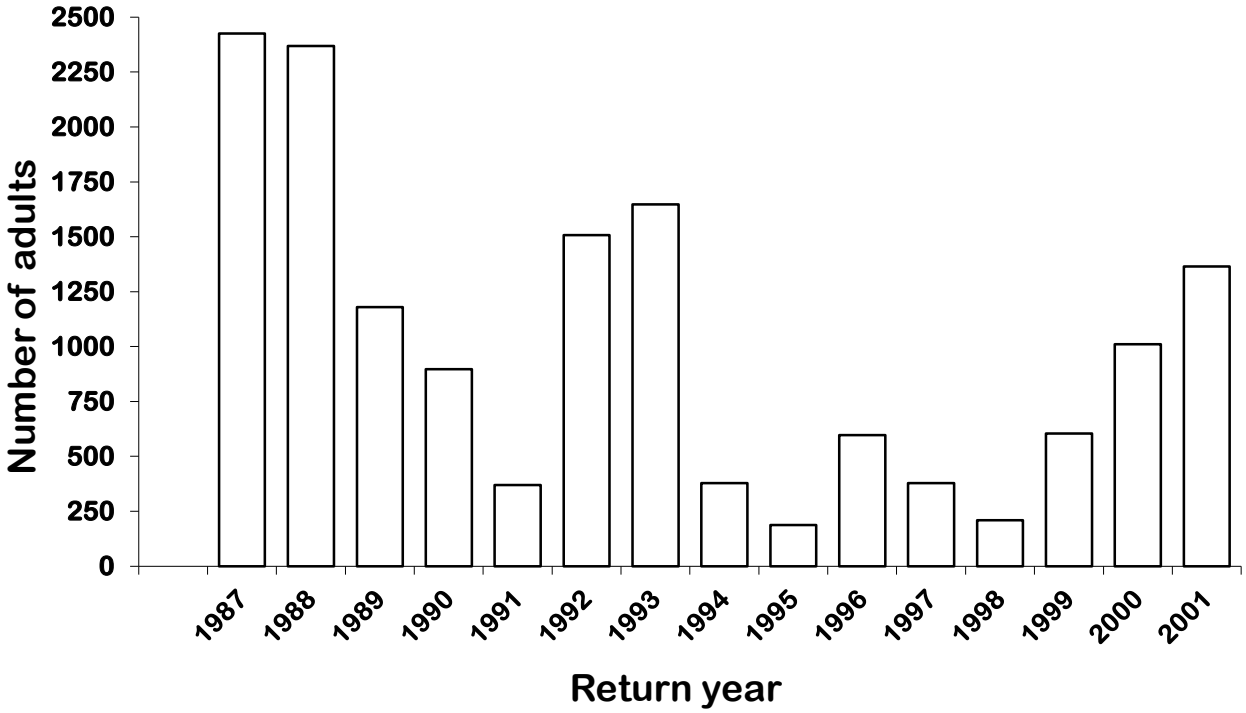

Figure 4. Annual spring Chinook salmon adult returns to the LSPCP area resulting from releases in the Grande Ronde basin, 1987-2001. The goal is 5,820 adults.

Most releases occurred at LFH, however supplementation releases of pre-smolts and smolts occurred in Catherine Creek and Upper Grande Ronde River for the 1980-1988 brood years and surplus Carson stock adults were outplanted into Catherine Creek, Upper Grande Ronde River and the Wallowa River from 1987-1989. Annual adult returns to the compensation area were generally well below the mitigation goal of 5,820 from 1987-2001 with the highest return reaching 42% of the goal (Figure 4). Smolt-to-adult survival and return rates were generally poor and the return rate goal of 0.65% was reached in only two of thirteen years for the 1985-1997 brood years (Figure 5).

We monitored the proportion of natural spawners that were hatchery strays in the Minam and Wenaha rivers to assess the success in meeting the management objective of maintaining these populations as endemic-wild. Stray hatchery adults from LFH releases comprised a majority of the spawners in these populations for many years from 1986-1994 (Figure 6). The estimated stray rates into these unsupplemented areas were high, exceeding 25% in some years (Figure 7).

The early years of hatchery operation and the results of monitoring the performance of the program in achieving priority management objectives provided critical conclusions about the success. Importing Carson and Rapid River Hatchery stocks to quickly build brookstock allowed smolt production goals to be met quickly and consistently. Smolt-to-adult return rates were poor, resulting in adult returns to the compensation area that were consitently below the goal. Sufficient numbers of adults were not consistently available to reestablish recreational fishing.

Tribal fishing opportunties were provided in only a few years and in restricted locations. Stray rates for hatchery fish were high and hatchery strays represented a high proportion of natural spawning fish in the Lostine, Minam and Wenaha rivers. Natural population status in supplemented populations was severly depressed and supplementation efforts had failed as indicated by poor recruits-per-spawner and very low abundance of natural-origin spawners.

Two policy-based rulings in the early 1990s influenced the direction of the hatchery program. ODFW adopted a Wild Fish Management Policy in 1990, which established criteria for the maximum acceptable level of non-local origin hatchery spawners in natural populations. In 1992, natural spring Chinook populations were listed initially as endangered and later as threatened by the National Marine Fisheries Services (NMFS) under the ESA. Given the high proportion of stray hatchery spawners throughout the basin, the hatchery program was operating well outside the ODFW Wild Fish Policy criteria and was generating outcomes that were inconsistent with ESA recovery and sound conservation principles.

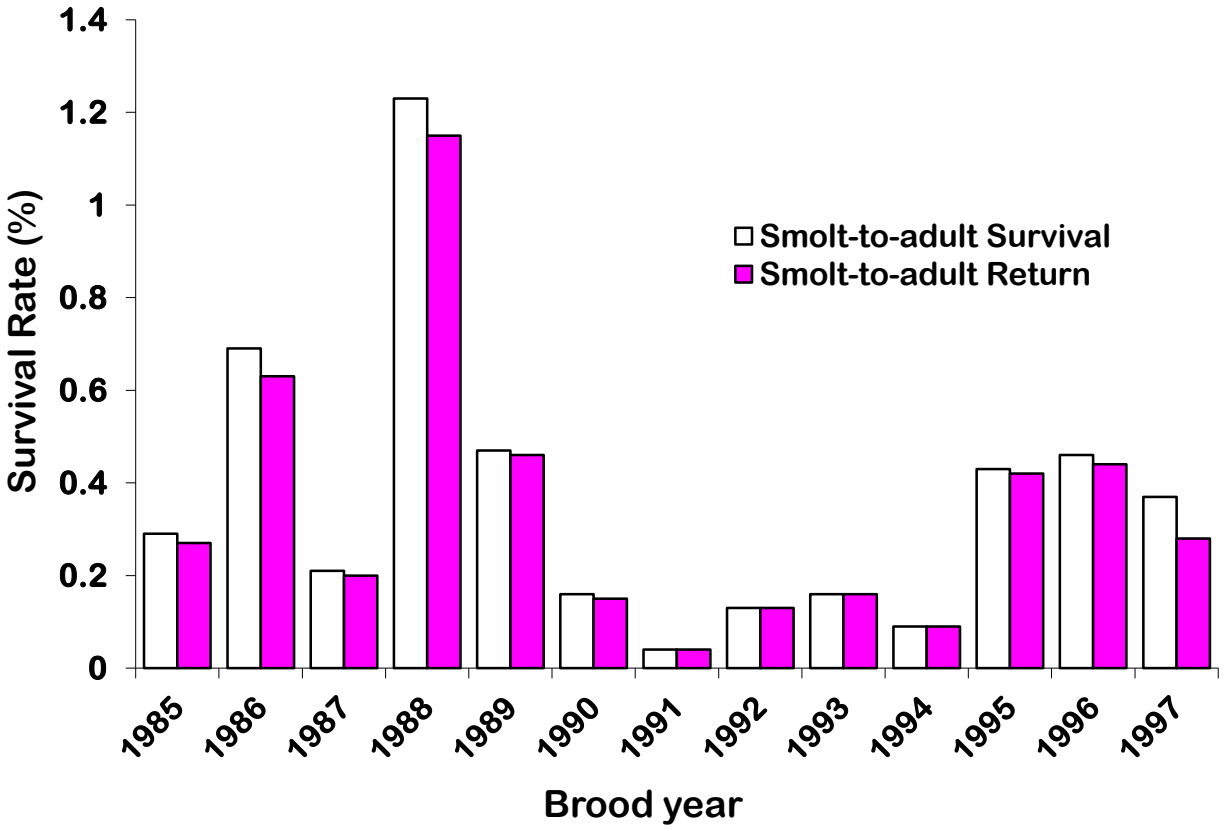

Figure 5. Smolt-to-adult survival and return rates for spring Chinook salmon smolts released in the Grande Ronde basin, 1985-1997 brood years.

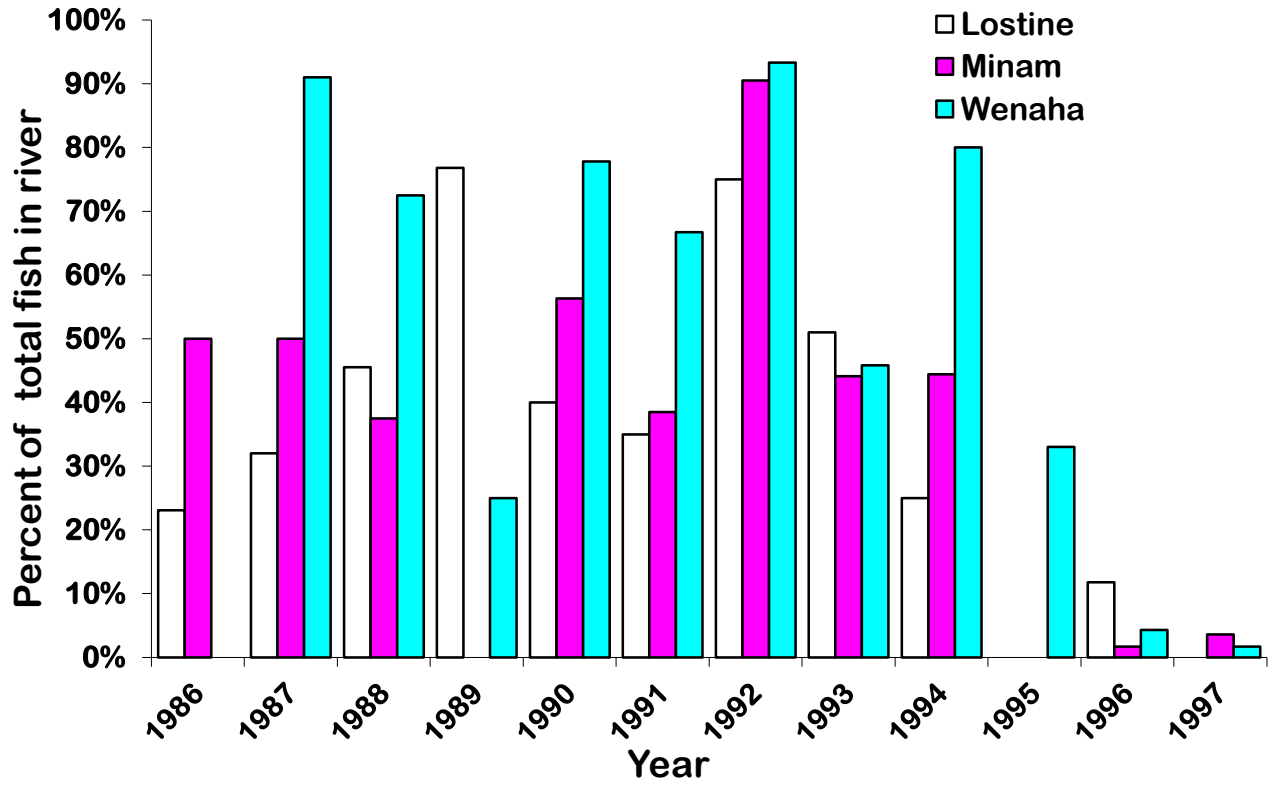

Figure 6. Percentage of naturally spawning fish in the Lostine, Minam, and Imnaha rivers that were Lookingglass Fish Hatchery-origin strays, 1986-1997.

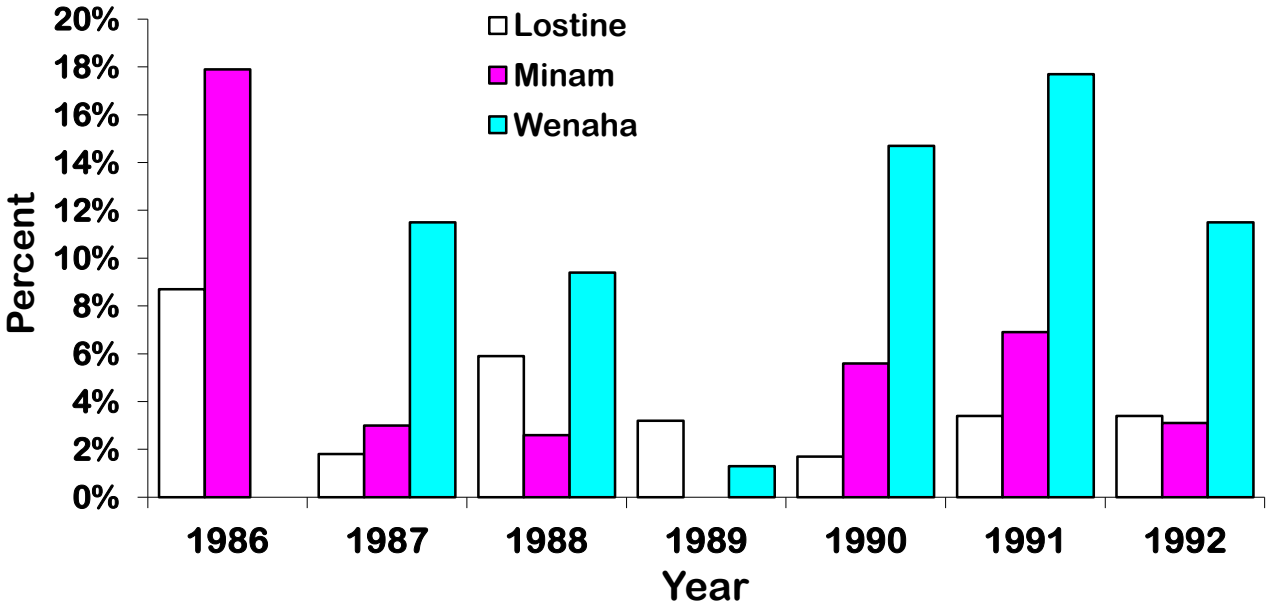

Figure 7. Stray rates of Lookingglass Fish Hatchery spring Chinook salmon into the Lostine, Minam and Wenaha rivers, 1986-1992.

Managers decided that significant hatchery reform measures were needed. However, information addressing critical uncertainties was required prior to developing hatchery reform approaches. The key information needs included: 1) What is the demographic status and the near term risk of extinction of Chinook salmon populations in the basin?; 2) What genetic effects had resulted from natural spawning non-local origin hatchery spawners?; and 3) How much genetic differentiation remained between natural populations and between hatchery and natural populations?

Natural-origin spawner abundance reached critically low levels throughout the 1990s. There were fewer than 50 spawners for numerous years in the Upper Grande Ronde River, Catherine Creek and Lostine River populations and spawner numbers fell below 10 in some populations (Figure 8). Recruits-per-spawner for Catherine Creek, Upper Grande Ronde River and Lostine River populations were below 1.0 for spawning years 1986-1993. Recruits-per-spawner for all three populations were above 0.5 in only two of the eight years (Figure 9).

Based on the status and trends in natural-origin abundance and productivity, we concluded that extinction risk was high. In addition, comprehensive genetic analyses indicated there was still significant genetic differentiation between hatchery and natural populations and between the Minam River, Wenaha River, Upper Grande Ronde River, Lostine River and Catherine Creek natural populations.

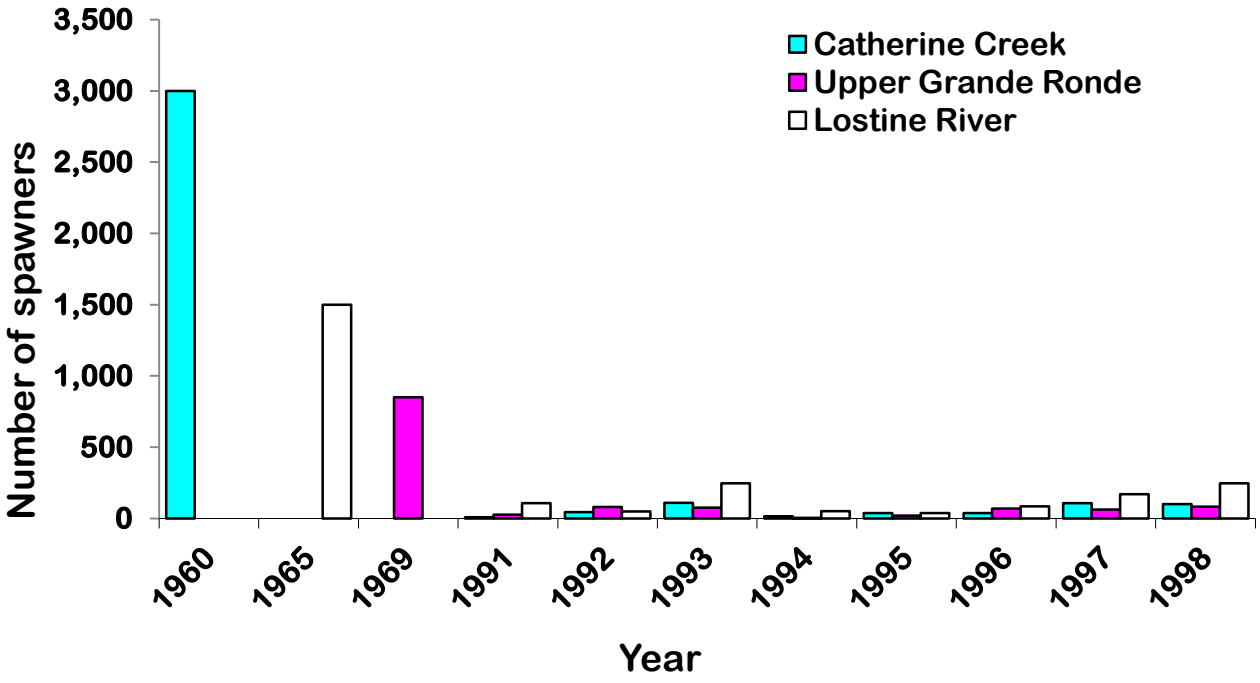

Figure 8. Natural-origin spawner abundance in Catherine Creek, Upper Grande Ronde River and Lostine River spring Chinook salmon populations. Pre-1990s data are presented for reference benchmarks.

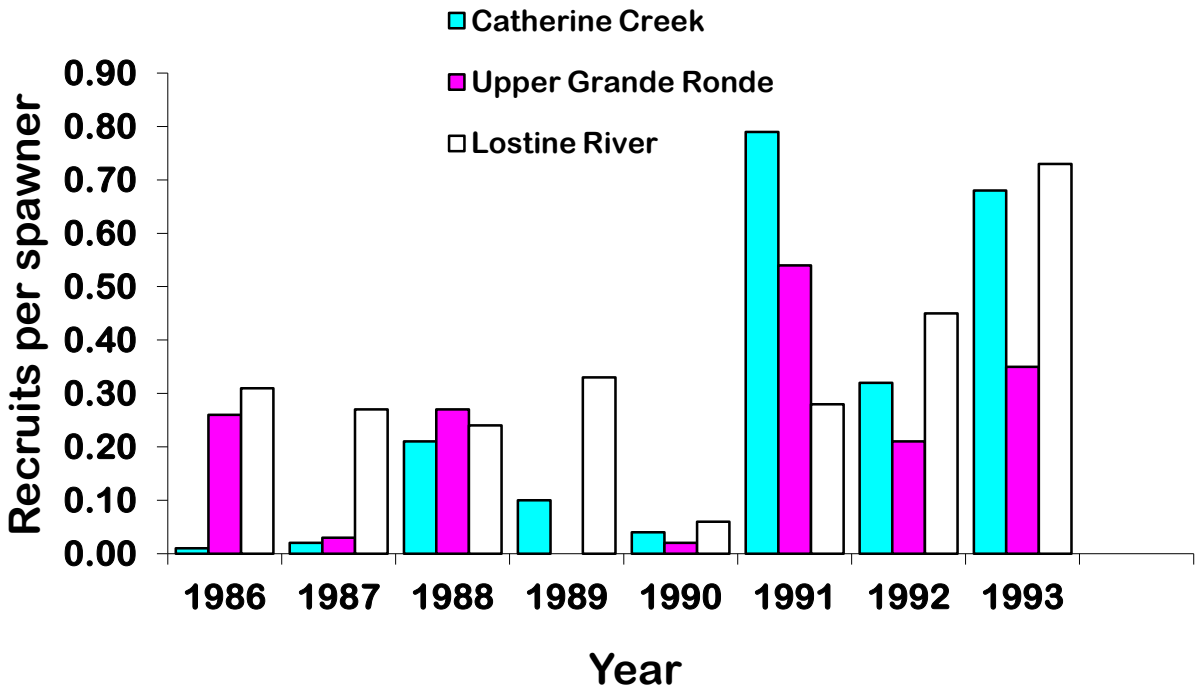

Figure 9. Recruits-per-spawner (spawner to spawner) for natural spawners in Catherine Creek, Upper Grande Ronde River, and Lostine River. Spawners include natural spawning hatchery and natural-origin fish and recruits are natural-origin only, 1986-1993 brood years.

There was consensus reached by co-managers that hatchery programs using endemic local broodstock should be initiated immediately in Catherine Creek, Upper Grande Ronde River and Wallowa-Lostine River populations. In addition, given the uncertainties associated with supplementation, a diversified risk management approach (low to high risk) should be employed and wild fish management sanctuaries should be maintained in the Minam and Wenaha river populations. Specific hatchery reform management actions that were taken, beginning in 1995, included the following: 1) eliminated releases of Rapid River stock Chinook salmon in the Grande Ronde Basin after the 1999 brood year and uniquely marked and conducted trap and removal of adults at Lower Granite Dam; 2) initiated captive broodstock program with collection of parr from Catherine Creek, the Upper Grande Ronde and Lostine rivers in 1995; 3) we began conventional supplementation programs (natural adult broodstock) in Catherine Creek (2001), the Upper Grande Ronde (2001) and Lostine (1997) rivers using sliding scale management strategies; 4) constructed acclimation and adult capture facilities on Catherine Creek and Upper Grande Ronde and Lostine rivers and made significant modifications to LFH; and 5) completed a comprehensive hatchery management and monitoring plan to guide programs into the future (NEOH).

The Interior Columbia Basin Technical Recovery Team (ICTRT) was formed in the mid-2000s, in part to identify independent populations, develop population viability criteria, and complete viability assessments. The ICTRT identified the Grande Ronde and Imnaha basin spring/summer Chinook salmon populations as a unique Major Population Group (MPG). A total of six independent populations were identified in the Grande Ronde basin, including the Wenaha River, Lookingglass Creek, Lostine-Wallowa Rivers, Minam River, Catherine Creek and the Upper Grande Ronde River. In addition, two populations were identified in the Imnaha Basin: Imnaha River and Big Sheep Creek. Both Lookingglass Creek and Big Sheep Creek populations were characterized as functionally extirpated and the status of the remaining six populations was assessed as high risk of extinction (Figure 10).

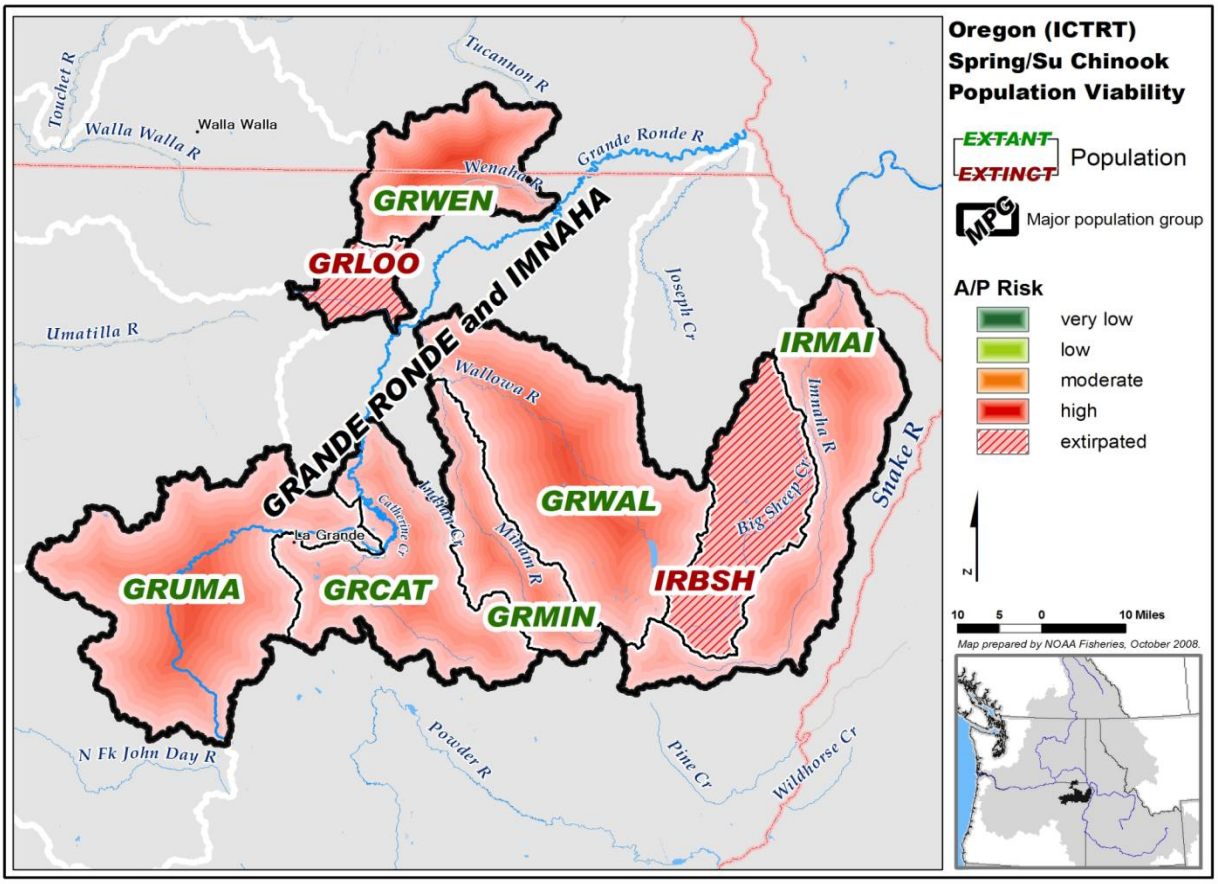

Figure 10. Viability status of spring/summer Chinook salmon populations in the Grande Ronde/ Imnaha Major Population Group (from ICTRT).

The ICTRT population designations paralleled the designations made by co-managers previously in the hatchery planning efforts completed in the mid-1990s. The initiation of local broodstock development and population specific hatchery programs resulted in the need to partition smolt and adult mitigation goals for each specific Grande Ronde basin Chinook hatchery program (Table 3). The implementation of population specific programs and captive broodstock added substantial complexity to the Grande Ronde basin Chinook hatchery programs.

Table 3. Population specific mitigation goals for Grande Ronde River basin spring Chinook salmon hatchery program.

Population	Goal	
Upper Grande Ronde River	250,000 Smolts	1617 Adults
Lookingglass Creek	250,000 Smolts	1617 Adults
Lostine River	250,000 Smolts	1617 Adults
Catherine Creek	150,000 Smolts	970 Adults
All programs	0.65% Smolt-to-Adult Return	

Implementation required the use of additional hatchery facilities and transport of adults and smolts to and from various locations. The complexity of the conventional and captive broodstock programs at the peak of implementation is illustrated by (Figure 11).

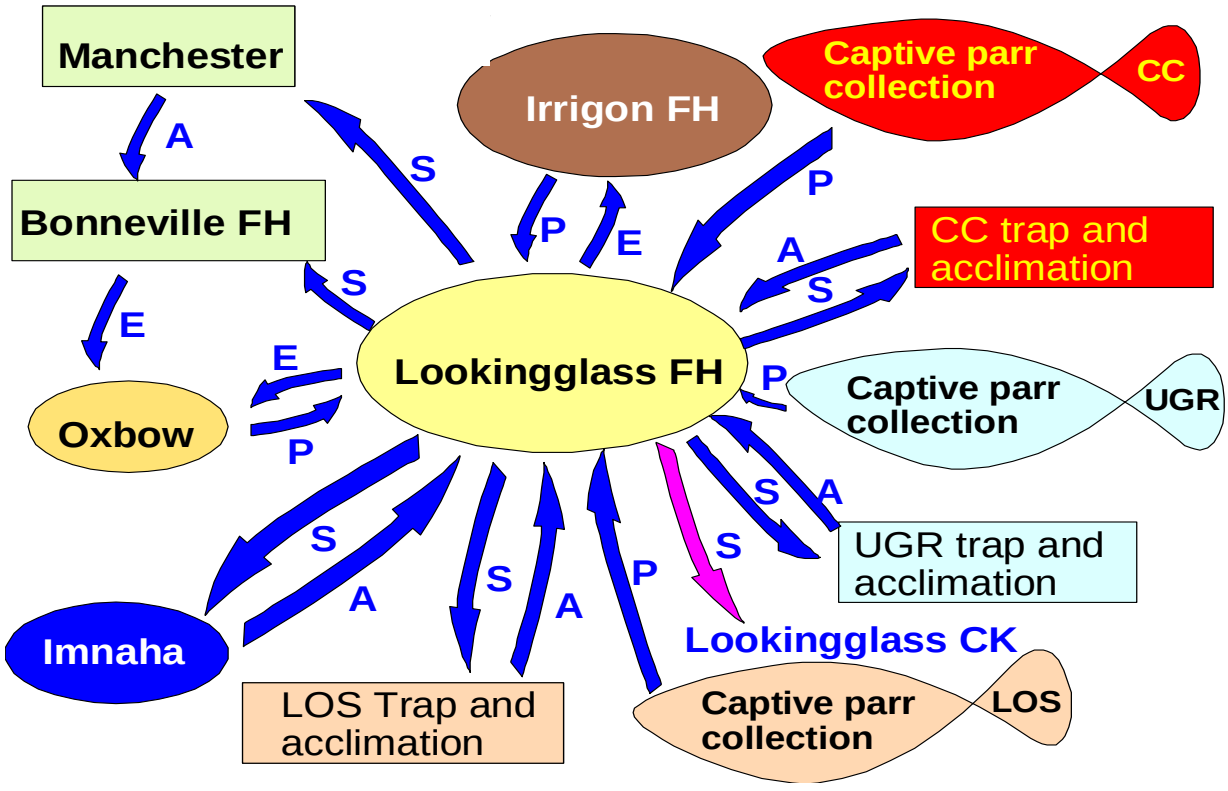

Figure 11. Northeast Oregon Chinook salmon hatchery program operational schematic illustrating the complexity of implementing conventional and captive broodstock programs for five population specific hatchery programs. CC = Catherine Creek, UGR = Upper Grande Ronde River. LOS = Lostine River, Imnaha = Imnaha River.

Numerous agencies and projects contribute to implementation of hatchery programs and RM&E for Grande Ronde basin Chinook salmon. The LSRCP program serves as the central hub for a network of projects that enable successful implementation (Figure 12). The diverse funding sources, projects, agencies, and individuals that contribute to this collaborative joint venture have provided the energy and creativity required to implement the large-scale hatchery reform that has been accomplished in the Grande Ronde River basin.

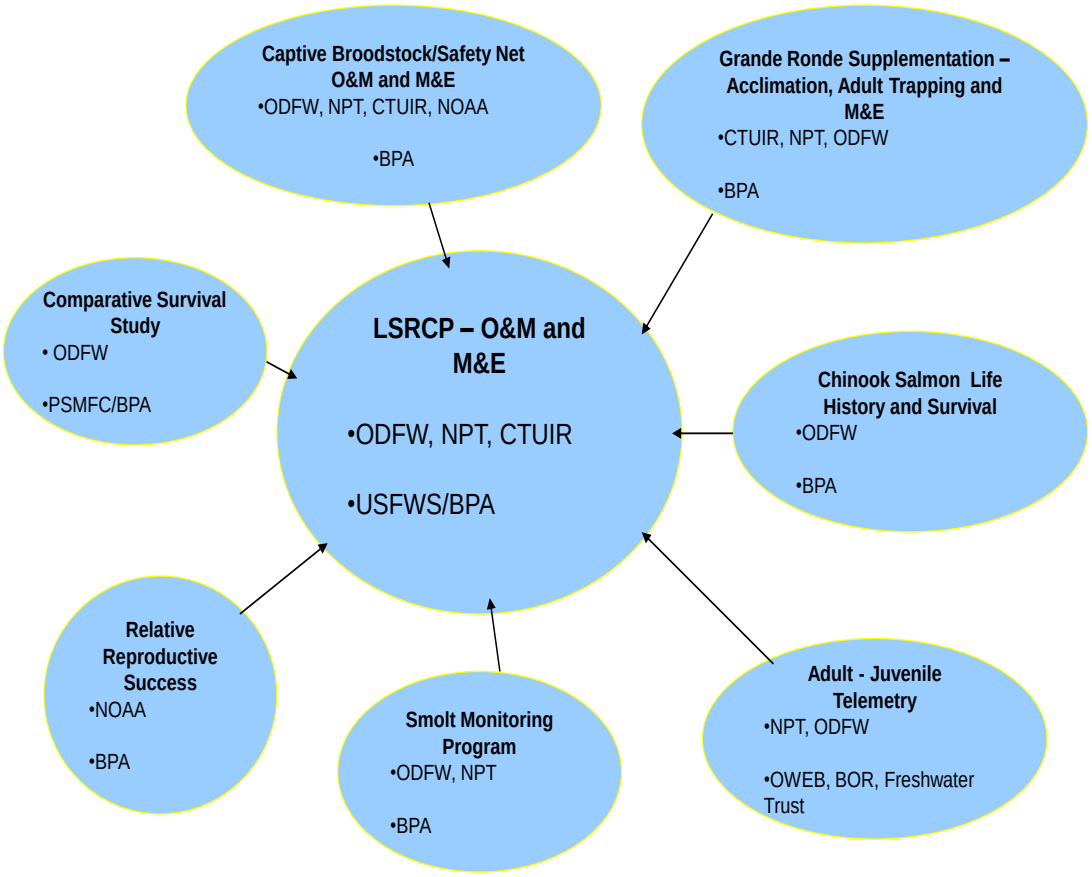

Figure 12. Grande Ronde River basin Chinook salmon hatchery program organization.

Preliminary results of the new hatchery programs are presented in separate papers. The true measure of success of these programs will be determined by the response of the natural populations, smolt survival, adult returns, and the ability to restore and sustain tribal and sport fisheries in the future.