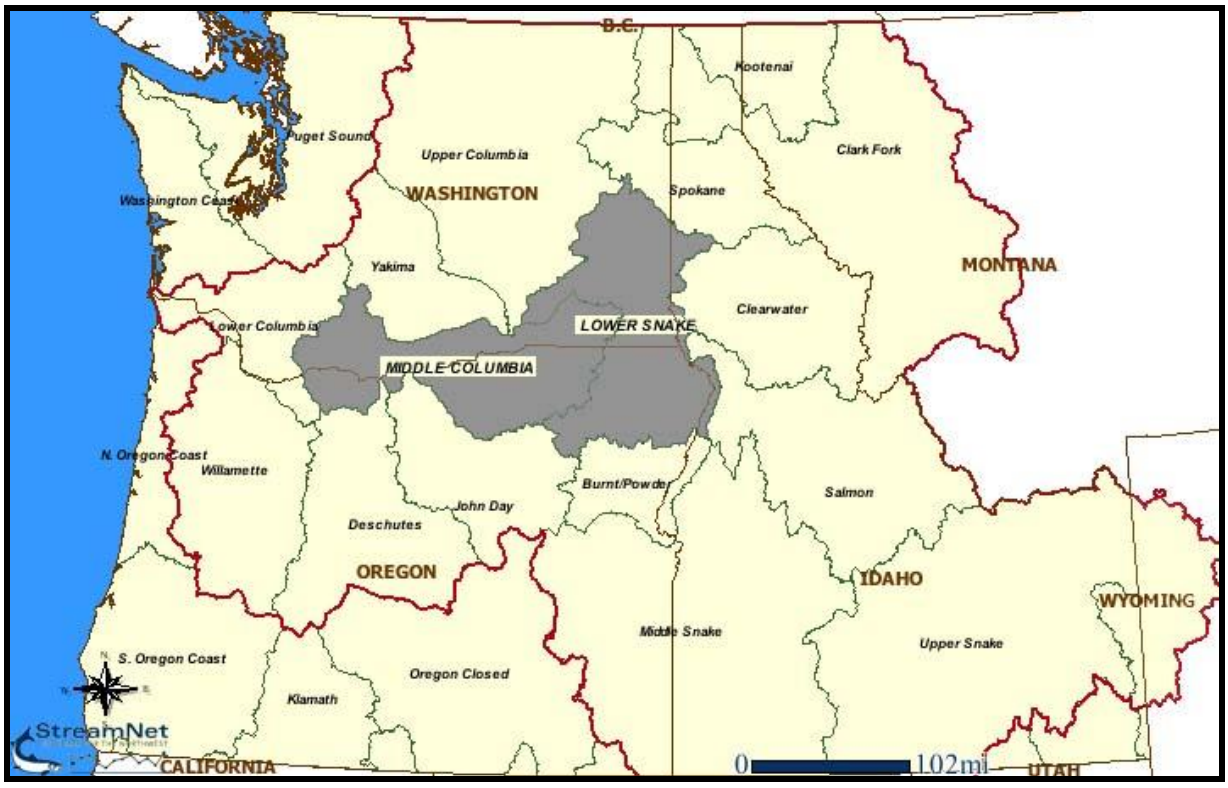
U.S. Fish and Wildlife Service Pacific Region

Columbia River Basin Hatchery Review Team

Columbia River Basin
Lower Snake and Middle Columbia Regions

Lower Snake Mainstem, Grande Ronde, Tucannon, Touchet, and Walla Walla River Watersheds



Washington Lower Snake River Compensation Plan State Operated Hatcheries

Lyons Ferry and Tucannon Fish Hatcheries

Assessments and Recommendations

Final Report, Appendix B:
Briefing Document; Summary of Background Information

March 2011

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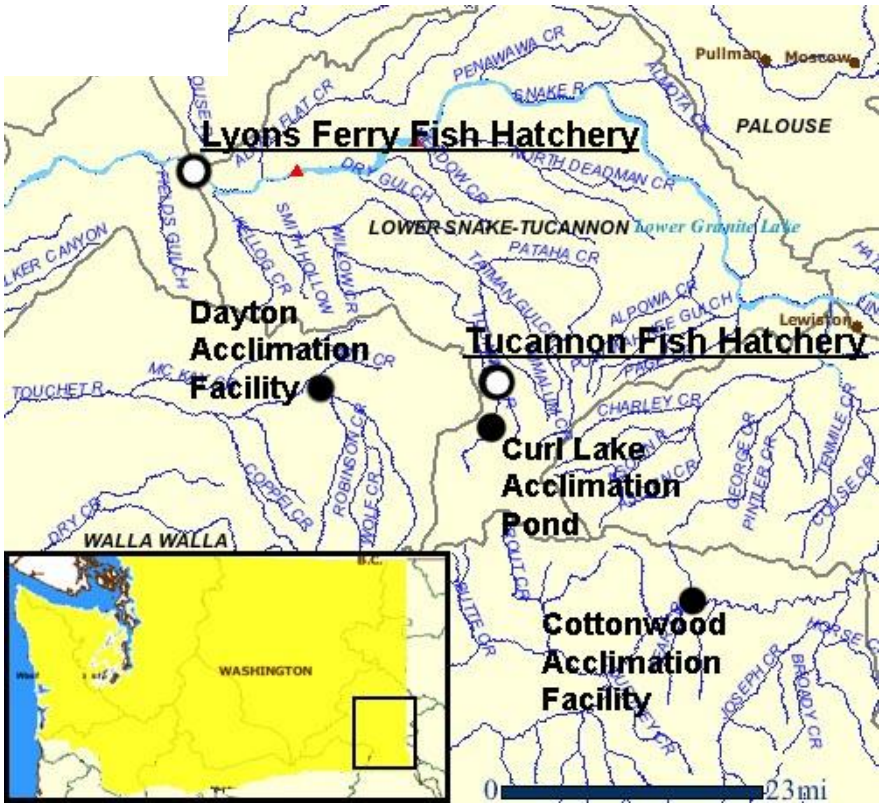

Figure 1. Lower Snake River Compensation Plan (LSRCP) Fish Hatcheries in Washington[1]

[1] *Modified figure from Streamnet : www.streamnet.org/website/bluesnetmapper/viewer.htm*

Table of Contents

I. Introduction to the Lower Snake Region

(Please see the Lower Snake NFH Assessments and Recommendations Report, Appendix B - Briefing Document for an overview of the Lower Snake region)

II. Lyons Ferry and Tucannon Fish Hatcheries

A. Description of hatchery

Site Overview -. Lyons Ferry Complex (LFC) includes Lyons Ferry Hatchery (Lyons Ferry FH), Tucannon Hatchery (Tucannon FH), Cottonwood Acclimation Facility (Cottonwood AF), Dayton Acclimation Facility (Dayton AF), and Curl Lake Acclimation Pond (Curl Lake AP). LSRCP funded fish production in Washington began in 1983, with the construction of trout and steelhead rearing facilities at the Lyons Ferry FH. Construction of salmon facilities and steelhead acclimation sites followed, and was completed in 1985. Major upgrades at Tucannon FH also occurred at that time, and operation of that facility has been funded by LSRCP every since. Production at all facilities has been directed toward meeting established program goals of returning 18,300 adult fall Chinook, 1,152 adult spring Chinook, 4,656 adult summer steelhead, and providing 67,500 angler days of fishing opportunity from 80,000 pounds of rainbow trout production, currently planted at 3 fish per pound (fpp). In addition to these LSRCP production goals, Washington Department of Fish and Wildlife (WDFW) funds a jumbo-sized (1.5 pounds each) rainbow trout program at Tucannon FH.

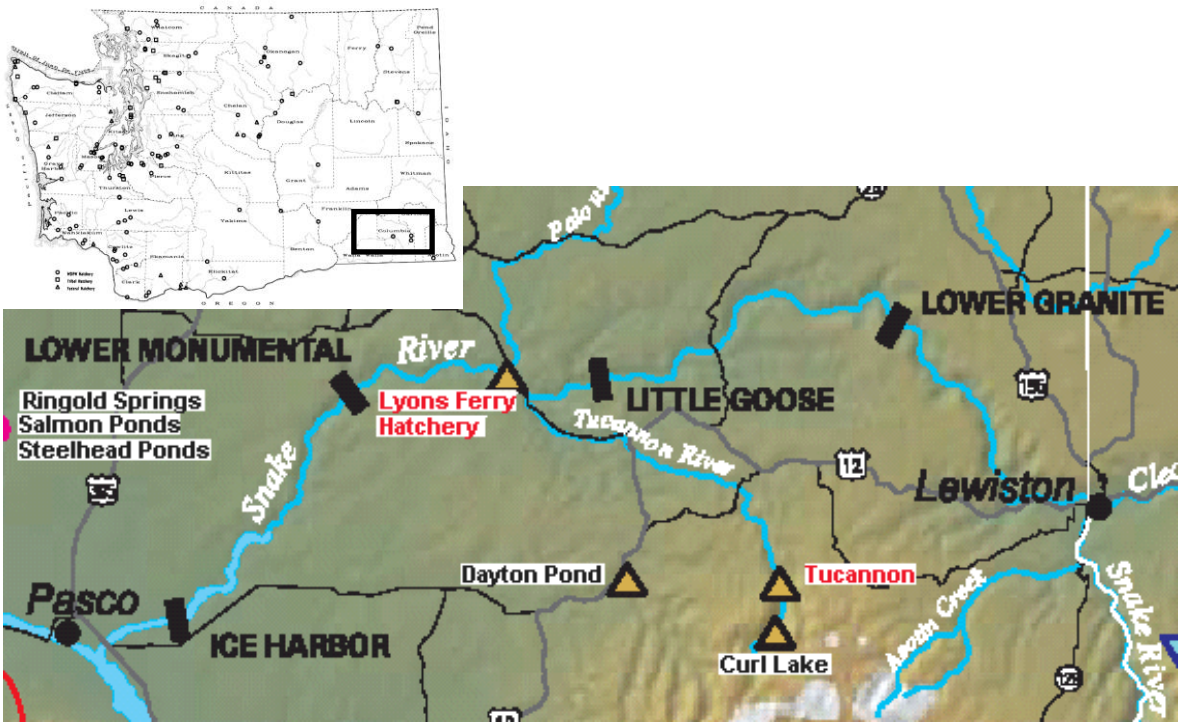

Figure 2. Lyons Ferry Complex Location in Washington [Provided by John Lovrak, USFWS, 2009]

Lyons Ferry FH - The Lyons Ferry Fish Hatchery (Lyons Ferry FH) is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington. Initially it was operated as two separate facilities. Washington Department

of Wildlife (WDW) operated the north hatchery, producing steelhead and rainbow trout. Washington Department of Fisheries (WDF) operated the south hatchery, rearing spring and fall Chinook. A merger of the two agencies in 1994 led to a merging of the two facilities, and has since been operated by WDFW through LSRCP funding as Lyons Ferry FH. Facilities include two incubation buildings with office space and feed storage, plus adult fish trapping, holding and spawning structures. A visitor center provides interpretive information for guests of the hatchery. There are eight residences for staff on site to fulfill security and emergency response needs.

Figure 3. Lyons Ferry Fish Hatchery Facility [Provided by John Lovrak, USFWS, 2009]

The Lyons Ferry FH rearing facilities include twenty-eight raceways at 10 ft x 100 ft x 2.8 ft and nineteen raceways at 10 ft x 88.5 ft x 3.5 ft. These raceways were covered in 2" square mesh netting in 2005 and 2006. There are three rearing lakes covered in 4" netting (added in 2003-04), holding ~ 590,000 cubic feet (ft3) of water each, approximately 1,100 ft x 90 ft x 10 ft in size. Netting has been added to these lakes and raceways to reduce predation losses. The adult holding facilities include three 83 ft x 10 ft x 5 ft adult raceways with housed spawning facilities incorporated over the center of these ponds, two 18 ft x 150 ft x 4.3 ft and two 21 ft x 150 ft x 4.3 ft adult salmon holding ponds, which also accommodate sub-yearling rearing when not needed for adult holding in the spring of the year. In 2005, channels were cut into two of these ponds, creating three temporary holding areas in each of the two modified ponds to accommodate marking and tagging of the subyearlings reared there. Screens were fabricated to fit the channels. Eight 20 ft x 4 ft fiberglass circular ponds are used for a captive brood spring Chinook program. These ponds were added in 1998 below the north raceways. No longer used for this program are fifteen 4 ft x 1.6 ft fiberglass circular ponds. Six 3.25 ft x 16 ft x 2.6 ft fiberglass tanks were added in the same area in 2006, allowing for decreased densities and improved flexibility in all stocks during early rearing. The incubation facilities include 112 full stacks (2 units of 8 trays each) of vertical incubators in the south trough room, and 88 shallow eyeing/hatching troughs and four 3.75 ft x 27.5 ft x 2 ft intermediate rearing troughs in the north trough room. The hatchery has a sophisticated alarm system and read-out screen. Some onscreen outputs for flow are erroneous. They have also experienced false alarms on occasion. The alarm system requires constant maintenance (i.e. cleaning probes) to reduce the instances of erroneous readouts and false alarms.

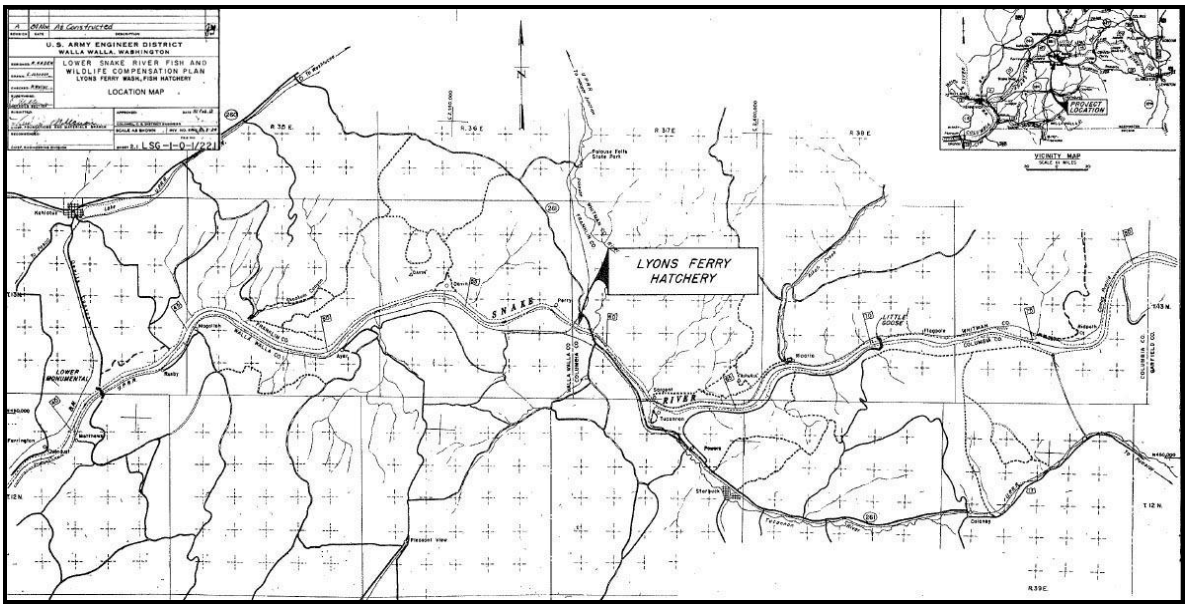

Figure 4. Lyons Ferry Fish hatchery Facility location in South-East Washington [Provided by John Lovrak, USFWS, 2009]

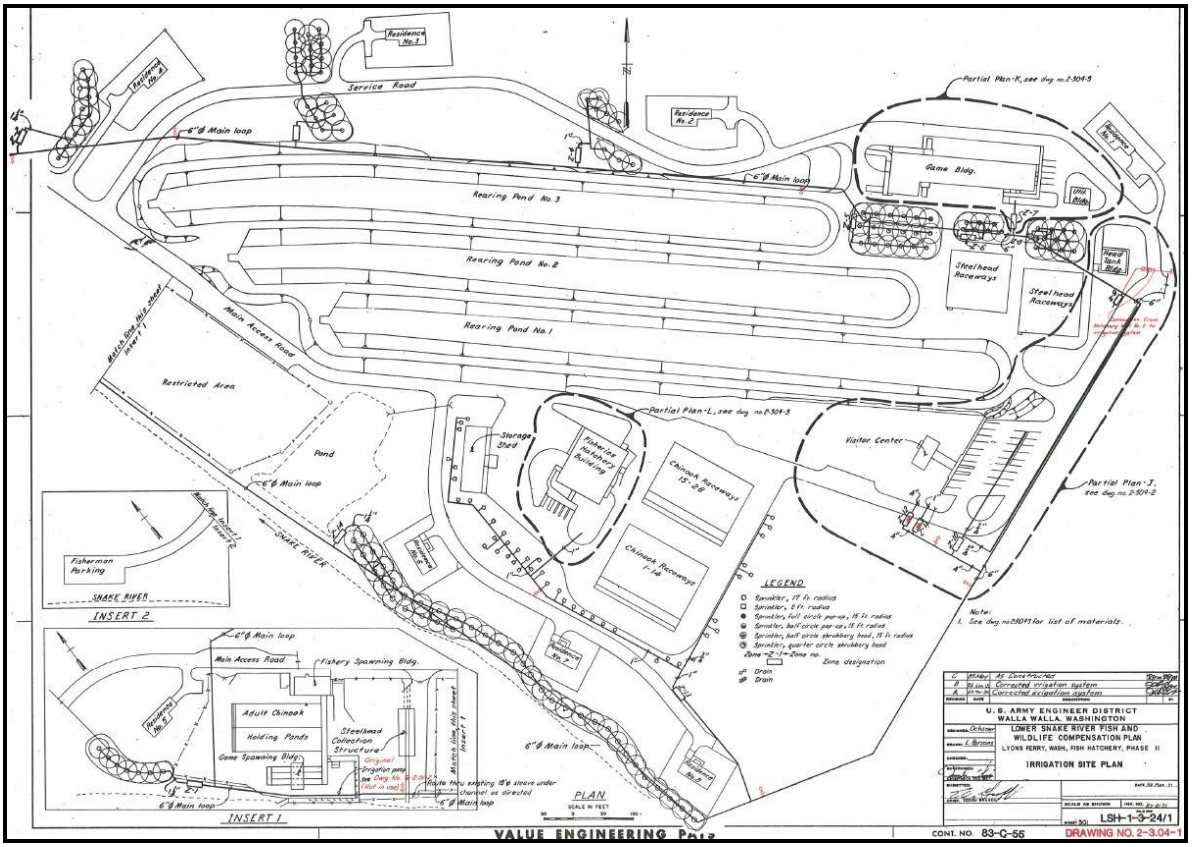

Figure 5. Lyons Ferry Fish Hatchery Facility design schematic [Provided by John Lovrak, USFWS, 2009]

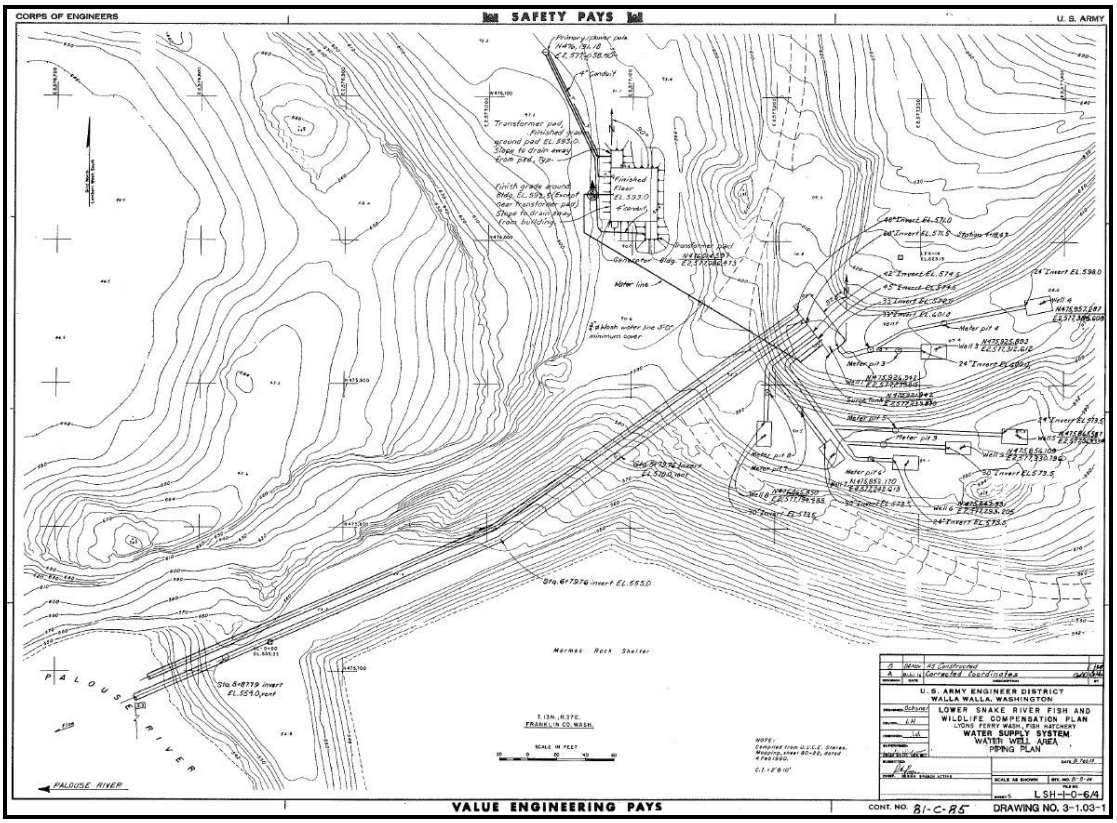

Figure 6. Lyons Ferry Fish Hatchery Facility water supply and local topography [Provided by John Lovrak, USFWS, 2009]

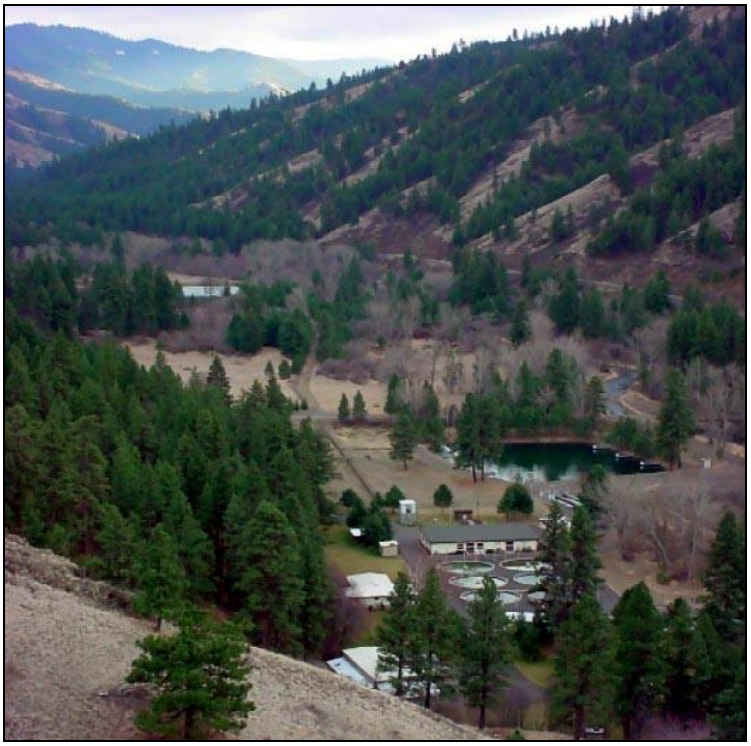

Figure 7. Tucannon Fish Hatchery Facility [Provided by John Lovrak, USFWS, 2009]

Tucannon FH - The Tucannon Fish Hatchery (Tucannon FH) is located along the Tucannon River, between the towns of Dayton and Pomeroy Washington, at RM 36 in Columbia County. Fish production began in 1949 by the Washington Department of Game. In 1983, construction began to remodel the hatchery as part of a transfer of ownership to LSRCP. In November 1986 construction was complete, and LSRCP has funded operations there ever since.

The Tucannon FH includes a combined incubation and office building, back-up power generation building, feed storage shed, shop, domestic water building, two well houses and a spring water collection building. There is also a river intake and trapping facility located upstream of Rainbow Lake, along the Tucannon River. There are two residences for staff on site to fulfill security and emergency response needs.

The rearing vessels at Tucannon FH include forty concrete 1 ft x 15ft x .5 ft shallow troughs, six concrete round ponds approximately 40 ft in diameter with a maximum of 2,660 ft3 of rearing area each, two concrete 10 ft x 80 ft x 3 ft raceways, one concrete 15 ft x 136 ft x 5 ft raceway, and one earthen rearing pond with a maximum of 136,221 ft3 of rearing space. The pond is approximately 170 ft x 200 ft x 6.5 ft in size.

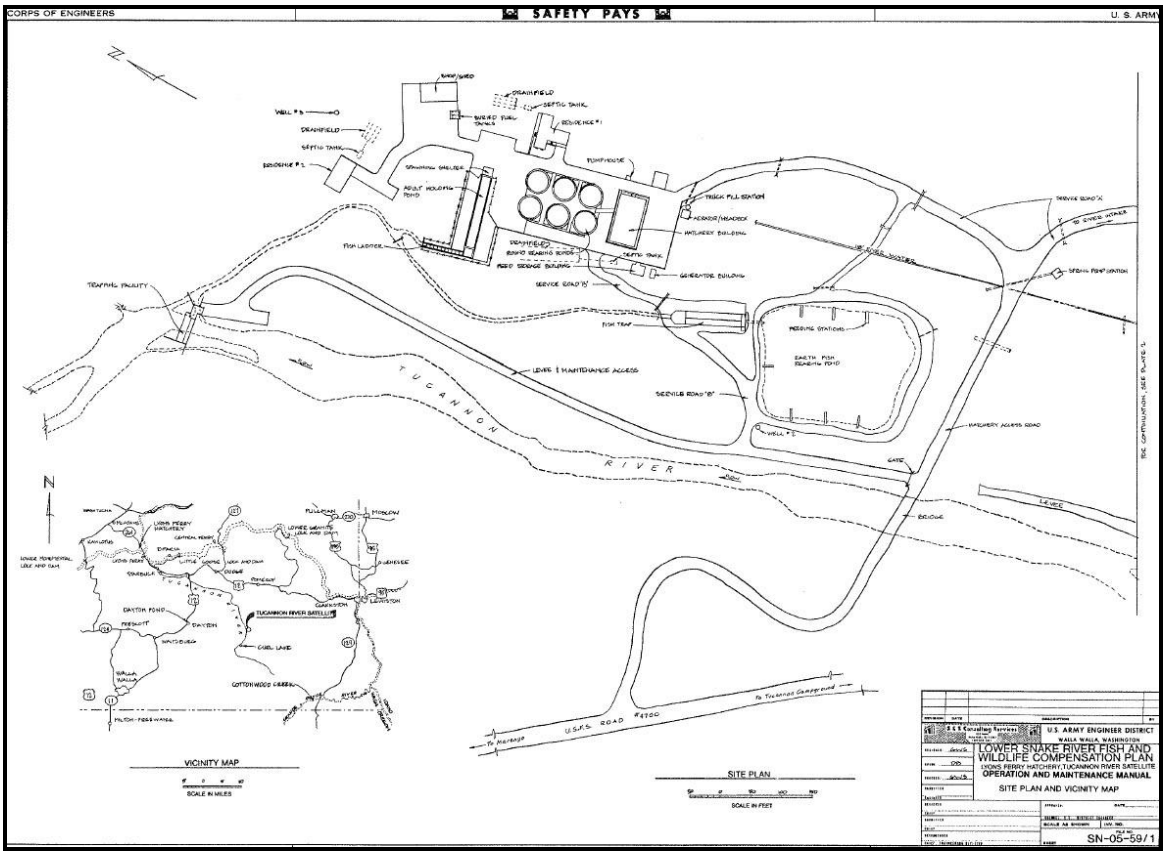

Figure 8. Tucannon Fish Hatchery Facility location and design schematics [Provided by John Lovrak, USFWS, 2009]

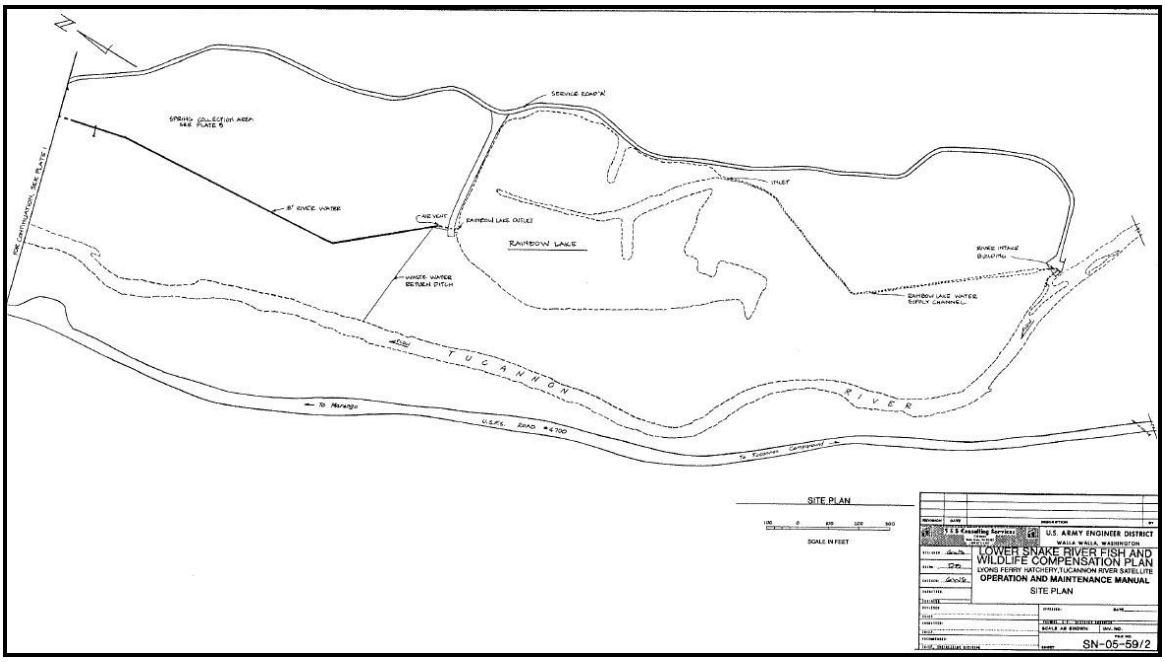

Figure 9. Tucannon Fish Hatchery Facility water supply and discharge schematics [Provided by John Lovrak, USFWS, 2009]

Cottonwood Acclimation Facility - Cottonwood Acclimation Facility is located along the Grande Ronde River at RM 28.7, directly above the confluence with Cottonwood Creek in Asotin County, Washington. Construction was completed in February 1985.

This facility includes an adult trapping facility on Cottonwood Creek, a small storage building, and a single trailer unit used as housing during operations. Cottonwood AF has a concrete bottom with earthen walls and holds ~357,000 ft3 of water. It also has a small trailer for use by staff required to be on-site at all times while the pond is in operation. It is presently used for acclimation and release of Wallowa stock summer steelhead into the Grande Ronde River.

Figure 10. Cottonwood Acclimation Facility [Provided by John Lovrak, USFWS, 2009]

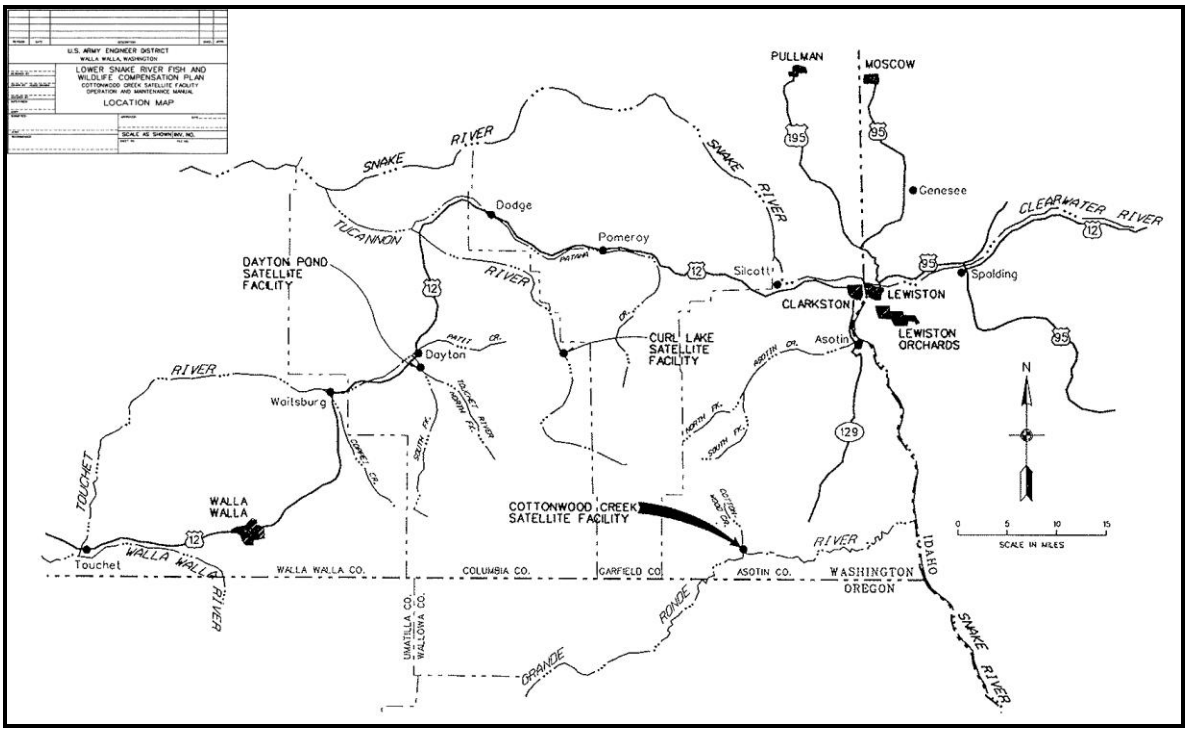

Figure 10. Cottonwood Acclimation Facility location along Snake River [Provided by John Lovrak, USFWS, 2009]

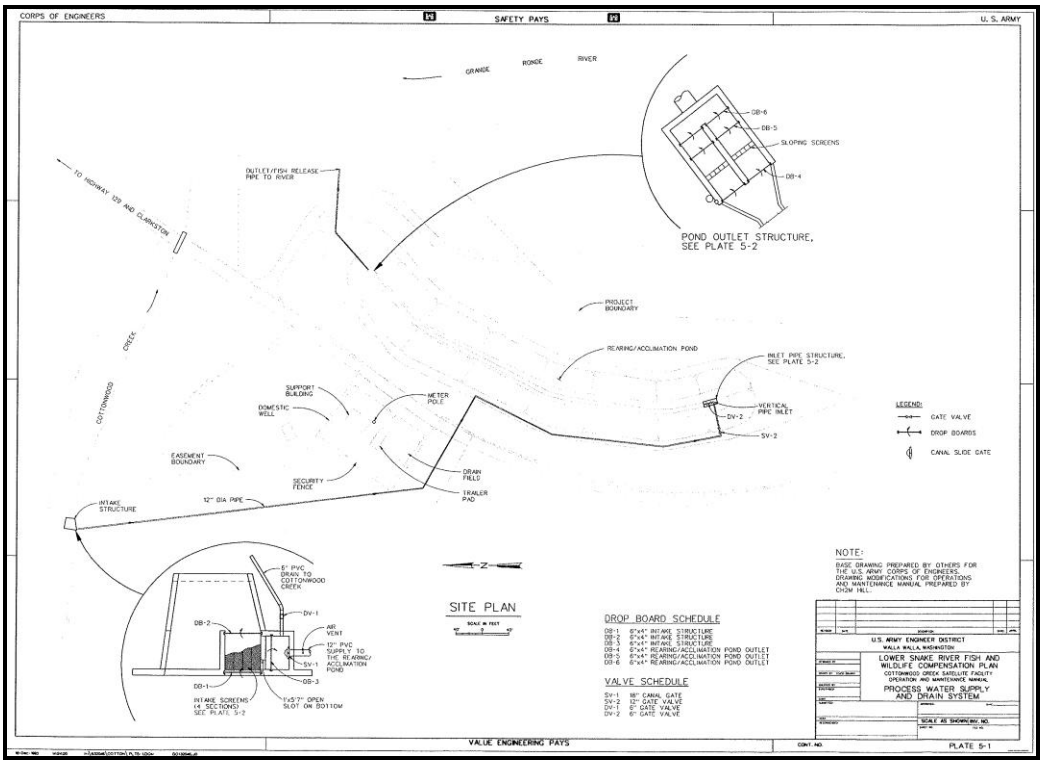

Figure 11. Cottonwood Acclimation Facility water supply and discharge schematics [Provided by John Lovrak, USFWS, 2009]

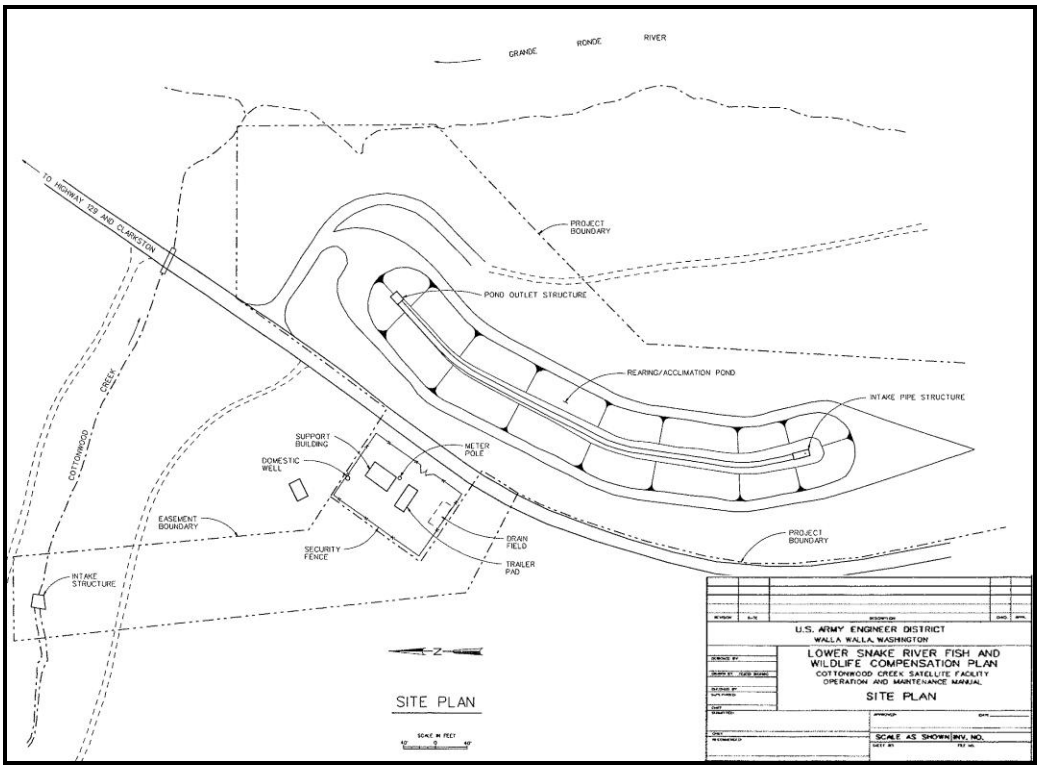

Figure 12. Cottonwood Acclimation Facility site plan [Provided by John Lovrak, USFWS, 2009]

Dayton Acclimation Facility - Dayton Acclimation Facility is located along the Touchet River at RM 53 in Columbia County, Washington. There is an adult trapping facility on the Touchet River just upstream of the acclimation pond at RM 53.3.

Figure 13. Dayton Acclimation Facility [Provided by John Lovrak, USFWS, 2009]

Construction of the Dayton AF was completed in October 1986. This pond is asphalt lined and holds ~ 200,000 ft3 of water. The pond is located adjacent to the Snake River Lab evaluation office and has a storage garage for equipment and feed. It also has a small trailer for use by staff required to be on-site at all times while the pond is in operation. It is presently used for acclimation and release of Lyons Ferry FH stock summer steelhead into the Touchet River.

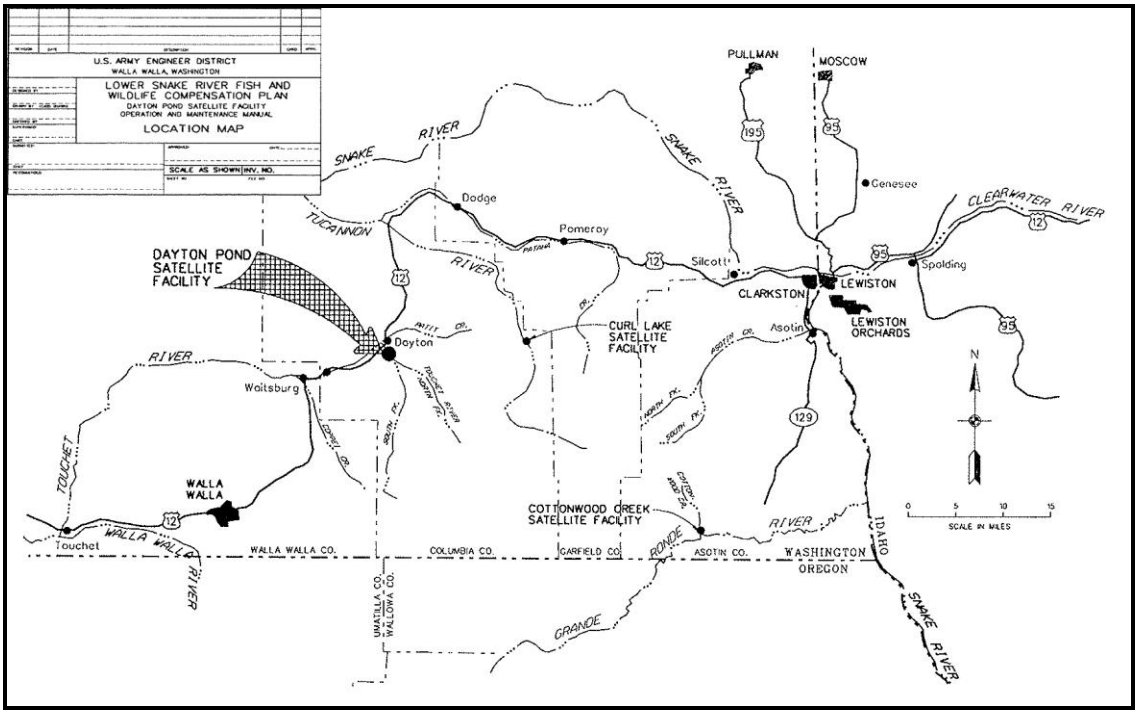

Figure 14. Dayton Acclimation Facility location along Snake River [Provided by John Lovrak, USFWS, 2009]

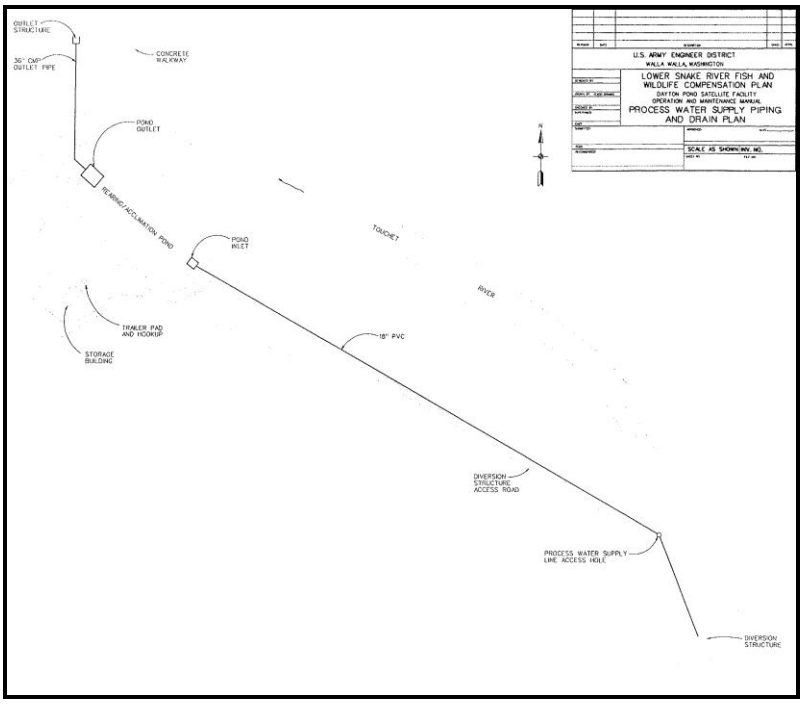

Figure 15. Dayton Acclimation Facility water supply and discharge schematics [Provided by John Lovrak, USFWS, 2009]

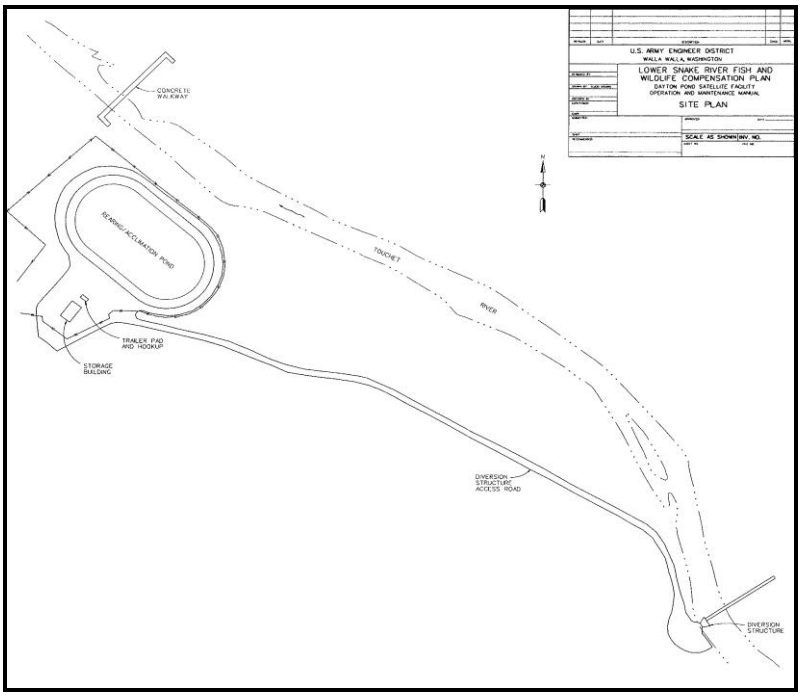

Figure 16. Dayton Acclimation Facility Site Plan [Provided by John Lovrak, USFWS, 2009]

Curl Lake Acclimation Pond - Curl Lake Acclimation Pond is located along the Tucannon River at RM 41 in Columbia County, Washington. The construction of Curl Lake AP was completed in

February 1985. Curl Lake AP is an earthen pond holding ~ 784,000 ft3 of water. Chinook acclimation in Curl Lake AP started in 1997. After the spring Chinook are released, the pond is stocked with resident trout for fishing. It is emptied after fishing season ends October 31st each year, and recharged by hatchery staff prior to spring Chinook acclimation the following January.

Other Acclimation Facilities - In addition to WDFW acclimation sites, LFC provides up to 465,000 yearling and 1,740,000 sub-yearling fall Chinook to three acclimation facilities operated by the Nez Perce Tribe (NPT): Pittsburg Landing and Captain John's Rapids on the Snake River between Asotin and Hells Canyon Dam, and Big Canyon on the Clearwater River. Size at transfer to the NPT AF's is 12 fpp for yearlings and 65 - 75 fpp for sub-yearlings. Size at release goal for acclimated fall Chinook yearlings is 10.0 fpp, and 50 fpp for sub-yearlings. Sub yearling size goals at transfer have been difficult to achieve due to increased marking, tagging and egg take strategies.

[WDFW Sept. 2008]

B. Hatchery water sources

Lyons Ferry FH - Water is supplied to Lyons Ferry FH from the Marmes pump station, which has emergency power backup generation. The Marmes pump (wells) facility has three 300 horsepower (hp) pumps, four 200 hp pumps and one 75 hp pump. The well water right for Lyons Ferry FH is 53,200 gallons per minute (gpm), or 118.5 cubic feet per second (cfs) of flow, and water temperature is a constant 52o F.

High concentrations of dissolved Manganese (variable among the eight wells. but especially high in Well #4 since it is shallower than the others), and particulate Manganese Oxide, is strongly suspected of limiting the density at which fall Chinook can be reared in raceways at Lyons Ferry FH. While the water also has higher concentrations of other minerals (common in deep wells), no negative impacts on eggs or fish from these are known. (Jon Lovrak -personal communication during site visit)

Tucannon FH - The Tucannon FH is supplied with three different water sources. River water is fed from the Tucannon River, and ranges in temperature from 33 to 60 o F, during use by the hatchery. The intake is located one half mile upstream of the hatchery. This water travels down an open channel into Rainbow Lake. From the outlet of Rainbow Lake the water travels through an 18" above ground pipeline to the hatchery. This pipeline was completely replaced in 2005. Rainbow Lake functions as a reservoir to provide the hatchery with cooler water in the summer months and warmer water in the winter months. It also provides a pool of water to draw from when encountering adverse intake conditions, resulting in temporary loss of water flows. The water right for this source is 16 cfs. Well water is pumped from two separate sources to an aeration tower, and then gravity fed to the rearing units and the domestic pump building. The combined well water right is 2 cfs, with well #2 running around 54 - 57o F and well #3 running a constant 61o F. Spring water is pumped from an underground collection site to the same aeration tower and gravity fed to rearing units. The water right for this source is 5.3 cfs, and has a stable temperature of 51 or 52o F.

Cottonwood Acclimation Facility - Cottonwood AP has a water right of 2,694 gpm (6 cfs) for the period January 1st through July 1st. It is supplied with water from Cottonwood Creek through a gravity water supply system, with the intake integrated into the adult trapping facility located ~

0.10 miles above the pond. Water temperatures range from 34 to 52o F during operation of the facility.

Dayton Acclimation Facility - The water right to the Dayton AP is 2,694 gpm (6 cfs) for the period of Jan 1st – May 15th of each year. It is supplied with water from the Touchet River through a gravity water supply system, with the intake located at the temporary adult trapping facility just upstream of the pond. Water temperatures during use by hatchery staff for steelhead acclimation range from 34 to 52o F.

Curl Lake Acclimation Pond - Curl Lake AP has a water right of 2,694 gpm (6 cfs). It is supplied with water from the Tucannon River through a gravity water supply system. It is currently utilized for acclimation of spring Chinook yearlings for release into the Tucannon River. Water temperatures at this time of year range from 34 to 48 o F.

[WDFW Sept. 2008]

C. Adult broodstock collection facilities

Fall Chinook - Collection of fall Chinook occurs at Lyons Ferry FH and Lower Granite Dam. The trapping protocol at Lyons Ferry FH is dependent upon what is estimated to be trapped at LGR, the in-season stray rate encountered, and updated return estimates. In effect, trapping is estimated for LGR, and then the remaining numbers of fish needed to meet egg take goals are trapped at Lyons Ferry FH. If changes occur in season, the percent trapped at LGR will not change, rather the trapping at Lyons Ferry FH changes. Excess adults trapped at NPTH may be used to supplement Lyons Ferry FH production shortages of LGR and volunteer adult returns.

Spring Chinook - Trapping for the Spring Chinook broodstock program is conducted exclusively at the Tucannon FH adult trap, located just upstream of the hatchery and adjacent to the Rainbow Lake intake. Adults collected for spawning are transferred by truck to Lyons Ferry FH for holding.

Steelhead - The Lyons Ferry Hatchery stock steelhead adults are trapped on-station from volunteers that swim into the fish ladder at Lyons Ferry FH. Fish are held in large adult holding raceways adjacent to the trap until sorting and spawning.

The Touchet River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage broodstock. These adults are trapped on the Touchet River at the Dayton AF intake structure and transferred to Lyons Ferry FH for holding and spawning.

The Tucannon River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage. The adults for this program are collected at a temporary trap on the lower Tucannon River and transferred to Lyons Ferry FH for holding and spawning.

Trapping of returning Wallowa stock steelhead adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River).

[WDFW Sept. 2008]

D. Broodstock holding and spawning facilities

- The adult holding facilities include three 83 ft x 10 ft x 5 ft adult raceways with enclosed spawning facilities incorporated over the center of these ponds. There are also two 18 ft x 150 ft x 4.3 ft and two 21 ft x 150 ft x 4.3 ft adult salmon holding ponds, which also accommodate sub-yearling rearing when not needed for adult holding in the spring of the year. In 2005, channels were cut into two of these ponds, creating three temporary holding areas in each of the two modified ponds to accommodate marking and tagging of the subyearlings reared there. Screens were fabricated to fit the channels. A project proposal for dividing the salmon adult ponds from four to eight is currently being discussed with LSRCP for increasing sorting and sampling capabilities. [WDFW Sept. 2008]

- All Wallowa stock steelhead are held and spawned at the Cottonwood Creek trap site, with the gametes transported to Lyons Ferry FH for fertilization, incubation, and rearing.

E. Incubation facilities

- The incubation room at Lyons Ferry FH is designed to accept and incubate eggs from individual females through the eyed stage. The south side incubation room holds four banks of 28 stacks, which hold 1,568 usable Heath trays. Each stack has its own water source. Water is single use flow through. Each female will be kept separate until eye-up. After eyeing is complete and ELISA and virus sample results are received, eggs will be combined, according to sample results, and placed in trays with substrate. Each tray will hold 5,000 eggs. Eggs with positive ELISA results will be kept separate or destroyed, according to fish health/production protocol. Eggs will hatch in the incubation trays and fry will be ponded in raceways at Lyons Ferry FH. [WDFW Aug. 2005b]

- The incubation building is fitted with back-up pumps to maintain flow through the trays in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. [pers. comm. Jon Lovrak, WDFW, 2009 – Hatchery Review Team facility visit)

F. Indoor rearing facilities

There are 88 shallow eyeing/hatching troughs and four 3.75 ft x 27.5 ft x 2 ft intermediate rearing troughs in the north trough room. Six 3.25 ft x 16 ft x 2.6 ft fiberglass tanks were added below the north side raceways in 2006, allowing for decreased densities and improved flexibility in all stocks during early rearing. [WDFW Sept. 2008]

G. Outdoor rearing facilities

The Lyons Ferry FH rearing facilities include twenty-eight raceways at 10 ft x 100 ft x 2.8 ft and nineteen raceways at 10 ft x 88.5 ft x 3.5 ft. These raceways were covered in 2" square mesh netting in 2005 and 2006. There are three rearing lakes now covered in 2" netting (completed in 2008), holding ~ 590,000 cubic feet (ft3) of water each, approximately 1,100 ft x 90 ft x 10 ft in size. Netting has been added to these lakes and raceways to reduce predation losses. There are also

two 18 ft x 150 ft x 4.3 ft and two 21 ft x 150 ft x 4.3 ft adult salmon holding ponds, which also accommodate sub-yearling rearing when not needed for adult holding in the spring of the year. In 2005, channels were cut into two of these ponds, creating three temporary holding areas in each of the two modified ponds to accommodate marking and tagging of the subyearlings reared there. Screens were fabricated to fit the channels.

The rearing vessels at Tucannon FH include forty concrete 1 ft x 15ft x .5 ft shallow troughs, six concrete round ponds approximately 40 ft in diameter with a maximum of 2,660 ft3 of rearing area each, two concrete 10 ft x 80 ft x 3 ft raceways, one concrete 15 ft x 136 ft x 5 ft raceway, and one earthen rearing pond with a maximum of 136,221 ft3 of rearing space. The pond is approximately 170 ft x 200 ft x 6.5 ft in size.

[WDFW Sept. 2008]

H. Release locations and facilities

Lyons Ferry FH - The Lyons Ferry FH is located along the Snake River at river mile (RM) 59.1, directly below the confluence of the Palouse River in Franklin County, Washington. Snake River fall Chinook and Lyons Ferry stock steelhead are released directly from the facility into the Snake River.

Cottonwood Acclimation Facility - Cottonwood AF is located along the Grande Ronde River at RM 28.7, directly above the confluence with Cottonwood Creek in Asotin County, Washington and is presently used for acclimation and release of Wallowa stock summer steelhead into the Grande Ronde River.

Dayton Acclimation Facility - Dayton AF is located along the Touchet River at RM 53 in Columbia County, Washington and is presently used for acclimation and release of Lyons Ferry stock summer steelhead into the Touchet River.

Curl Lake Acclimation Pond - Curl Lake AP is located along the Tucannon River at RM 41 in Columbia County, Washington and is currently used for acclimation and release of Tucannon River spring Chinook into the Tucannon River. After the spring Chinook are released, the pond is stocked with resident trout for fishing. It is emptied after fishing season ends October 31st each year, and recharged by hatchery staff prior to spring Chinook acclimation the following January.

Other Acclimation Facilities - In addition to WDFW acclimation sites, LFC provides up to 465,000 yearling and 1,740,000 sub-yearling Snake River fall Chinook to three acclimation facilities operated by the Nez Perce Tribe (NPT): Pittsburg Landing (RKM 346) and Captain John Rapids (Rkm 263) on the Snake River between Asotin and Hells Canyon Dam, and Big Canyon (Rkm 57) on the Clearwater River.

Direct stream releases – Snake River fall Chinook are direct released into the Snake River at Couse Creek near Captain John Rapids, into the Grande Ronde River near the Oregon/Washington border, into the Snake River at Hells Canyon Dam as part of the Idaho Power program, and into the Clearwater and mainstem Snake rivers as part of a USACOE transportation study. Lyons Ferry stock summer steelhead are direct released into the lower Tucannon and Walla Walla rivers. Touchet summer steelhead are direct released into the Touchet River at Baileysburg Bridge on the North Fork Touchet River. Tucannon River summer steelhead are direct released into the upper

Tucannon River. Triploid Kamloops stock rainbow trout are transferred to IDFG and planted into the Clearwater and Snake Rivers. Spokane stock rainbow trout are transferred to IDFG and planted into Idaho reservoirs. Spokane stock rainbow trout are also planted into various lakes in SE Washington.

[WDFW Sept. 2008]

I. Outmigrant monitoring facilities

Annual hatchery production is intended to meet LSRCP adult return goals for several species. Current production levels are set to meet the adult return goals for hatchery steelhead most years while minimizing any adverse effects on ESA listed salmon and steelhead. Production levels for salmon and steelhead at Lyons Ferry FH have been approved through the *U.S. v Oregon* (*US v OR*) 2008-2017 Management Agreement; Lyons Ferry FH Fall Chinook salmon production priorities contained in Tables B4A and B4B. Lyons Ferry FH is planning BY2008 fall Chinook production based on table *B4B*).

Spring Chinook production is now solely comprised of a conventional program. With the phase out of the captive broodstock program in 2006, the conventional smolt release program goal will be increased to 225,000 smolts per year (as agreed to under US v OR), for release in 2009. Lyons Ferry FH utilizes two steelhead stocks (Lyons Ferry and Wallowa) for mitigation objectives under LSRCP, and is testing two natural broodstocks in the Touchet and Tucannon Rivers. Numbers of fish released in 2008 were annual goals proposed for 2009, representing the program as negotiated by the co-managers.

It is important to stress that *any* change to a specific program at Lyons Ferry FH or Tucannon FH will potentially impact the other programs, so "current capacity" values represent rearing limits *as the programs are structured today*. Additionally, restrictions anywhere within the rearing cycle will determine program size. Restrictions can be rearing vessels, water, tagging groups and schedules, fish management decisions regarding harvest or adult return contribution and carrying capacity, etc.

Monitoring and Evaluation (M&E) has been ongoing since 1983 and 1985 for trout and salmon programs respectively. Recent emphasis has centered on meeting Endangered Species Act (ESA) permitting and recovery planning requirements. Hatchery Scientific Review Group recommendations may also affect management decisions in the coming years. Routine monitoring includes length, weight, K factor, external fin evaluation, tag retention and fish health examinations. Pre-release quality control checks on fin clips, tag retention, etc. is completed on all WDFW releases by WDFW staff.

[WDFW Sept. 2008]

J. Additional or special facilities

None

K. Outreach and public education facilities/programs

- Approximately, 840 tourists visit Lyons Ferry FH annually.
- Lyons Ferry FH has a visitors' center with signs describing salmon life-history, the Snake and Columbia River basin environment, and hatchery production.
- Staff work with three local schools as part of salmon in the classroom projects. School groups tour the facility annually.
- Lyons Ferry FH/WDFW cosponsors fishing derbies in ponds adjacent the Tucannon River and in Clarkston.
- The USFWS maintains a web site with the goal to provide timely information to the public regarding hatchery operations and program benefits.

L. Special issues or problems (e.g. water and property rights issues, law suits, etc.)

- It is unclear if the Servcie is the owner of record for water rights associated with all the LSRCP facilities operated by the WDFW.
- The LSRCP facilities operated by the WDFW do not report water diversions into the US Fish and Wildlife Service, Region 1, Division of Water Resources Database.
- Table. Water rights associated with LSRCP facilities operated by WDFW (information provided by Region 1 Engineering, Division of Water Resources)

staname	fwsnum	appnum	pernum	certnum	claimnum	priordate	wrlname	srcsname	cfsrate	gpmrate
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 6		27000
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 5		27000
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 4		27000
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 3		27000
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 1		27000
LYONS FERRY NFH	1074	G3-26147	G3-26147P	G3-26147C		1/27/1979	USACOE	WELL 2		27000
LYONS FERRY NFH	1075	G3-22703	G3-22703P	G3-22703C		2/25/1974	USACOE	WELL		175
LYONS FERRY NFH	1075	G3-22703	G3-22703P	G3-22703C		2/25/1974	USACOE	WELL		175
TUCANNON NFH	1079				G3-046061CL	6/30/1951		WELL		10
TUCANNON NFH	1080	S3-09570	7310	5050		4/29/1950	WA DEPT. OF GAME	UNNAMED SPRINGS	2.5	
TUCANNON NFH	1081	S3-13720	10274	6560		12/16/1955	WA DEPT. OF GAME	TUCANNON R	4	
TUCANNON NFH	1082	S3-22009	16415	11437		2/3/1970	WA DEPT. OF GAME	TUCANNON R	12	
TUCANNON NFH	1083	G3-27674	G3-27674P	G3-27674C		10/4/1983	USACOE	A WELL		300
TUCANNON NFH	1084	G3-28233	G3-28233P	G3-28233C		10/17/1986	USACOE	A WELL		600
COTTONWOOD CR SF	1076	S3-27704	S3-27704P	S3-27704C		12/1/1983	USACOE	COTTONWOOD CR	6	
COTTONWOOD CR SF	1077	G3-27662	G3-27662P	G3-27662C		8/23/1983	USACOE	A WELL		20
DAYTON POND SF	1078	S3-28263	S3-28263P	S3-28263C		12/31/1986	USACOE	TOUCHET R	6	
CURL LAKE SF	1085	S3-27767	S3-27767P	S3-27767C		1/20/1984	WA DEPT OF WILDLIFE	TUCANNON R	6	

IIA. Lyons Ferry Fall Chinook

A. General information

Lyons Ferry FH (Phase II) was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 101,800 pounds (9,162,000 smolts) of fall Chinook salmon (90 fpp) for release. All adults for the program were to be trapped at Ice Harbor Dam and returns to the hatchery ladder. The adult return goal for the program is 18,300 fall Chinook salmon back to the project area (above Ice Harbor Dam). [USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase II) was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 101,800 pounds (9,162,000 smolts) of fall Chinook salmon (90 fpp) for release. [USFWS May 1990]

2. Goals of program

The goal of this program is to return 18,300 fall Chinook salmon above Ice Harbor Dam to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]

3. Objectives of program

Approximately 3,426 fall Chinook adults (1,600 females) and 198 jacks are needed for broodstock for the Lyons Ferry Fish Hatchery fall Chinook salmon program. This number is the total number of fish that need to be trapped to meet egg take goals through priority seventeen of the current *US v OR* agreement. The objective is exclusive to stray culling requirements to meet the stray rate proportion of <5%. Generally, between 3,000 and 5,000 fish are trapped at Lower Granite Dam and Lyons Ferry FH.

The Lyons Ferry FH was initially designed to release 9.16 million fall Chinook subyearlings at around 90 fpp. Currently this facility produces 1.8 million subyearlings at approximately 50 fpp, and another 900,000 yearlings at 10-12 fpp. Additionally, the facility traps and spawns returning adult fall Chinook to meet egg take needs elsewhere, which includes providing over 1,000,000 eggs (1.0 million smolts) annually for the IPC program. A program change was implemented in 2007 which includes 421,000 eyed eggs (400,000 smolts) from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery.

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Integrated recovery/mitigation program. Continue to provide mitigation as specified under the LSRCP program (USACE 1975) while meeting conservation and recovery criteria established for the Snake River fall Chinook ESU. Provide harvest opportunities established under US v OR for tribal and recreational fisheries. [WDFW Aug. 2005b]

5. Alignment of program with ESU-wide plans

The Snake River fall Chinook are managed as one population across several facilities. Both the natural and hatchery populations of Snake River fall Chinook are listed as threatened under the Endangered Species Act. Two out of the three fall Chinook populations identified by the TRT are extinct (Marsing Reach and Salmon Falls). Snake River fall Chinook is the only remaining major population group for the Snake River fall Chinook ESU. [Draft Columbia river Salmon Hatchery Analysis Population Report, January 2009 – HSRG]

Lyons Ferry FH and the resulting production of fall Chinook is part of legally required mitigation provided to Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." As such, managers will have to identify their legal mandates, and do their best to provide fish for harvest, while protecting naturally spawning populations. WDFW believes they have taken such actions with the proposed program outlined in this HGMP to be consistent with the Policy Recommendations in the APR. The Columbia River Fish Management Plan (CRFMP) and annual agreements dictate production of fall Chinook. Co-managers negotiate release numbers annually. In addition, WDFW plans to operate within guidelines listed in the upcoming Snake River Fall Chinook Hatchery Management Plan (SRFCHMP). Currently this document is being drafted by several entities.

After CWT analysis was completed on the adult fall Chinook processed at Lyons Ferry FH in 1989, NMFS was concerned with the large number of stray fish found in the Lyons Ferry FH broodstock. It was decided that the progeny from the 1989 return of fall Chinook would not be used in future broodstocks. Also, it was decided by NMFS that Snake River Stock reared at Lyons Ferry FH, because of their genetic similarity to natural fish, would be considered essential for recovery of the Snake River natural population. The NMFS wanted as many strays as possible to be removed from the population at LGR Dam. The goal NMFS set for strays escaping past LGR Dam to spawn was to not exceed 5% of the total run. Operation of the trapping program at LGR Dam through 2002 therefore was instrumental in maintaining stock integrity of Snake River fall Chinook. The protocol changed in 2003 when an 11% random sample of fall Chinook at LGR occurred. Significantly fewer strays were removed from the population at the dam, resulting in an estimated 8% strays above LGR dam. [WDFW Aug. 2005b]

6. Habitat description and status where fish are released.

Human development and land management impacts, consistent with those identified across the Columbia and Snake River basins, affect natural fall Chinook production in the Snake River. Loss of channel diversity, increased sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature, and inundation and loss of spawning/rearing habitat through dam construction, and fragmentation of habitat all affect productivity of natural fall Chinook populations within the watershed. No comprehensive review of the ecological health of the Snake River in Washington in relation to salmonid population status and recovery has been completed at this time. Limiting factors such as water temperature, channel stability, sediment load, and instream habitat (in tributaries to the mainstem) are known to exist in the basin, but the extent of these problems are un-quantified to date. State programs in place provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Policy Act (NEPA) review. [WDFW Aug. 2005b]

7. Size of program and production goals (No. of spawners and smolt release goals)

The trapping goal is 3,426 (which includes 1,600 females) adults and 198 jacks based upon stray rates and prespawning mortalities encountered in 2006-07, and 3,500 eggs per female average This goal is the total number of fish that need to be trapped to meet egg take goals through priority seventeen. These goals are exclusive to stray culling requirements to meet the stray rate proportion of <5%. Generally, between 3,000 and 5,000 fish are trapped.

Currently this facility produces 1.8 million subyearlings at approximately 50 fpp, and another 900,000 yearlings at 10-12 fpp. Additionally, this facility traps and spawns returning adult fall Chinook to meet egg take needs elsewhere, which includes providing over 1,000,000 eggs annually for the IPC program. A program change was implemented in 2007 which includes 421,000 eyed eggs from Lyons Ferry FH transfer to Oregon Fish and Wildlife (ODFW) for rearing at the Irrigon Hatchery. These fish will be released into the Grande Ronde River in Washington as subyearlings by ODFW.

[WDFW Sept. 2008]

C. Description of program and operations

1. Broodstock goal and source

The Snake River fall Chinook ESU consists of fall Chinook which spawn in the Snake, Clearwater, Salmon, Imnaha, and Grande Ronde river basins. After adaptation of the LSRCP program in 1976, WDFW initiated a fall Chinook egg bank development program for the Snake River. WDFW initiated adult trapping at IHR Dam between 1977 and 1993. In addition, fish have been trapped on-site at Lyons Ferry FH since 1984. Over time the program

has changed to a supplementation program to enhance fall Chinook production in the Snake River using Snake River stock. The incidence of stray fish in the broodstock at Lyons Ferry began increasing until 1989 when it was determined after spawning that 41% of fish used for broodstock were strays. It was decided that maintaining the genetic integrity of Snake River fall Chinook was paramount. Moreover, the management agencies were concerned that strays were spawning in the wild with natural Snake River stock and the integrity of the natural population was being compromised. The 1989 brood year were not used as broodstock. In 1990, trapping also began at LGR Dam to monitor and remove strays from the Snake River and to supplement broodstock for Lyons Ferry FH. As of 1990 WDFW began reading coded wire tags to determine origin of fish prior to spawning. Until 2003, any fish of unknown origin were removed at LGR Dam and excluded from the broodstock used for supplementation to maintain the integrity of the natural population. Genetic sampling and characterization has been done and results indicate that Snake River stock reared at Lyons Ferry Hatchery are indeed closer to the original natural spawning population in the Snake River, than the Columbia River stocks or the Snake River population during high stray rate years. In 1993 trapping ceased at Ice Harbor dam because of the high number of strays from the Columbia River that were detected during a three year radio telemetry project. (As of 2008 we began targeting trapping at LGR to increase wilds in broodstock and we supplement broodstock with fish trapped at Lyons Ferry FH). In 2003, the program began including unmarked/untagged Snake River origin hatchery females trapped at Lyons Ferry FH in production. In 2004 unmarked/untagged Snake River hatchery females and natural Snake River origin females from both trapping locations were used for broodstock. Based on scale analysis of unmarked/untagged fish, only Snake River hatchery or natural origin fish are used (Scales are no longer valid for in-basin from out-of-basin fish. See the "Spawning protocols" section later in this document). Managers desire to include at least 10% naturally produced Snake River stock fall Chinook in Lyons Ferry FH broodstock annually. Any Snake River origin hatchery fish not needed for production are returned to the Snake River to "supplement" the natural population. The majority of unmarked fish are allowed to spawn naturally in the Snake River each year. [WDFW Aug. 2005b]

Revised production table listing Snake River fall Chinook salmon production priorities for Lyons Ferry FH per the UsvOR Management Agreement, Table B4B, and agreed upon by members of the SRFMP for Brood Years 2008-2017. [WDFW Sept. 2008]

Priority	**Production Program**				
	Rearing Facility	**Number**	**Age**	**Release Location(s)**	**Marking**
1	Lyons Ferry	450,000	1+	On station	225KAdCWT+VIE 225K CWT +VIE
2	Lyons Ferry	150,000	1+	Pittsburg Landing	70K AdCWT 80K CWT only
3	Lyons Ferry	150,000	1+	Big Canyon	70K AdCWT

					80K CWT only
4	Lyons Ferry	150,000	1+	Captain John Rapids	70K AdCWT 80K CWT only
5	Lyons Ferry	200,000	0+	On station	200K AdCWT
6	Lyons Ferry	500,000	0+	Captain John Rapids	100K AdCWT 100K CWT only 300K Unmarked
7	Lyons Ferry	500,000	0+	Big Canyon	100K AdCWT 100K CWT only 300K Unmarked
8	Lyons Ferry	200,000	0+	Pittsburg Landing	100K AdCWT 100K CWT only
9	Oxbow	200,000	0+	Hells Canyon Dam	200K AdCWT
10	Lyons Ferry	200,000	0+	Pittsburg Landing	200K Unmarked
11	Lyons Ferry	200,000	0+	Direct stream evaluation Near Captain John Rapids	200K AdCWT
12	DNFH/Irrigon	250,000	0+	Transportation Study**a**	250K PIT Tag only
13	Lyons Ferry, e	200,000	0+	Grande Ronde River	200K AdCWT
14	DNFH/Irrigon	78,000	0+	Transportation Studya	78K PIT tag only
15	Umatilla	200,000	0+	Hells Canyon Dam	200K AdCWT
16	Lyons Ferry, b	200,000	0+	Grande Ronde River	200K Unmarked
17	Umatilla	600,000	0+	Hells Canyon Dam	600K Ad only
TOTAL	**Yearlings**	**900,000**			
Subyearlings	**3,528,000 (of which 328,000 are for Transportation Study)**				

a. USACOE Transportation Study wild surrogate groups direct stream released into the Clearwater and mainstream Snake River

b. for logistical purposes, fish may be potentially reared at Irrigon (LSRCP)

c. Production of transportation study surrogates is in effect for five years. After this group of fish has been provided for five brood years the transportation study group will be removed from the table and the groups of fish below will move up one step in priority. If eggs available for subyearling production are 1/2m or less, production of the transportation study surrogate group will be reduced to 250k or be deferred for that year. The PAC will review

broodstock collected and projected egg take and make a recommendation to the policy group on whether to provide 250,000 fish or defer by November 1.
d. USACOE Transportation Study natural-origin surrogate groups direct stream released into the Clearwater near Big Canyon Creek and mainstem Snake River near Couse Creek.
e. for logistical purposes, fish may be potentially reared at Irrigon (LSRCP).

2. Adult collection procedures and holding

The trapping goal is 3,426 (which includes 1,600 females) adults and 198 jacks based upon stray rates and prespawning mortalities encountered in 2006-07, and 3,500 eggs per female average This goal is the total number of fish that need to be trapped to meet egg take goals through priority seventeen (Table 3). These goals are exclusive to stray culling requirements to meet the stray rate proportion of <5%. Generally, between 3,000 and 5,000 fish are trapped. Collection occurs at Lyons Ferry FH and LGR. The trapping protocol at Lyons Ferry FH is dependent upon what is estimated to be trapped at LGR, the in-season stray rate encountered, and updated return estimates. In effect, trapping is estimated for LGR, and then the remaining numbers of fish needed to meet egg take goals are trapped at Lyons Ferry FH. If changes occur in season, the percent trapped at LGR will not change, rather the trapping at Lyons Ferry FH changes. Excess adults trapped at NPTH may be used to supplement Lyons Ferry FH production shortages of LGR and volunteer adult returns.

Lyons Ferry Hatchery - Trapping at Lyons Ferry FH begins in early September, and continues throughout the spawning season, generally ending by late November or early December. All Snake River fall Chinook that voluntarily enter Lyons Ferry FH may be retained for spawning. Once the number of fish needed to trap at Lyons Ferry FH is estimated, a trapping schedule will be set to reflect the number of fish that need to be trapped weekly, based upon fall Chinook counts at Lower Monumental Dam. When the weekly target is met, no more fish will be retained until the following week. If the hatchery trap is run for steelhead collection and no fall Chinook are needed at the time, the fish will be recycled back to the river. If both fall Chinook and steelhead targets for the week have been met, the ladder will be screened to prevent access to the trap. Since the forecast of fall Chinook returns is similar to last year we do not anticipate having to adjust the trapping rate at Lyons Ferry FH. All adults trapped at Lyons Ferry FH will be retained. Jacks will be trapped and retained not to exceed 15% of the males needed for spawning. Additional jacks may be retained for CWT sampling. Minijacks will be trapped and retained not to exceed 200 fish for CWT sampling.

Coho salmon are occasionally identified at Lyons Ferry FH during fall Chinook trapping and spawning operations. WDFW does not propagate coho salmon in the Snake River, but will contact NPT representatives for proper disposition of these fish.

Lower Granite Dam - Trapping at LGR may begin as early as August 18 if river water temperatures are less than 70 o F. Trapping has occurred at a predetermined sampling rate up to 20% of each hour, twenty-four hours per day. Collected fish are divided between the Lyons Ferry FH and NPTH (usually 70:30 ratio) as agreed upon annually, with a predetermined hauling schedule shared between both facilities to meet this need. This hauling schedule is adjusted as appropriate.

[WDFW Sept. 2008]

Table. Estimated numbers of returning natural-origin Snake River fall Chinook salmon have varied greatly since 1975, with estimates of natural-origin fish passing above Lower Granite Dam (LGR) averaging 1,543 (range 101 - 6,607) per year from 1975 to 2007.

Return year	Total # fall Chinook to LGR	Hatchery	Natural	% Natural
1975	1000	0	1,000	100.00%
1976	470	0	470	100.00%
1977	600	0	600	100.00%
1978	640	0	640	100.00%
1979	500	0	500	100.00%
1980	450	0	450	100.00%
1981	340	0	340	100.00%
1982	720	0	720	100.00%
1983	540	112	428	79.26%
1984	640	316	324	50.63%
1985	691	253	438	63.39%
1986	784	335	449	57.27%
1987	951	698	252	26.50%
1988	627	259	368	58.69%
1989	706	411	295	41.78%
1990	575	474	101	17.57%
1991	1019	701	318	31.21%
1992	957	337	620	64.79%
1993	1209	432	777	64.27%
1994	1037	328	484	46.67%
1995	1375	996	379	27.56%
1996	1732	898	840	48.50%
1997	1955	1,134	821	41.99%
1998	3911	3,284	627	16.03%
1999	5237	3,515	1,722	32.88%
2000	10994	7,335	3,659	33.28%
2001	17915	11,285	6,630	37.01%
2002	18478	11,871	6,607	35.76%
2003	21047	16,714	4,333	20.59%
2004	22077	15,711	6,366	28.84%
2005	13,985	10,558	3,427	24.50%
2006	15,664	11,987	3,677	23.47%
2007	20,960	18,687	2,273	10.84%

11/5/08 Debbie Milks, WDFW

Historical run of hatchery and wild fall Chinook to Lower Granite River Dam

Does not include fish trapped at Lyons Ferry Hatchery or fall Chinook to the Tucannon River

Does not take into account fish removed from the run for Spawning needs at Lyons Ferry FH or Nez Perce Tribal Hatchery

3. Adult spawning

a) Spawning protocols

Spawning protocols will be consistent with that listed in the draft SRFMP. Spawning will occur weekly, generally on Tuesdays and Wednesdays, starting the third or fourth week in October. It will continue until late November or early December, as necessary to meet egg-take goals. All recovered CWT's will be read or elastomer tags identified during spawning to ensure separation of Lyons Ferry FH origin fish from unknown fish. (Scales are no longer valid for in-basin vs. out of basin determinations as of 2007. DNA can only determine about 30% of the origins with 90% accuracy of assignment. Because of using untagged fish in our broodstock it is not surprising that stray genes are now in our broodstock. Also by including wilds in our broodstock our hatchery fish now have wild genes making them look wild.)

Lyons Ferry FH origin fish (determined by CWT, VI, DNA or scale analysis) will be retained for broodstock. Natural Origin Snake River fish will be incorporated into the broodstock at a target rate of up to 30% (per the SRFMP), provided that this number does not exceed 20% of the natural origin spawning population. Stray (non-Lyons Ferry FH origin) hatchery fish as determined by CWT will be culled if not needed by other Columbia Basin hatcheries. Strays based on scale analysis will also be DNA sampled to verify origin. If scales determine the fish is a stray but DNA analysis indicates the fish is an in-basin fish, the DNA results will dictate the final origin of that fish (Discontinued for 2008 or in the future because of cost and only being able to get determinations on 30% of the samples).

Untagged strays may be included in broodstock up to 5%. This limit may be adjusted if necessary to meet production goals and if approved by the co managers. Changes regarding a higher stray rate usage in the broodstock, which may limit the integration efforts, are currently being discussed. If not needed, strays will be destroyed. Eggs produced from unknown origin brood fish may be utilized in the subyearling program, but not in the yearling program. In addition, Snake River origin (based on WDFW scale readings or genetic samples) unmarked/untagged fish (hatchery and natural), and AD-only fish (from LGR) will be included in the broodstock. It is suggested that unmarked/untagged fish from LGR be used preferentially over unmarked fish at Lyons Ferry FH, as they are more likely to be of Snake River origin. This action will be examined on an annual basis. It is the intent of WDFW to minimize use of out-of-basin fish in the broodstock.

One ocean males, less than 57cm fork length, will be incorporated into the broodstock at a level not to exceed 15% of the adult males collected. No fish less than 45 cm will be included in the broodstock. Fork length determinations were adjusted based on size at age of CWT fish recovered in 2006. A proposal to increase the percentage of four and five year old fish in the broodstock to offset the higher harvest rate of these fish in lower river fisheries was agreed upon by all members.

[WDFW Sept. 2008]

b) No. of males and females spawned each year over past 10 years (table)

Brood Year	Origin	Females	Males	Jacks	Total
2007					
2006					
2005	Nat. Lyons Ferry FH Snake R. Hat **Total**	81 1,177 142 **1,400**	87 8412 69 **997**	3 79 8 **90**	**171** **2,097** **219** **2,487**
2004	Nat. Lyons Ferry FH **Total**	127 1,197 **1,324**	2 1,319 **1,321**	1 (?) **(11.7%)**	**130** **2,516** **2,646**
2003	Nat. Lyons Ferry FH **Total**	2 851 **853**	0 794 **794**	0 (?) **(27.3%)**	**2** **1,645** **1,648**
2002		1,259	1,322	(6.0%)	**2,581**
2001		1,338	1,338	(14.0%)	**2,676**
2000		1,180	1,183	(?)	**2,363**
1999		1,550	1,498	(?)	**3,048**
1998		796	774	(?)	**1,570**
1997		444	535	(?)	**979**
1996		550	625	(?)	**1,175**

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

4. Fertilization

a) Protocols

Mating protocol is to minimize hatchery stray incorporation into Lyons Ferry Hatchery broodstock while incorporating potentially as many wild fall Chinook as possible. Mating will occur in a 1 x 1 cross. A mating matrix is listed in Appendix C. Because the spawning population is large (>1,000), increasing genetic diversity is not presently a concern. Males

may be split and used on multiple females if needed. To maximize the incorporation of wild fish in broodstock, we will scan all untagged fish for PIT tags. If it is determined the fish is wild we will make sure that fish is used in spawning. If the PIT tagged wild fish is a male, we may reserve a portion of the gametes to use on another female.

Fertilized eggs will be water hardened for one hour in 100-ppm iodophore, and incubated in vertical stack incubators. Progeny from below-low enzyme linked immuno-sorption assay (ELISA) females are used for the yearling programs[1]. Disposition of eggs from females yielding moderate or high titers during ELISA sampling is determined by co-managers as appropriate. These eggs are used for subyearling programs, or may be culled. Progeny of females not ELISA sampled are only used for subyearlings.

Assuming full production, IPC will receive 1,053,000 eyed eggs (842,000 for Umatilla Hatchery + 211,000 for Oxbow Hatchery. ODFW's Irrigon Hatchery will receive up to 421,000 eyed eggs to meet a release goal of 400,000 subyearlings into the Grande Ronde River and 345,000 eyed eggs for the USACOE Transportation Study.

There is the potential that surplus Snake River origin adults may be available at the broodstock collection stations once egg take goals have been met. These fish will be returned to the river to continue their upstream migration, or out-planted into natural spawning areas. All LGR origin adults with CWT must be retained for sampling. Adults and jacks released below LGR will be externally marked to ensure they do not compromise run reconstruction efforts at LGR.

[WDFW Sept. 2008]

b) Number of eggs collected and fertilized each year over past 10 years (table)

Table 7. Eggtake and survival numbers by life stage of Lyons Ferry origin fall Chinook spawned at LFH, brood years 1996-2005.

Brood Year	Eggs taken	ELISA Loss [a]	Eggs Shipped [b]	Eyed Eggs retained	Fry ponded	Intended Program
1996	1,433,862	0	0	1,377,202	941,900	Yearling
					419,677	Subyearling
1997	1,184,141	0	0	1,134,641	1,037,221	Yearling
					63,849	Subyearling
1998	2,085,155	0	0	1,978,704	916,261	Yearling
					1,010,344	Subyearling
1999	3,980,455	156,352	0	3,605,482	991,613	Yearling
					2,541,759	Subyearling
2000	3,576,956	53,176	115,891	3,249,377	998,768	Yearling
					2,159,921	Subyearling
2001	4,734,234	144,530	200,064	4,230,432	1,280,515	Yearling
					2,697,406	Subyearling
					125,600	Research
2002	4,910,467	44,900	1,195,067	3,540,000	1,032,205	Yearling
					2,376,251	Subyearling
					73,229	Research
2003	2,812,751	0	250,400	2,476,825	985,956	Yearling
					1,455,815	Subyearling
					0	Research
2004	4,625,638	0[a]	1,053,278	3,421,751	914,594	Yearling
					2,191,102	Subyearling
					184,682	Research
2005	4,929,630	0	1,180,000	3,378,600[c]	980,940	Yearling
					2,078,206	Subyearling
					216,417	Research

[a] Eggs from ELISA positive females were incorporated into the rest of the brood stock in 1996-1998 and 2003-2004.
[b] The destination of shipped eggs prior to 2003 can be found in previous Annual Reports. In 2005, eyed eggs were shipped to Oxbow Hatchery (210,000), Umatilla Hatchery (940,000) and NPTH (30,000).
[c] An additional 154,100 "eyed-eggs" were destroyed as ponded fry in February 2006. These eggs were from matings which included one stray parent.

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

5. *Incubation*

- Eggs are reared in the vertical incubators, and are treated with formalin to reduce fungus on a daily basis. They are shocked at eye-up around 550 temperature units (TU's), and handpicked shortly thereafter. After eggs are picked, folded Vexar sheets are added to each tray for substrate. Formalin treatments stop just before hatch, and after complete yolk-sac absorption by hatched fry (at around 1900 TU's), they are transferred to

raceways for rearing. Head troughs providing well water to the incubators are alarmed, and visual inspections of flow through the trays along with head trough levels are conducted daily. [WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

- Progeny from females rated as "below-low"(<0.1 optical density by ELISA) for BKD are used for the yearling programs. Progeny of "low", "moderate", and "high" BKD-ELISA and untested females can be utilized in the subyearling fall Chinook program. These fish are distributed among all subyearling releases when possible. [Lyons Ferry complex AOP – October 1, 2008 – September 30, 2009]

6. Ponding

a) Protocols

Lyons Ferry FH production fry are moved to outside raceways at ~1,600 fpp. In addition to standard raceways, adult salmon holding raceways are also utilized for subyearling fall Chinook rearing. By utilizing these larger ponds, densities in other raceways are dramatically reduced. Chronic Bacterial Gill Disease has occurred in recent years at Lyons Ferry FH and is possibly related to significant increases in the Lyons Ferry FH program. The Bacterial Gill problem is similar to that encountered during the initial years of operation at Lyons Ferry FH, when extremely high numbers of subyearlings were programmed. As a result of these density related concerns, the current density index for fall Chinook subyearlings at or smaller than 100 fpp will not exceed 0.08. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fpp. These density index goals were developed to improve fish quality and survival. [WDFW Sept. 2008]

b) Number of fry ponded each year, including % hatch each year

Table 9. Estimated survivals (%) between various life stages at LFH for fall Chinook of LFH/Snake River hatchery origin, 1990-2004 brood years.

Brood year	Release stage	Green egg-ponded fry	Ponded fry-release	Green egg-release
1990	Yearling	86.8[a]	94.5	82.1
	Subyearling	86.8[a]	98.0	85.1
1991	Yearling	89.1[a]	94.1	83.8
1992	Yearling	92.7	96.5	89.5
	Subyearling	92.7	98.4	91.2
1993	Yearling	88.0[a]	99.0	87.1
1994	Yearling	92.7	99.3	92.1
1995[b]	Yearling	90.8	94.8	86.1
	Subyearling	90.8	99.0	89.9
1996	Yearling	95.0	76.6	72.8
	Subyearling	95.0	89.5	85.0
1997	Yearling	93.0	92.5	86.0
	Subyearling	93.0	97.6	90.8
1998	Yearling	92.4	94.8	87.6
	Subyearling	92.4	95.1	87.9
1999	Yearling	92.4	66.3[c]	61.3[c]
	Subyearling	92.4	95.2	87.9
2000	Yearling	92.8	91.3	84.8
	Subyearling	92.8	94.9	88.1
2001	Yearling	93.6	79.5	74.5
	Subyearling	93.6	97.7	95.8
2002	Yearling	95.3	86.8	82.8
	Subyearling	95.3	94.8	90.3
2003	Yearling	95.5	75.7	72.3
	Subyearling	95.5	95.1	90.8
2004	Yearling	93.0	96.8	90.1
	Subyearling	93.0	97.6	90.8
Yearling mean:	%	**92.2**	**89.2**	**82.2**
	SD	2.6	10.0	8.4
Subyearling mean:	%	**92.8**	**96.1**	**89.5**
	SD	2.3	2.6	2.9

[a] Eggs from ELISA positive females were incorporated into the rest of the brood stock in 1996-1998 and 2003-2004.

[b] The destination of shipped eggs prior to 2003 can be found in previous Annual Reports. In 2005, eyed eggs were shipped to Oxbow Hatchery (210,000), Umatilla Hatchery (940,000) and NPTH (30,000).

[c] An additional 154,100 "eyed-eggs" were destroyed as ponded fry in February 2006. These eggs were from matings which included one stray parent.

[WDFW Apr. 2005]

7. Rearing/feeding protocols

- Lyons Ferry FH production fry are moved to outside raceways at ~1,600 fpp. In addition to standard raceways, adult salmon holding raceways are also utilized for subyearling fall Chinook rearing. By utilizing these larger ponds, densities in other raceways are dramatically reduced. Chronic Bacterial Gill Disease has occurred in recent years at Lyons Ferry FH and is possibly related to significant increases in the Lyons Ferry FH program. The Bacterial Gill problem is similar to that encountered during the initial years of operation at Lyons Ferry FH, when extremely high numbers of subyearlings were programmed. As a result of these density related concerns, the current density index for fall Chinook subyearlings at or smaller than 100 fpp will not exceed 0.08. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fpp. These density index goals were developed to improve fish quality and survival. [WDFW Sept. 2008]

- Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Fry are initially fed 8 or more times per day. Feeding frequency, percent body weight per day, and feed size are adjusted as fish increase in size in accordance with good fish culture practices and program goals. [WDFW Aug. 2005b]

8. Fish growth profiles

Table 10. Growth and size of Snake River Stock fall Chinook for yearling production at Lyons Ferry FH for the 2001-2003 Brood Years released in 2003-2005.

2001 brood year			*2002 brood year*			*2003 brood year*		
Month/Year	**Fpp**	**G/fish**	**Month/Year**	**Fpp**	**G/fish**	**Month/Year**	**Fpp**	**G/fish**
1/02	1200	**0.4**	1/03	**1200**	**0.4**	1/04	**1200**	**0.4**
2/02	1000	0.5	**2/03**	497	0.9	**2/04**	590	0.8
3/02	514	0.9	**3/03**	249	1.8	**3/04**	321	1.4
4/02	303	1.5	**4/03**	166	2.7	**4/04**	159	2.8
5/02	170	2.7	**5/03**	127	3.6	**5/04**	109	4.1
6/02	113	4.0	**6/03**	87	5.2	**6/04**	74	6.0
7/02	70	6.5	**7/03**	75	6.1	**7/04**	51	8.8
8/02	50	9.1	**8/03**	35	13.0	**8/04**	39	11.5
9/02	37	12.3	**9/03**	30	15.1	**9/04**	29	15.4
10/02	28	16.2	**10/03**	27	16.8	**10/04**	25	18.0
11/02	21	21.6	**11/03**	20	22.7	**11/04**	20	22.7
12/03	18	25.2	**12/04**	17	26.7	**12/05**	18	25.2

1/03	15	30.3	**1/04**	14	32.4	**1/05**	15	30.3
2/03	12	37.8	**2/04**	12	37.8	**2/05**	11	41.0
3/03	10	45.4	**3/04**	10.5	43.2	**3/05**	9.5	47.0
4/03			**4/04**			**4/05**		

Table 11. Growth and size of Snake River Stock fall Chinook for subyearling production at Lyons Ferry FH for the 2002-2004 Brood Years released in 2003-2005.

2002 brood year			*2003 brood year*			*2004 brood year*		
Month/Year	**Fpp**	**G/fish**	**Month/Year**	**Fpp**	**G/fish**	**Month/Year**	**Fpp**	**G/fish**
1/03	1200	**0.4**	**1/04**	**1200**	**0.4**	**1/05**	**1200**	**0.4**
2/03	420	1.1	**2/04**	407	1.1	**2/05**	365	1.2
3/03	168	2.7	**3/04**	195	2.3	**3/05**	154	2.8
4/03	84	5.4	**4/04**	86	5.3	**4/05**	78	5.6
5/03	65	7.3	**5/04**	70	6.5	**5/05**	60	7.5
6/03	50	9.1	**6/04**	51	8.9	**6/05**	56	7.8

[WDFW Aug. 2005b]

9. Fish health protocols and issues

- Chronic Bacterial Gill Disease has occurred in recent years at Lyons Ferry FH and is possibly related to significant increases in the Lyons Ferry FH program. The Bacterial Gill problem is similar to that encountered during the initial years of operation at Lyons Ferry FH, when extremely high numbers of subyearlings were programmed. As a result of these density related concerns, the current density index for fall Chinook subyearlings at or smaller than 100 fpp will not exceed 0.08. Density values can increase on a sliding scale to a maximum value of 0.14 for yearlings at 10-12 fpp. These density index goals were developed to improve fish quality and survival. [WDFW Sept. 2008]

- From 2003 to 2006, infectious hematopoietic necrosis virus (IHNV) has been detected in the pre-release exams done on the subyearling and yearling juveniles at the Big Canyon Acclimation site although no mortality was noted. Fish are at the acclimation sites long enough to pick up infections from anadromous salmonids in their river water supply. Enteric redmouth disease caused some mortality at this site in 2007. [pers. comm, Kathy Clemens, USFWS, 2009]

- The parasite Nucleospora salmonis has been detected the fall Chinook yearlings at Lyons Ferry FH and at the Big Canyon Acclimation Site. Sampling was done in 2008, 2009 at Lyons Ferry FH and from 2007-2009 at Big Canyon. In 2009, the subyearlings at were sampled. The significance of this finding remains to be determined. In the Hagerman

Valley, this parasite is immunosuppressive and responsible for increased mortality and disease issues. Recently, there is evidence that the parasite may be transmitted vertically. . [pers. comm, Kathy Clemens, USFWS, 2009]

10. Chemotherapeutant use

- Fall Chinook collected at Lower Granite Dam are injected at capture with oxytetracycline and erythromycin (20 mg/kg fish) at Lower Granite Dam before transfer to Lyons Ferry FH. The fish collected from Lower Granite receive a second injection of erythromycin one month before spawning.

- Fall Chinook collected at Lyons Ferry FH ladder are injected with erythromycin (20 mg/kg fish) at sorting, up to 25 days after collection. Once spawning starts, newly trapped fish are injected at the next spawn day (up to seven days after trapping).

- Yearling fall Chinook are given a 28 day prophylactic treatment using feed treated with erythromycin to reduce the potential for Bacterial Kidney Disease (BKD) outbreaks. [WDFW Sept. 2008]

11. Tagging and marking of juveniles

A total of 200,000 subyearlings are 100% coded-wire tagged and adipose fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. There will be no additional PIT tags. Captain John Acclimation Facility receives 500,000 subyearlings in May, as does Big Canyon Acclimation Facility, from Lyons Ferry FH. Both groups are comprised of 100,000 CWT, 100,000 AD CWT, and 300,000 unmarked fish. Pittsburg Landing will receive 400,000 subyearlings in May. This group is comprised of 100,000 CWT, 100,000 AD CWT, and 200,000 unmarked fish. All marking and tagging is completed by WDFW in March and April, prior to transfer. Pit tagging may occur prior to and/or post transfer to acclimation sires. These fish are acclimated and released in June by NPT. Prior to release, NPT will PIT tag 2,500 random fish each at Big Canyon and Pittsburg Landing, and 3,500 fish at Captain John, to be compatible with the direct stream released fish out planted at Couse Creek.

An additional 200,000 subyearlings may be direct stream released into the Snake River at Couse Creek, near Captain John Rapids. These fish are part of a study to compare survival of fish released directly versus those acclimated prior to release. We will coordinate with the NPT to assure that the direct release will correspond with the Captain John acclimated release, scheduled for June. All of these fish will be AD-CWT marked and include 3,500 PIT tags.

ODFW will also direct stream release 400,000 subyearlings into the Grande Ronde River near the Washington border. This group of fish is identified as priorities 13 & 16. They will be transferred to Irrigon Hatchery from Lyons Ferry FH as eyed eggs, reared and tagged there, then released into the Grande Ronde River in Washington in early June. 200,000 fish will be AD CWT marked (*priority 13*), and 200,000 will be unmarked and untagged. WDFW will randomly PIT tag 3,500 fish from this release. The co-managers will coordinate exact release location and timing.

A yearling release of 450,000 fish from Lyons Ferry FH directly into the Snake River at 10 fpp is programmed for 2010. All of these fish will be marked and/or tagged during September 2009 (half AD CWT left-red VIE, and half CWT left-red VIE), and transferred into Lake Two. A portion of these fish may also be PIT tagged (as many as 30,000) at the same time to better estimate escapement of adults through the hydro system to Lyons Ferry FH, LGR, and the Tucannon River. Those fish receiving a PIT tag will not be VIE tagged. Fish will be volitionally released from the rearing pond into the Snake River during the period of April 1-15, 2010. On or after April 15, all remaining fish in the lake will be forced out, unless river conditions dictate an alternative release time. Since all three lakes share a common release structure, the fall Chinook release must be coordinated with steelhead releases.

Three yearling groups will be marked and/or tagged at Lyons Ferry FH in September 2009 (AD+CWT; CWT only; and up to 57,000 PIT tags), then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fpp) for final rearing and release by NPT in April 2010 at a target of 10 fpp. Prior to release, NPT staff will PIT tag 4,000 random fish at each site for emigration timing and survival through the hydro-system. This tagging will be coordinated with the COE transportation study. If COE transportation tagging does not occur tagging will be conducted at the acclimation sites.

[WDFW Sept. 2008]

12. Fish Release

a) Protocols

A total of 200,000 subyearlings are 100% coded-wire tagged and adipose fin clipped in April for release from Lyons Ferry FH into the Snake River in early June. Captain John Acclimation Facility receives 500,000 subyearlings in May, as does Big Canyon Acclimation Facility, from Lyons Ferry FH. Pittsburg Landing will receive 400,000 subyearlings in May. These fish are acclimated and released in June by NPT. An additional 200,000 subyearlings may be direct stream released into the Snake River at Couse Creek, near Captain John Rapids. These fish are part of a study to compare survival of fish released directly versus those acclimated prior to release. We will coordinate with the NPT to assure that the direct release will correspond with the Captain John acclimated release, scheduled for June.

ODFW will also direct stream release 400,000 subyearlings into the Grande Ronde River near the Washington border. They will be transferred to Irrigon Hatchery from Lyons Ferry FH as eyed eggs, reared and tagged there, then released into the Grande Ronde River in Washington in early June. The co-managers will coordinate exact release location and timing.

A yearling release of 400,000 fish from Lyons Ferry FH directly into the Snake River at 10 fpp is programmed for 2010. Fish are volitionally released over a three day period from the rearing pond into the Snake River sometime between April 1-15, 2010. Since all three lakes share a common release structure, the fall Chinook release must be coordinated with steelhead releases.

Three yearling groups will be marked and/or tagged at Lyons Ferry FH in September 2009, then transferred to Captain John, Big Canyon, and Pittsburg Landing acclimation sites (at ~ 12 fpp) for final rearing and release by NPT in April 2010 at a target of 10 fpp.

[WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Table. Proposed BY2008 Snake River fall Chinook tagging, transfers and releases.

Site	Transfer Goal	Release Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/ Release Date
Oxbow (IPC)	211,000	200,000	Eyed Eggs	0+	100% AD CWT	10,000	Jan – Feb 2009 (transfer)
Umatilla (IPC)	842,000	-0-	Eyed Eggs	0+	200K AD CWT 600K AD Only	Not Applicable	Jan – Feb 2009 (transfer)
DNFH/research	345,200	345,200	Eyed Eggs	0+	Unknown	328,000	Jan – Feb 2009 (transfer)
Lyons Ferry FH	200,000	200,000	50	0+	100% AD CWT	47,222	May – Jun 2009
Grande Ronde Direct - Irrigon	421,000	400,000	Eyed Eggs	0+	200K ADCWT 200K Unmarked	3,500	Jan – Feb 2009 (transfer)
Capt. John	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Big Canyon	500,000	100,000 100,000 300,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Pittsburg	400,000	100,000 100,000 200,000	50 50 50	0+ 0+ 0+	CWT Only AD CWT Unmarked	3,500	Mar – Jun 2009
Direct near Capt. John	200,000	200,000	50	0+	100% AD CWT	3,500	June 2009

Lyons Ferry FH	450,000	450,000	10	1+	225K AD CWT VIE 225K CWT VIE	27,778	April 2009
Capt. John	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Feb - 2010 (transfer)
Pittsburg Landing	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)
Big Canyon	155,000	150,000	12	1+	70K AD CWT 80K CWT Only	5,000	Mar - 2010 (transfer)

[WDFW Sept. 2008]

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns

Table 5. Estimated adult returns of fall Chinook from the LSRCP program to the Snake River Basin. Based on CWT recoveries at Lyons Ferry FH, LGR adult trap, the Tucannon River, and the run reconstruction at LGR Dam. Includes recoveries from fall Chinook returning from Lyons Ferry FH and NPT acclimated releases. Jacks in this table are less than 53 cm fork length.

Return year	Returns to the Snake River Basin	
	Adults	Jacks
1995	1,274	2,071
1996	1,227	548
1997	1,227	711
1998	3,586	1,227
1999	4,091	1,209
2000 [a]	4,353	4,239
2001 [a]	9,009	4,995
2002 [a]	11,674	4,918
2003	10,780	6,775
2004 [b]	10,762	1,780

[a] Norma Sands, NOAA on 9/17/04.

[b] Preliminary conservative estimate that will increase when run reconstruction to Lower Granite Dam is finalized. Estimate was made using a 15% trap rate although the majority of the season the trap rate was 13% at LGR Dam.

[WDFW Aug. 2005b]

Table. Estimated escapement of Lyons ferry origin fall Chinook to the Snake River

Year	Adults	Jacks	Total
2000	4,498	3,681	8,179
2001	9,361	4,756	14,117
2002	11,355	5,157	16,512
2003	11,604	6,894	18,498
2004	14,880	2,391	17,271
2005	8,476	2,276	10,752
2006			
2007			

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

b) Return timing and age-class structure of adults

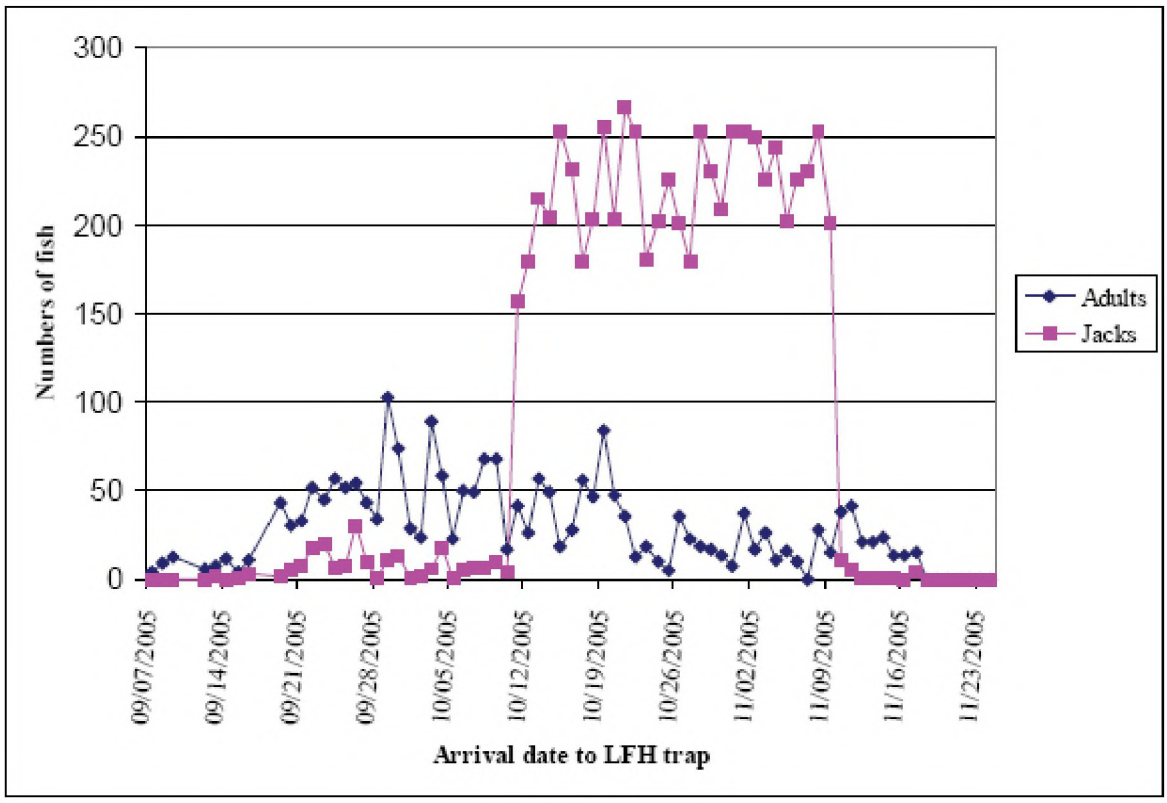

Figure 3. Number of adult and jack fall Chinook arriving at the LFH trap by date.

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

Table 17. Fish trapped at LGR Dam, hauled to LFH, and processed (killed) to determine composition, 2005.

Origin	Adults	Jacks	Comp of Adults	Comp of Jacks
LF/Snake River Hatchery	476	100	55.7%	90.9%
LF/Snake River natural (wild)	205	5	24.0%	4.5%
Strays (out-of-basin)	148	4	17.3%	3.6%
Hatchery origin (unassigned)	3	1	0.4%	0.9%
Unknown origin (natural or hatchery)	22	0	2.6%	0.0%
Summer Chinook	1	0	0.1%	0.0%
Totals	**855**	**110**	**100.0%**	**100.0%**

Table 18. Run Reconstruction estimates of numbers of fall Chinook to LGR Dam during 2005.

Origin	Adults	Jacks	Comp of Adults	Comp of Jacks
LF/Snake River Hatchery	7,163	1,880	61.5%	80.1%
LF/Snake River natural (wild)	3,109	319	26.7%	13.6%
Strays (out-of-basin)	1,367	148	11.7%	6.3%
Totals	**11,638**	**2,347**	**100.0%**	**100.0%**

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

c) Smolt-to-adult return rates

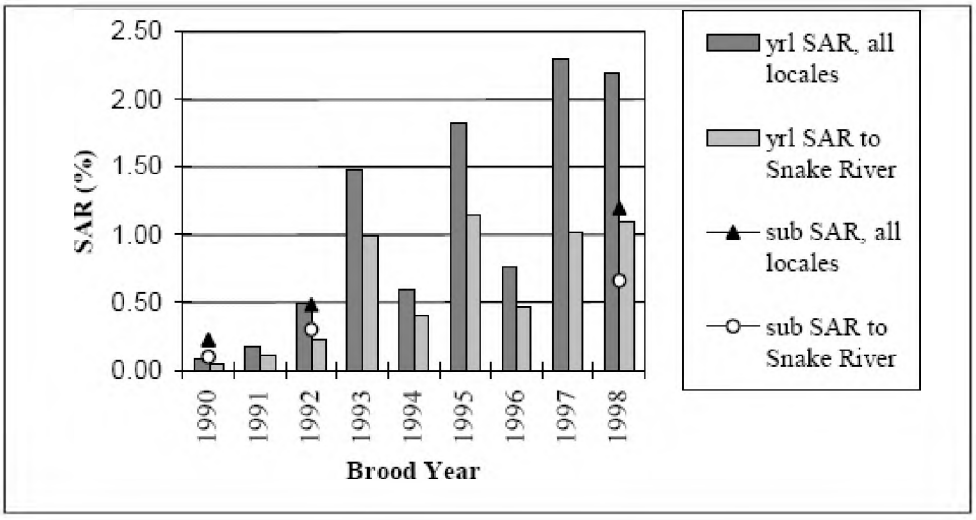

Figure 7. Survivals by broodyear of WDFW released LF/Snake River hatchery fall Chinook yearlings and subyearlings to the Snake River and all locations combined, brood years 1990-1998.

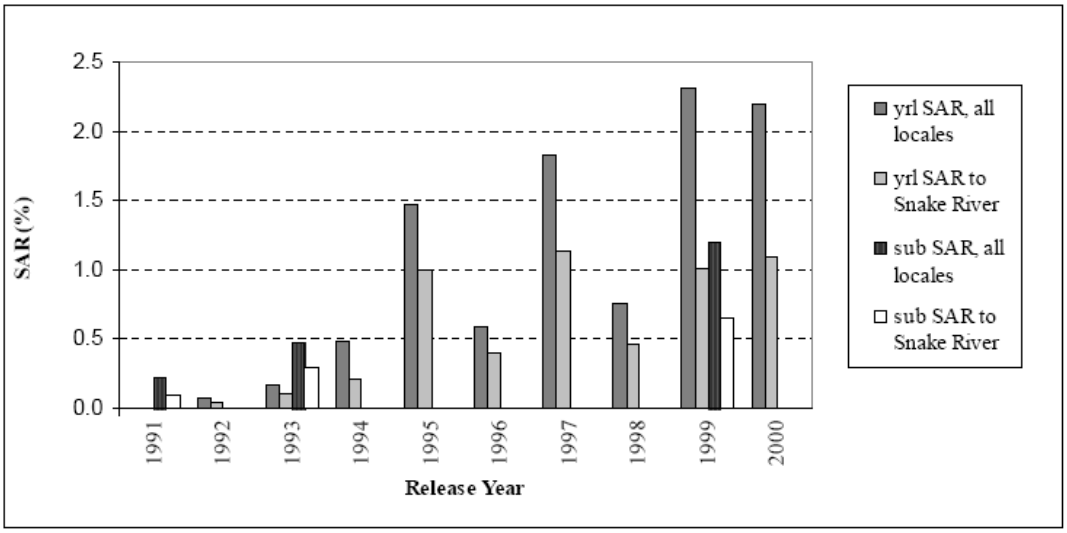

Figure 8. Survivals by release year of WDFW released LF/Snake River hatchery fall Chinook yearlings and subyearlings to the Snake River and all locations combined, brood years 1990-1998.

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

d) Stock productivity (e.g. recruits per spawner)

No information provided

2. Contributions to harvest and utilization (e.g. food banks)

Multiple fisheries benefit from the fall Chinook mitigation program in the ocean and the Columbia River. Fall Chinook from Lyons Ferry FH releases have been documented in Columbia River fisheries at higher rates than in all ocean harvest combined. The majority of recoveries have been in the Snake River at adult traps, Lyons Ferry FH, and spawning grounds. WDFW intends to have Snake River fisheries directed at harvest of marked hatchery fish within a few years. [WDFW Aug. 2005b]

Appendix J; Table 1. Estimated final locations of wire tagged LFH/Snake River hatchery origin fish in return years 2001 and 2002. Data is based upon RMIS downloads as well as run reconstruction estimates of fish returning above LGR Dam to spawn. A list of CWTs used to generate this table is available upon request. All release locations are included.

			Subyearling Brood Year					Yearling Brood Year								
Return Year	Area	Locale	1996	1998	1999	2000	Total	1994	1995	1996	1997	1998	1999	2000	VIE[a] (no BY)	Total	Grand Total
2001	freshwater	SN	36	1188	640		1864	4	26	370	1984	2131	21		938	5474	7338
		COL	37	187	15		239		41	279	1537	607	66			2530	2769
	freshwater Total		73	1375	655		2103	4	67	649	3521	2738	87		938	8004	10107
	ocean	AK	8	8			16		4	26	72	1				103	119
		BC	3	48			51			70	743	177				990	1041
		CA									106					106	106
		OR		108			108		5	52	1817	204	1			2079	2187
		WA		188	3		191		2	82	815	393				1292	1483
		HS			3		3				8	31				39	42
	ocean Total		11	352	6		369		11	230	3561	806	1			4609	4978
2001 Total			84	1727	661		2472	4	78	879	7082	3544	88		938	12613	15085
2002	freshwater	SN		846	739	215	1800			8	256	1712	1256	530	1077	4838	6638
		COL		170	53	14	237			5	173	1111	272	49		1610	1847
	freshwater Total			1016	792	229	2037			13	429	2823	1528	579	1077	6448	8485
	ocean	AK	3	69			72				32	103	12			147	219
		BC		128	121		249		7	11	54	831	117			1020	1269
		CA		3			3				7	74				81	84
		OR		38	10		48			9	70	1039	63	1		1182	1230
		WA		189	99		288				110	1452	80			1642	1930
		HS			1		1					1	5			6	7
	ocean Total		3	427	231		661		7	20	273	3500	277	1		4078	4739
2002 Total			3	1443	1023	229	2698		7	33	702	6323	1805	580	1077	10526	13224

[a] Estimates were based upon VIEs observed on fish released at LGR Dam.

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

Appendix L; Table 1. Estimated final locations of wire tagged LFH/Snake River hatchery origin fish in return years 2003 and 2004. Based upon RMIS downloaded on 4/22/05 as well as run reconstruction estimates of fish returning above LGR Dam to spawn. Snake River recoveries for 2004 are not included.

			Subyearling Brood Year						Yearling Brood Year							
Return Year	Area	Locale	1998	1999	2000	2001	2002	Total	1997	1998	1999	2000	2001	2002	Total	Grand Total
2003	freshwater	SN	97	759	264	1,033		2,153	21	804	1,269	3,036	1,991		7,121	9,274
		COL	51	45	295	2		393	2	570	1,648	2,896	137		5,253	5,646
	freshwater Total		**148**	**804**	**559**	**1,035**		**2,546**	**23**	**1,374**	**2,917**	**5,932**	**2,128**		**12,374**	**14,920**
	ocean	AK	22	19	4			45		66	15				81	126
		BC	12	127	15			154	13	212	729	157			1,111	1,265
		CA								9	8				17	17
		OR		21	12			33		71	360	110			541	574
		WA	13	69	17			99	2	162	508	120			792	891
	ocean Total		**47**	**236**	**48**			**331**	**15**	**520**	**1,620**	**387**			**2,542**	**2,873**
2003 Total			195	1,040	607	1,035		2,877	38	1,894	4,537	6,319	2,128		14,916	17,793
2004	freshwater	COL		8	34	19	1	62		11	189	560	541	17	1,318	1,380
	freshwater Total			**8**	**34**	**19**	**1**	**62**		**11**	**189**	**560**	**541**	**17**	**1,318**	**1,380**
	ocean	AK		16	18			34		8	21	38			67	101
		BC		11	66	25		102		14	150	672	212		1,048	1,150
		CA			13			13			15	64	12		91	104
		OR			7	9	2	18			87	692	268		1,047	1,065
		WA		4	47	67		118			142	662	300		1,104	1,222
	ocean Total			**31**	**151**	**101**	**2**	**285**		**22**	**415**	**2,128**	**792**		**3,357**	**3,642**
2004 Total				39	185	120	3	347		33	604	2,688	1,333	17	4,675	5,022

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

Appendix I. Locations and estimated totals of LFH/Snake River origin wire tagged fish recovered during 2005. Based upon RMIS downloads from 4/17/07 of CSV files. (Note: **Estimates to the Snake River are not included)**

			Subyearling Brood Year					Yearling Brood Year						
Area	Locale*	Recovery Location	2000	2001	2002	2003	Total	1999	2000	2001	2002	2003	Total	Grand Total
Freshwater	COL	Priest Rapids Hatchery								1			1	1
		Ringold Springs Hatchery									2	1	3	3
		Three Mile Dam (Umatilla R.)								1	24	25	50	50
		Wind River-Carcass Survey								6			6	6
		Combined Fisheries	3	28	18	1	50	3	222	551	99	10	885	935
Freshwater Total			**3**	**28**	**18**	**1**	**50**	**3**	**222**	**558**	**125**	**36**	**944**	**994**
Ocean	AK	Combined Fisheries		15	4	2	21		17	30	1	1	49	70
	BC	Combined Fisheries	6	80	20	8	114	12	314	761	43		1130	1244
	CA	Combined Fisheries							6	34			40	40
	HS	Combined Fisheries			4		4		4	6	13		22	26
	OR	Combined Fisheries		6	5		11	3	83	506	45		636	647
	WA	Combined Fisheries		92	52		144	5	204	857	54		1119	1263
Ocean Total			**6**	**193**	**84**	**10**	**293**	**19**	**627**	**2195**	**155**	**1**	**2,997**	**3,291**
Total			**9**	**221**	**102**	**11**	**343**	**22**	**849**	**2753**	**281**	**37**	**3,942**	**4,285**

* (COL=Columbia River, AK=Alaska, BC=British Columbia, CA=California, OR=Oregon, WA=Washington, HS=High Seas. Data for untagged fish associated with the wire tagged fish are not included.)

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

3. Contributions to conservation

Congress authorized the LSRCP in 1976. As a result of that plan, Lyons Ferry Hatchery (Lyons Ferry FH) was constructed and has been in operation since 1984. One objective of the hatchery was to compensate for an estimated annual loss of 18,300 adult, Snake River stock, fall Chinook salmon. An evaluation program was initiated in 1984 to monitor the success of Lyons Ferry FH in meeting the LSRCP compensation goals and to identify any production adjustments required to accomplish those goals. This mitigation program was modified in the early 1990s by agreement of the *United States v. Oregon* parties to supplement natural fall Chinook production above Lower Granite Dam (LGR). This action was consistent with the U.S. Endangered Species Act and Washington's Wild Salmonid Policy.

The WDFW has two general goals in its fall Chinook evaluation program: (1) monitor hatchery practices at Lyons Ferry FH to ensure quality smolt releases, high downstream migrant survival, and sufficient adult fish contribution to fisheries and escapement to meet the LSRCP compensation goals; and (2) gather genetic information to help maintain the integrity of the Snake River Basin fall Chinook salmon stock. Efforts have contributed to evaluating the

status of Snake River fall Chinook by monitoring population abundance, spatial distribution, genetics, and life history (sex and age of returns) as well as removing some hatchery strays at LGR on the Snake River to minimize the effects of out-of-basin strays on the population. [WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

4. Other benefits

Tribal harvest and surplus adults trapped at facilities provide a cultural and subsistence benefits to Columbia River tribes.

E. Research, monitoring, and evaluation programs

- **WDFW indicators for program monitoring and evaluation:**

3.2.1 Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding over-harvest of non-target species.

- *Annual escapements of natural populations that are affected by fisheries targeting program fish.*

3.3.1 Program contributes to an increasing number of spawners returning to natural spawning areas.

- *Number of spawners on spawning ground and at hatchery by age.*

- *Number of redds in production index areas.*

- *Spawner-recruit ratios.*

3.4.2 Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.

- *Number of spawners of natural origin removed for broodstock.*

- *Number and origin of spawners migrating to natural spawning areas.*

3.4.3 Life history characteristics of the natural population do not change as a result of this artificial production program.

- *Specific life history characteristics to be measured in the artificially produced population include:*

  - Juvenile dispersal timing
  - Juvenile size at emigration, and emigration age composition
  - Adult return timing
  - Adult return age and sex composition

- Adult size at return
- Spawn timing, distribution
- Juvenile rearing densities and distribution
- Juvenile condition factors and survivals at several growth stages prior to final release
- Adult physical characteristics (length)
- Fecundity and egg size
- In addition, WDFW believes that smolt-to-adult survivals be included as an indicator.

- Specific life history characteristics of the natural population to be measured at the program's outset and each generation thereafter include:

- • Adult run timing
- • Adult return age, and sex composition
- • Adult size at return
- • Spawn timing and distribution
- • Adult physical characteristics (length)
- • Fecundity and egg size
- • Emigration age composition (based on scale analysis)

[Note: Needs to be coordinated with NMFS at LGR adult trap and agreed upon by co-managers of fall Chinook in the Snake River. Additional funding would need to be secured to address this task. See Snake River Fall Chinook Hatchery Management Plan (in development)].

3.5.3 Artificially produced adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.

- The ratio of observed and/or estimated total numbers of artificially produced fish on natural spawning grounds, to total number of naturally produced fish, for each significant spawning area.

- Observed and estimated total numbers of naturally produced and artificially produced adults passing a counting station close to natural spawning areas.

(Note: We will supply the Technical Advisory Committee with the data needed to estimate the run of fall Chinook to Lower Granite Dam. In addition we will address any questions the Technical Advisory Committee or other co-managers have regarding the dataset.)

3.5.6 The number of adults returning to the hatchery that exceed broodstock needs is declining.

- Number of adults available for broodstock (moving geometric mean, based on number of ages at return for this species).

3.7.4 Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.

- *Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence*

- *Juvenile densities during artificial rearing.*

3.7.7 Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.

- *Mortality rates in trap.*

- *Pre-spawning mortality rates of trapped fish in hatchery.*

(Note-This standard is also listed under benefits. In 2003 the program began including unmarked/untagged hatchery females in production. We are allowed by NMFS to retain all unmarked/untagged fish caught at LGR Dam as part of a systematic sub-sample of the population (11-15%). Based on scale analysis only Snake River hatchery or wild fish are used for broodstock, while stray fish are euthanized unless fall Chinook brood fish are needed in another basin.)

3.7.8 Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.

- *Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.*

WDFW will use the above indicators to determine whether the program has or is, causing unacceptable impacts, or poses unacceptable risks to the listed natural populations within the Snake River Basin. The ability of the evaluation staff to estimate hatchery and natural proportions in the Snake River and other basins will be determined by implementation plans, budgets, and assessment priorities.

[WDFW Sept. 2008]

- **The ACOE has made a request for up to 345,220 eyed eggs** from Lyons Ferry FH for use in an in-river/transportation study, acting as surrogates for natural fish. Eggs for this study may be shipped to DNFH or Irrigon Hatchery for incubation and rearing. Alternatively, they may be reared at Lyons Ferry FH if space allows. All of the fish would be PIT tagged prior to release, as funded and contracted by the ACOE. Additionally, the ACOE requested 250,000 per the *USvOR* agreement. PIT-tags will be divided between all subyearling production releases in the Snake River basin, acting to represent the hatchery component of the in river/transportation study. The Lyons Ferry FH portion of these fish will be PIT tagged at Lyons Ferry FH, as contracted and funded by the ACOE, and coordinated with hatchery staff.

The co-managers recognize that acclimation prior to release is expected to provide fish performance advantages, however current facility limitations within the basin preclude acclimation of all subyearling groups. A direct versus acclimated study is being conducted by the USFWS, WDFW and NPT to scientifically evaluate the merit of direct stream releases of fall Chinook subyearlings versus acclimated releases. BY08 will be the fourth year of this five year direct release study The study will determine if new acclimation facilities in the Snake River basin should be constructed, or are unnecessary. It compares fish performance between groups of the same size (current release size goal is 50 fish/lb), but reared and released under different conditions. Rearing protocols will conform to standard practices, with a focus on maintaining acceptable growth rates, environmental quality, and fish health. Since the managers agree that fish size is critical to the survival of subyearling fall Chinook, size at release will be the primary determinant of release date. Normal acclimation time at CJR is three weeks, and normal release is expected around May 21-25 each year. The acclimation group will be transported to CJR approximately three weeks prior to scheduled release at a projected average size of 75 mm (70 fish/lb). 3,500 PIT tags will be inserted into a random sample of fish within this group prior to release. A second group will be reared at Lyons Ferry FH and direct stream released at Couse Creek, just downriver from CJR. They will also have 3,500 randomly inserted PIT tags within this release group. Every effort will be made to meet fish size, and period of acclimation, but the cooperators recognize the potential for early release if fish health will be compromised by environmental or facility conditions. If an early release occurs, the cooperators will coordinate releases as closely as possible.

This study will provide managers with performance comparisons between CJR acclimated and directly released Lyons Ferry FH reared subyearling fall Chinook including: (1) passage date at LGR, (2) travel time to LGR, (3) survival from release to the tailrace of LGR, (4) growth and condition measured from release to LGR, (5) smolt-to-adult return rates (SAR's) measured from release to LGR, and (6) spawner fidelity to the Snake River. LGR will be the primary evaluation point for accomplishing all of these objectives with the exception of objective 6.

[WDFW Sept. 2008]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

The sizes of the adult ponds at Lyons Ferry FH limit our options when working fish during spawning. The holding ponds are very large and more fish can be held in the ponds than can be crowded into the fallback channel. Over-crowding fish in the fallback channel causes undue stress, which can lead to pre-spawning mortality. The vessels cannot be divided with crowders because each pond needs to be drained all at once. Also, an open pond must be available for use when fish are returned back to the pond. Since there are only two ponds slated for fish trapped from each location (Lyons Ferry FH and LGR), one must be completely emptied before fish can be returned to that pond. In addition, fish that were previously inoculated must be kept separately from the new arrivals. Differences in run composition and spawn timing between fish trapped at each location exacerbate the situation. Dividing the

ponds would enable us to spawn one pond of Lyons Ferry FH trapped fish and one pond of LGR trapped fish on the same day. This would allow us to work within our spawning protocol, and decrease the number of males used multiple times (maximize N_b).

Fallback at LGR Dam is known to occur. Data from a 1993 telemetry study indicated fish released as juveniles at Lyons Ferry FH occasionally cross LGR Dam when they return as adults, then descend through the system to be trapped at Lyons Ferry FH. Likewise, out-of-basin fish have exhibited similar migration patterns. Any fish trapped at LGR and released to continue upstream is operculum punched.

Data from carcass surveys on the Tucannon may be biased. The sample size of carcasses recovered each year is very small. Our concern is that the carcasses recovered do not adequately reflect the composition of fish spawning in the Tucannon. Run composition is estimated based on adults recovered. Since we recover more females than males it is possible we are overestimating the older age classes (females) and under estimating the younger age classes (males and jacks). We do not know if the composition is accurate or if it is biased due to recovery methods.

The release of unmarked/untagged fish into the Snake River may be causing us to underestimate escapement of fish associated with LSRCP mitigation. The absence of CWTs in these fish forces us to depend upon scale analysis to differentiate in-basin (LSRCP or IPC) from out-of-basin fish.

Hatchery minijacks and jacks from Lyons Ferry FH constitute a significant portion of the fall Chinook returns to the Snake River during most years, but some years the run is dominated by minijacks and jacks.

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

No information provided.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

Snake River fall-run Chinook from Lyons Ferry Hatchery broodstock appear to be genetically distinguishable from the out-of-basin samples (unmarked/untagged hatchery yearling volunteers and Umatilla Hatchery broodstock) that were analyzed. Chinook that volunteer to Lyons Ferry Hatchery that are from unmarked/untagged hatchery subyearling releases and identified as hatchery origin appear to be similar to Lyons Ferry Hatchery broodstock and could be used to supplement the broodstock. Identification of the hatchery or natural origin and subyearling or yearling status would be necessary for inclusion into Lyons Ferry Hatchery broodstock. Natural origin fall-run Chinook collected at Lower

Granite Dam appear to have some out-of-basin influence based on the lack of difference to the unmarked/untagged hatchery yearling volunteers and Umatilla Hatchery broodstock. .

[WDFW Apr. 2005, WDFW Apr. 2006, WDFW Feb. 2003, WDFW Sept. 2007a]

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

Release of large numbers of hatchery fall Chinook juveniles into multiple locations for supplementation within the Snake River Basin on top of naturally spawning populations poses a competition risk to natural-origin juvenile fall Chinook.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

No information provided

IIB. Tucannon River Spring Chinook

A. General information

Lyons Ferry FH (Phase II) also included rearing of spring Chinook for the Tucannon River and was designed to produce 132,000 spring Chinook at 15 fpp for a total of 8,800 pounds. All adults for the program were to be trapped and held at Tucannon FH until late August when spawning occurs. The eggs were then to be transported to Lyons Ferry FH for fertilization, incubation, and rearing and then returned to the Tucannon FH adult ponds in the fall for acclimation and release in April. The adult return goal for the program is 1,152 spring Chinook salmon back to the project area. [USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase II) was constructed in 1984 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 8,800 pounds (142,000 smolts) of spring Chinook salmon (15 fpp) for release. [USFWS May 1990]

2. Goals of program

The goal of this program is to return 1,152 spring Chinook salmon to the project area to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]

3. Objectives of program

- The Tucannon River Spring Chinook supplementation program is comprised of conventional in-river broodstock sources, as the 10 year captive brood program has been eliminated. Returning adults trapped at the Tucannon FH comprise the conventional broodstock component. The captive broodstock component was initiated in 1997 to prevent extirpation of this listed stock. It was designed to last only one generation (five brood years). This program concluded with the release of 2006 BY smolts in 2008. The conventional release goal was increased to 225,000 beginning with the 2006 brood year.

- Trapping for the Spring Chinook broodstock program is conducted exclusively at the Tucannon FH adult trap, located just upstream of the hatchery and adjacent to the Rainbow Lake intake. Up to 170 fish (85 wild and 85 hatchery adults) will be collected for broodstock, while remaining adults and one ocean fish are counted and released upstream. One ocean fish will be included in the brood at a rate not to exceed 15% of the adult males

although this rate may be exceeded during low run years. This increased limit is necessary to meet the new release target of 225,000 yearling smolts.

- The egg take goal for the program is 272,000 green eggs to meet the conventional release goal of 225,000 smolts (beginning with the 2006 brood year).

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Integrated Recovery Program (Supplementation). Continue to provide mitigation as specified under the LSRCP program (USACE 1975) while meeting conservation and recovery criteria established for the Tucannon River population and Snake River spring/summer Chinook ESU. The goal of this program is the restoration and enhancement of spring Chinook salmon in the Tucannon River using supplementation with the indigenous stock. Conserve genetic resources of naturally reproducing Tucannon River spring Chinook due to low population abundance using captive broodstock propagation methods. [WDFW Aug. 2005c]

5. Alignment of program with ESU-wide plans

- Lyons Ferry Complex is part of the LSRCP Program and the production of spring Chinook is part of legally required mitigation provided to the state of Washington under the LSRCP Program. Spring Chinook production is recognized under the U.S. vs. Oregon annual production plan as part of the fall fishing agreement.

- The natural population of spring Chinook in the Tucannon River has been decreasing and depressed since 1984. The spring Chinook population was listed as "endangered" under the ESA as part of the Snake River spring/summer Chinook ESU (April 22, 1992; FR 57 No. 78: 14653). The listing status was changed to "threatened" in 1995 (April 17, 1995; FR 60 No. 73: 19342). The LSRCP spring Chinook supplementation program has been operated since 1985 to provide mitigation for adult spring Chinook lost because of construction and operation of the lower Snake River dams. The current hatchery supplementation program has used Tucannon River stock since the program's inception. The Tucannon River stock was derived from fish captured at the Tucannon FH adult trap, thereby representing individuals that were endemic to the Tucannon River. The May 10, 1999, Biological Opinion issued by NMFS on the Tucannon River spring Chinook program (captive broodstock) considered the supplementation and captive broodstock programs to be the best chance to maintain the existence and chance for recovery of natural spring Chinook within the Tucannon River.

[WDFW Aug. 2005c]

6. Habitat description and status where fish are released.

Limited comprehensive review of the ecological health of the Tucannon River watershed in relation to salmonid population status and recovery has been completed. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin (WDFW unpublished data), but the extent of these problems is un-quantified. State

programs provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Protection Act (NEPA) review.

Most watershed restoration/improvement projects are funded through the Columbia Conservation District Tucannon Model Watershed Management Plan (1996). Efforts include fencing to ensure riparian vegetative recovery, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland, and screening of irrigation diversions. Taken together, habitat protection and improvement measures have, and will continue to improve habitat for and productivity of the basin's spring Chinook population.

[WDFW Aug. 2005c]

7. Size of program and production goals (No. of spawners and smolt release goals)

Up to 170 fish (85 wild and 85 hatchery adults) will be collected for broodstock, while remaining adults and one ocean fish are counted and released upstream. One ocean fish will be included in the brood at a rate not to exceed 15% of the adult males although this rate may be exceeded during low run years. This increased limit is necessary to meet the new release target of 225,000 yearling smolts. [WDFW Aug. 2005c]

C. Description of program and operations

1. Broodstock goal and source

WDFW will collect captive broodstock progeny when run size limits endemic and hatchery origin broodstock collection goals. However, their use in broodstock will be limited. The priority will be to collect as many endemics and hatchery origin broodstock to meet program goals. WDFW may also retain all of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the Tucannon River Fish Hatchery adult trap each year if the total annual adult returns to the trap is less than 105 fish. If the total annual adult returns to the trap are 105 fish or more, WDFW is authorized to retain up to 70 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap each year and must release at least 30 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap above the hatchery trap for natural spawning. [WDFW Aug. 2005c]

2. Adult collection procedures and holding

Trapping for the Spring Chinook broodstock program is conducted exclusively at the Tucannon FH adult trap, located just upstream of the hatchery and adjacent to the Rainbow Lake intake. Up to 170 fish (85 wild and 85 hatchery adults) will be collected for broodstock, while remaining adults and one ocean fish are counted and released upstream. One ocean fish

will be included in the brood at a rate not to exceed 15% of the adult males although this rate may be exceeded during low run years. This increased limit is necessary to meet the new release target of 225,000 yearling smolts. WDFW will collect captive broodstock progeny when run size limits endemic and hatchery origin broodstock collection goals. However, their use in broodstock will be limited. The priority will be to collect as many endemics and hatchery origin broodstock to meet program goals. WDFW may also retain all of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the Tucannon River Fish Hatchery adult trap each year if the total annual adult returns to the trap is less than 105 fish. If the total annual adult returns to the trap are 105 fish or more, WDFW is authorized to retain up to 70 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap each year and must release at least 30 percent of the adult, ESA-listed, Snake River spring/summer Chinook salmon that return to the trap above the hatchery trap for natural spawning. Adults collected for spawning are transferred by truck to Lyons Ferry FH for holding. [WDFW Aug. 2005c]

3. Adult spawning

a) Spawning protocols

- Maintaining an equal sex ratio in the spawning population is the goal of the program. A 2x2 factorial spawning occurs to increase the number of crosses. At times the small number of fish ripe on individual days usually limits spawning options. Males are usually limited to primary status on one half the eggs from two females. Where insufficient males are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution. [WDFW Aug. 2005c]

- Spring Chinook adults, trapped at Tucannon FH will be spawned during September at Lyons Ferry FH, with an egg take goal of 272,000 green eggs. All spring Chinook carcasses are frozen after spawning, and hauled to the upper Tucannon River for nutrient enhancement, if viral samples test negative. [WDFW Sept. 2008]

b) No. of males and females spawned each year over past 10 years (table)

Brood year	Origin	Females	Males	Jacks	Total
2007	Nat.	27	24	0	**51**
	Hat.	9	22	0	**31**
	Total	**36**	**46**	**0**	**82**
2006	Nat.	18	18	0	**36**
	Hat.	27	25	0	**52**
	Total	**45**	**43**	**0**	**88**
2005	Nat.	25	22	0	**47**
	Hat.	24	24	0	**48**

	Total	**49**	**46**	**0**	**95**
2004	Nat.	28	20	0	**48**
	Hat.	18	22	0	**40**
	Total	**46**	**42**	**0**	**88**
2003	Nat.	17	24	0	**41**
	Hat.	20	14	0	**34**
	Total	**37**	**38**	**0**	**75**
2002	Nat.	22	20	0	**42**
	Hat.	25	26	0	**51**
	Total	**47**	**46**	**0**	**93**
2001	Nat.	29	23	0	**52**
	Hat.	27	25	0	**52**
	Total	**56**	**48**	**0**	**104**
2000	Nat.	3	5	0	**8**
	Hat.	35	30	0	**65**
	Total	**38**	**35**	**0**	**73**
1999	Nat.	30	15	0	**45**
	Hat.	14	27	0	**41**
	Total	**44**	**42**	**0**	**86**
1998	Nat.	1	3	0	**4**
	Hat.	36	82	0	**108**
	Total	**37**	**85**	**0**	**112**

[WDFW Aug. 2003, WDFW Aug. 2005a, WDFW Aug. 2006, WDFW Aug. 2008, WDFW Sept. 2007b, WDFW Sept. 2004, WDFW Sept. 2002]

4. Fertilization

a) Protocols

Spring Chinook adults, trapped at Tucannon FH will be spawned during September 2008 at Lyons Ferry FH, with an egg take goal of 272,000 green eggs. A 2:2 matrix spawning protocol is followed as approved by WDFW Evaluation staff. Fertilized eggs will be water hardened in 100-ppm iodophore for one hour. [WDFW Sept. 2008]

b) Number of eggs collected and fertilized each year over past 10 years (table on next page)

Table 18. Estimates of Tucannon spring Chinook salmon abundance (*spawned and reared in the hatchery*) by life stage for 1985-2007 broods.

Brood Year	Females Spawned		Mean Fecundity[a]		Number of Eggs	Number of Parr	Number of Smolts	Progeny[b] (returning adults)
	Natural	Hatchery	Natural	Hatchery				
1985	4	-	3,883	-	14,843	13,401	12,922	45
1986	57	-	3,916	-	187,958	177,277	153,725	339
1987	48	-	4,096	-	196,573	164,630	152,165	190
1988	49	-	3,882	-	182,438	150,677	146,200	447
1989	28	9	3,883	2,606	133,521	103,420	99,060	243
1990	21	23	3,993	2,697	126,334	89,519	85,800	28
1991	17	11	3,741	2,517	91,275	77,232	74,060	25
1992	28	18	3,854	3,295	156,359	151,727	87,752[c]	81
1993	21	28	3,701	3,237	168,366	145,303	138,848	207
1994	22	21	4,187	3,314	161,707	132,870	130,069	34
1995	6	15	5,224	0	85,772	63,935	62,272	180
1996	18	19	3,516	2,843	117,287	80,325	76,219	260
1997	17	25	3,609	3,315	144,237	29,650	24,184	181
1998	30	14	4,023	3,035	161,019	136,027	127,939	830
1999	1	36	3,965	3,142	113,544	106,880	97,600	29
2000	3	35	3,969	3,345	128,980	123,313	102,099	175
2001	29	27	3,612	3,252	184,127	174,934	146,922	129
2002	22	25	3,981	3,368	169,364	151,531	123,586	133
2003	17	20	3,789	3,812	140,658	126,400	71,154	77
2004	28	18	3,444	2,601	140,459	128,877	67,542	33
2005	25	24	3,773	2,903	161,345	151,466	149,466	
2006	18	27	2,887	2,654	123,629	112,350	106,530	
2007	27	9	3,847	2,869	124,543	117,182		

[a] 1985 and 1989 mean fecundity of natural females is the average of 1986-88 and 1990-93 brood years; 1999 mean fecundity of natural fish is based on the mean of 1986-1998 brood years.
[b] Numbers do not include down river harvest or other out-of-basin recoveries.
[c] Number of smolts is less than actual release number. 57,316 parr were released in October 1993, with an estimated 7% survival. Total number of hatchery fish released from the 1992 brood year was 140,725. We therefore use the listed number of 87,752 as the number of smolts released.

[WDFW Aug. 2008]

5. *Incubation*

- The Chinook salmon incubation rooms at Lyons Ferry FH are designed to accept and incubate eggs from individual females through the eyed stage. The incubation rooms receive constant 11o C well water. One incubation room utilizes heath incubation stacks; the other utilizes colanders nested in PVC buckets that receive water via individual plastic tubes. Isolated incubation vessels allow for controlling disease and for documenting fecundities and fertilization success of the different groups. Incubating eggs are treated with formalin every other day at 1,667 ppm (37% formalin) for 15 minutes to control fungus. After development to the eyed-egg stage, the eggs are shocked and Evaluation Staff remove the dead eggs. Substrate (layered plastic screening material) is added to the trays, and eggs from each female are placed back in its original tray. Eggs are allowed to hatch and sac fry rear in the trays, or troughs until yolk absorption is complete. [WDFW Aug. 2005c]

- Eggs are treated with formalin daily to reduce fungus and reared in vertical incubation trays. At eye-up, they are shocked, handpicked, and substrate is added to each tray. [WDFW Sept. 2008]

6. Ponding

a) Protocols

- When the incubating fry (supplementation and captive progeny) have completely absorbed their yolk sac, they are ponded in standard raceways at Lyons Ferry FH (3.1 x 1.1 x 30.5 m). Each raceway is supplied with 500-1,000 gal/min of well water at constant temperature. Raceways are cleaned weekly by brushing screens and vacuuming pond floors. [WDFW Aug. 2005c]

- Six intermediate fiberglass tanks were purchased and installed in 2006, giving culturists greater early-rearing space for all programs. This not only reduced densities, it also allows individual spawn groups to be grown together in size before mixing in outside raceways. It also means fish are moved to the raceways at a much larger size, possibly increasing survival to release. Staff also installed an in-line site tube in the venturi vacuum hose, which allows culturists to physically observe the hose to make sure no fish are accidentally vacuumed during routine pond cleaning. Finally, staff have researched various screen seals, and are now using one type for all stocks, proven to be most effective during rearing. [WDFW Sept. 2008]

- Lyons Ferry FH raceway rearing density index criteria for spring Chinook generally should not exceed 0.15 lbs/ft3 for fish >100 Fpp to help ensure healthy fish. Early rearing (immediate post ponding) densities can be higher. When the spring Chinook are reared in rearing ponds (Curl Lake), densities can be 10% of the raceway maximum. [WDFW Aug. 2005c]

- At Tucannon Hatchery, raceways are supplied with oxygenated well or river water from the hatchery's central degassing building. Approximately 1,000-gpm (2.2 cfs) water enters raceway A, 400 gpm (0.9 cfs) enters raceways E and W and 200 gpm (0.45 cfs) enters the round ponds. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Feeding is by hand presentation. [WDFW Aug. 2005c]

- At Curl Lake Acclimation Pond, water is supplied directly from the Tucannon River. A maximum of 6 cfs can be drawn from the river to the pond, though rarely is 5 cfs used. Based on the river water temperature, oxygen levels range between 11-14 ppm. Density indexes within Curl Lake are very low with a DI of 0.005 lbs/ft3 assuming a maximum 300,000 fish at 15 fpp. Fish are fed by truck mounted feed blower. [WDFW Aug. 2005c]

b) Number of fry ponded each year, including % hatch each year

Table 19. Percent survival by brood year for juvenile salmon and the multiplicative advantage of hatchery-reared salmon over naturally-reared salmon in the Tucannon River.

	Natural			Hatchery			Hatchery Advantage		
Brood Year	Egg to Parr	Parr to Smolt	Egg to Smolt	Egg to Parr	Parr to Smolt	Egg to Smolt	Egg to Parr	Parr to Smolt	Egg to Smolt
1985	10.6	46.6	4.9	90.3	96.4	87.1	8.5	2.1	17.6
1986	13.1	56.7	7.4	94.3	86.7	81.8	7.2	1.5	11.0
1987	10.4	55.6	5.8	83.8	92.4	77.4	8.0	1.7	13.3
1988	15.2	54.3	8.3	82.6	97.0	80.1	5.4	1.8	9.7
1989	14.4	51.2	7.4	77.5	95.8	74.2	5.4	1.9	10.1
1990	13.2	57.4	7.6	70.9	95.8	67.9	5.4	1.7	8.9
1991	19.0	54.7	10.4	84.6	95.9	81.1	4.5	1.8	7.8
1992	14.2	49.2	7.0	97.0	57.8	56.1	6.8	1.2	8.0
1993	12.9	57.1	7.4	86.3	95.6	82.5	6.7	1.7	11.2
1994	7.1	55.0	3.9	82.2	97.9	80.4	11.6	1.8	20.7
1995	0.0	0.0	0.3	74.5	97.4	72.6	--	--	--
1996	1.2	56.7	0.7	68.5	94.9	65.0	55.8	1.7	--
1997	13.2	64.0	8.4	20.6	81.6	16.8	1.6	1.3	2.0
1998	8.7	65.2	5.6	84.5	94.1	79.5	9.8	1.4	14.1
1999	12.3	51.2	6.3	94.1	91.3	86.0	7.7	1.8	13.7
2000	13.8	44.9	6.2	95.6	82.8	79.2	6.9	1.8	12.8
2001	6.1	60.1	3.6	95.0	84.0	79.8	15.7	1.4	22.0
2002	6.7	83.8	5.7	89.5	81.6	73.0	13.3	1.0	12.9
2003	9.1	56.2	5.1	89.9	56.3	50.6	9.8	1.0	9.9
2004	6.0	68.3	4.1	91.8	52.4	48.1	15.3	0.8	11.8
2005	5.8	83.1	4.8	93.9	98.7	92.6	16.1	1.2	19.1
2006				90.9	94.8	86.2			
2007				94.1					
Mean	10.1	55.8	5.8	84.0	87.3	72.6	11.1	1.5	12.5
SD	4.7	16.2	2.4	16.0	14.1	17.0	11.2	0.4	4.8

[WDFW Aug. 2008]

7. Rearing/feeding protocols

Fry are initially fed 8 or more times per day. Feeding frequency, percent BWD and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals. In the future, some aspects of natural rearing techniques may be utilized (in-pond structures, covers for shading, in-water feeders, etc) for rearing fish at Lyons Ferry FH. However, Lyons Ferry FH is a production hatchery, and as such, the raceways were not designed for small group rearing, or for easily placing/removing natural structures in raceways. [WDFW Aug. 2005c]

8. Fish growth profiles

Table 10. Tucannon River Spring Chinook Stock Growth – 1999 and 2000 Brood Years.		
	2000 BY	**1999 BY**
Month	**Fish/Lb**	**Fish/Lb**
November	1600.0	1600.0
December	844.0	800.0
January	264.0	600.0
February	157.0	98.0
March	76.3	71.8
April	59.0	66.8
May	58.0	50.0
June	53.0	37.0
July	48.5	32.3
August	43.0	30.0
September	38.0	27.4
October	33.0	25.6
November	27.1	19.3
December	24.7	18.6
January	22.2	18.0
February	19.2	17.0
March	17.1	13.0
April	15.2	13.0

[WDFW Aug. 2005c]

9. Fish health protocols and issues

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs are removed after shocking, and dead sac-fry are removed during ponding procedures. A fish health specialist makes at least monthly visits to each hatchery, and more if required to diagnose and recommend treatments for disease. [WDFW Aug. 2005c]

10. Chemotherapeutant use

A prophylactic aquamycin treatment is used to control BKD. This treatment lasts 28 days, and is typically applied in July and August, through feed with 4.5% aquamycin. [WDFW Sept. 2008]

11. Tagging and marking of juveniles

In September 2008, the BY07 progeny were 100% CWT/VIE (½ purple and ½ blue non-fluorescent) tagged with no fin clip. There were 55,893 tagged fish for one group, and 59,949 from the other group. Each size group for the evaluation study were marked with a separate tag code, along with separate colored elastomer tags. The elastomer tags will be helpful to identify the different fish size groups when sampled, prior to release and during migration.

Both fish groups will be transferred to Tucannon FH in October for final rearing and release. At Tucannon FH, both groups are reared in concrete round ponds or raceways on river water, except when well water is added mid-winter to maintain water temperatures near 40^{o} F. Checks for elastomer and CWT retention are conducted prior to transferring the fish to Curl Lake AP in February.

[WDFW Sept. 2008]

12. Fish Release

a) Protocols

For 2009, the target release goal is 55,000@ 9 fpp & 59,000 @ 15 fpp (114,000 total). All fish will be released from Curl Lake AP in March or April.

Table. Proposed BY 2007 Tucannon River spring Chinook tagging, transfers and releases.

Site (Type)	BY07 Goal	Expected at release	Size (fpp)	Age	Mark/ CWT/ Elastomer	PIT Tags	Transfer/Release Date
Curl Lake AP (Conventional) Curl Lake AP (Conventional)	112,500 112,500	59,000 55,000	15 9	1+ 1+	100% CWT VIE 100% CWTV IE VIE	2,500 2,500	Mar – Apr 2009 Mar – Apr 2009

[WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Table 18. Estimates of Tucannon spring Chinook salmon abundance (*spawned and reared in the hatchery*) by life stage for 1985-2007 broods.

	Females Spawned		Mean Fecundity[a]					
Brood Year	Natural	Hatchery	Natural	Hatchery	Number of Eggs	Number of Parr	Number of Smolts	Progeny[b] (returning adults)
1985	4	-	3,883	-	14,843	13,401	12,922	45
1986	57	-	3,916	-	187,958	177,277	153,725	339
1987	48	-	4,096	-	196,573	164,630	152,165	190
1988	49	-	3,882	-	182,438	150,677	146,200	447
1989	28	9	3,883	2,606	133,521	103,420	99,060	243
1990	21	23	3,993	2,697	126,334	89,519	85,800	28
1991	17	11	3,741	2,517	91,275	77,232	74,060	25
1992	28	18	3,854	3,295	156,359	151,727	87,752[c]	81
1993	21	28	3,701	3,237	168,366	145,303	138,848	207
1994	22	21	4,187	3,314	161,707	132,870	130,069	34
1995	6	15	5,224	0	85,772	63,935	62,272	180
1996	18	19	3,516	2,843	117,287	80,325	76,219	260
1997	17	25	3,609	3,315	144,237	29,650	24,184	181
1998	30	14	4,023	3,035	161,019	136,027	127,939	830
1999	1	36	3,965	3,142	113,544	106,880	97,600	29
2000	3	35	3,969	3,345	128,980	123,313	102,099	175
2001	29	27	3,612	3,252	184,127	174,934	146,922	129
2002	22	25	3,981	3,368	169,364	151,531	123,586	133
2003	17	20	3,789	3,812	140,658	126,400	71,154	77
2004	28	18	3,444	2,601	140,459	128,877	67,542	33
2005	25	24	3,773	2,903	161,345	151,466	149,466	
2006	18	27	2,887	2,654	123,629	112,350	106,530	
2007	27	9	3,847	2,869	124,543	117,182		

[a] 1985 and 1989 mean fecundity of natural females is the average of 1986-88 and 1990-93 brood years; 1999 mean fecundity of natural fish is based on the mean of 1986-1998 brood years.

[b] Numbers do not include down river harvest or other out-of-basin recoveries.

[c] Number of smolts is less than actual release number. 57,316 parr were released in October 1993, with an estimated 7% survival. Total number of hatchery fish released from the 1992 brood year was 140,725. We therefore use the listed number of 87,752 as the number of smolts released.

[WDFW Aug. 2008]

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Table 2. Numbers of spring Chinook salmon captured, trap mortalities, fish collected for broodstock, or passed upstream to spawn naturally at the TFH trap from 1986-2007.

	Captured at Trap		Trap Mortality		Broodstock Collected		Passed Upstream	
Year	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery	Natural	Hatchery
1986	247	0	0	0	116	0	131	0
1987	209	0	0	0	101	0	108	0
1988	267	9	0	0	116	9	151	0
1989	156	102	0	0	67	102	89	0
1990	252	216	0	1	60	75	191	134
1991	109	202	0	0	41	89	68	105
1992	242	305	8	3	47	50	165	202
1993	191	257	0	0	50	47	130	167
1994	36	34	0	0	36	34	0	0
1995	10	33	0	0	10	33	0	0
1996	76	59	1	4	35	45	33	7
1997	99	160	0	0	43	54	47	76
1998 [a]	50	43	0	0	48	41	1	1
1999 [b]	1	139	0	1	1	135	0	0
2000 [c]	28	177	0	17	12	69	13	94
2001	405	276	0	0	52	54	353	222
2002	168	610	0	0	42	65	126	545
2003	84	151	0	0	42	35	42	116
2004	311	155	0	0	51	41	260	114
2005[d]	131	114	0	3	49	51	82	60
2006[e]	61	78	0	3	36	53	25	22
2007[f]	112	112	0	6	54	34	58	72

[a] Two males (one natural, one hatchery) captured were transported back downstream to spawn in the river.
[b] Three hatchery males that were captured were transported back downstream to spawn in the river.
[c] Seventeen stray LV and AD/LV fish were killed at the trap.
[d] Three AD clipped stray fish were killed at the trap.
[e] One AD/NO WIRE and one AD/LV/CWT stray fish were killed at the trap. The remaining trap mortality was a Tucannon hatchery-origin fish that died due to trapping.
[f] Six AD/NO WIRE stray fish were killed at the trap.

[WDFW Aug. 2008]

b) Return timing and age-class structure of adults

Table 10. Peak dates of arrival of natural and hatchery salmon to the TFH adult trap and peak (date) and duration (number of days) for spawning in the hatchery and river, 1986-2007.

	Peak Arrival at Trap		Spawning in Hatchery			Spawning in River	
Year	Natural	Hatchery	Natural	Hatchery	Duration	Combined	Duration
1986	5/27	–	9/17	–	31	9/16	36
1987	5/15	–	9/15	–	29	9/23	35
1988	5/24	–	9/07	–	22	9/17	35
1989	6/06	6/12	9/15	9/12	29	9/13	36
1990	5/22	5/23	9/04	9/11	36	9/12	42
1991	6/11	6/04	9/10	9/10	29	9/18	35
1992	5/18	5/21	9/15	9/08	28	9/09	44
1993	5/31	5/27	9/13	9/07	30	9/08	52
1994	5/25	5/27	9/13	9/13	22	9/15	29
1995[a]	–	6/08	9/13	9/13	30	9/12	21
1996	6/06	6/20	9/17	9/10	21	9/18	35
1997	6/15	6/17	9/09	9/16	30	9/17	50
1998	6/03	6/16	9/08	9/16	36	9/17	16
1999[a]	–	6/16	9/07	9/14	22	9/16	23
2000	6/06	5/22	–	9/05	22	9/13	30
2001	5/23	5/23	9/11	9/04	20	9/12	35
2002	5/29	5/29	9/10	9/03	22	9/11	42
2003	5/25	5/25	9/09	9/02	36	9/12	37
2004	6/04	6/02	9/14	9/07	29	9/08	30
2005	6/01	5/31	9/06	9/06	28	9/14	28
2006	6/12	6/09	9/12	9/12	28	9/8	---[b]
Mean	**5/31**	**6/03**	**9/11**	**9/10**	**28**	**9/14**	**35**
2007	6/04	6/04	9/18	9/04	22	9/12	30

[a] Too few natural salmon were trapped in 1995 and 1999 to determine peak arrival.
[b] Access restrictions during the Columbia Complex Forest Fire prohibited spawning ground surveys during the beginning of spawning.

[WDFW Aug. 2008]

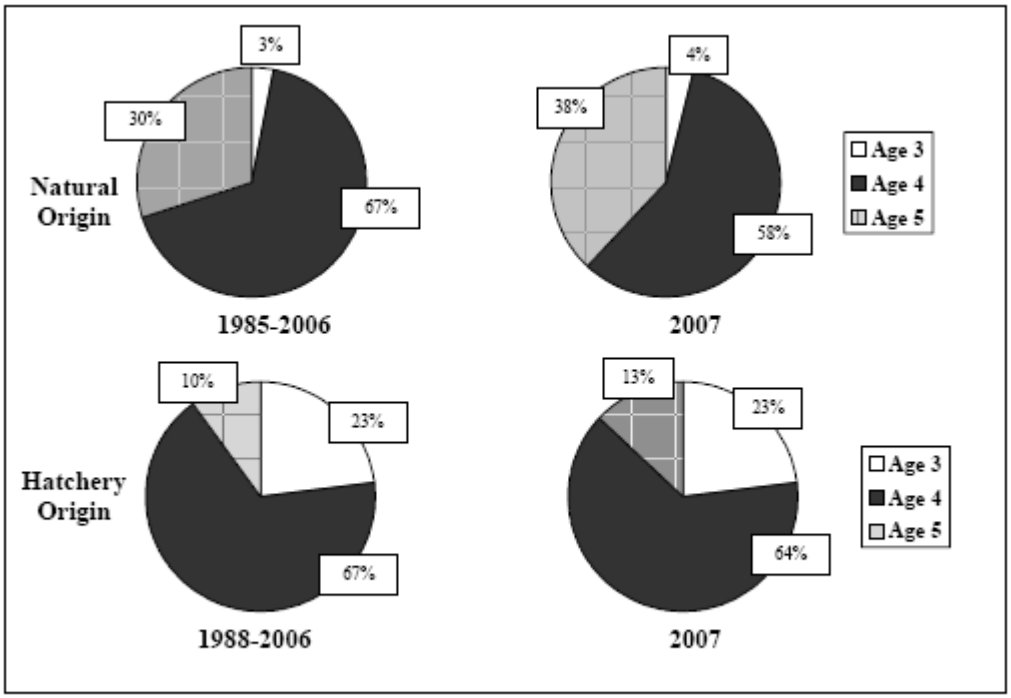

Figure 4. Historical (1985-2006), and 2007 age composition for spring Chinook in the Tucannon River.

[WDFW Aug. 2008]

c) Smolt-to-adult return rates

Table 18. Estimates of Tucannon spring Chinook salmon abundance (*spawned and reared in the hatchery*) by life stage for 1985-2007 broods.

	Females Spawned		Mean Fecundity[a]					
Brood Year	Natural	Hatchery	Natural	Hatchery	Number of Eggs	Number of Parr	Number of Smolts	Progeny[b] (returning adults)
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1986	57	-	3,916	-	187,958	177,277	153,725	339
1987	48	-	4,096	-	196,573	164,630	152,165	190
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1990	21	23	3,993	2,697	126,334	89,519	85,800	28
1991	17	11	3,741	2,517	91,275	77,232	74,060	25
1992	28	18	3,854	3,295	156,359	151,727	87,752[c]	81
1993	21	28	3,701	3,237	168,366	145,303	138,848	207
1994	22	21	4,187	3,314	161,707	132,870	130,069	34
1995	6	15	5,224	0	85,772	63,935	62,272	180
1996	18	19	3,516	2,843	117,287	80,325	76,219	260
1997	17	25	3,609	3,315	144,237	29,650	24,184	181
1998	30	14	4,023	3,035	161,019	136,027	127,939	830
1999	1	36	3,965	3,142	113,544	106,880	97,600	29
2000	3	35	3,969	3,345	128,980	123,313	102,099	175
2001	29	27	3,612	3,252	184,127	174,934	146,922	129
2002	22	25	3,981	3,368	169,364	151,531	123,586	133
2003	17	20	3,789	3,812	140,658	126,400	71,154	77
2004	28	18	3,444	2,601	140,459	128,877	67,542	33
2005	25	24	3,773	2,903	161,345	151,466	149,466	
2006	18	27	2,887	2,654	123,629	112,350	106,530	
2007	27	9	3,847	2,869	124,543	117,182		

[a] 1985 and 1989 mean fecundity of natural females is the average of 1986-88 and 1990-93 brood years; 1999 mean fecundity of natural fish is based on the mean of 1986-1998 brood years.
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[WDFW Aug. 2008]

Table 21. Adult returns and SARs of hatchery salmon to the Tucannon River for brood years 1985-2002.

		Number of Adult Returns, known and expanded (exp.)							
		Age 3		Age 4		Age 5		SAR (%)	
Brood Year	Estimated Number of Smolts	Known	Exp.	Known	Exp.	Known	Exp.	w/ Jacks	No Jacks
1985	12,922	9	19	25	26	0	0	0.35	0.20
1986	153,725	79	83	99	238	8	18	0.22	0.17
1987	152,165	9	22	70	151	8	17	0.12	0.11
1988	146,200	46	99	140	295	26	53	0.31	0.24
1989	99,057	7	15	100	211	14	17	0.25	0.23
1990	85,500	3	6	16	20	2	2	0.03	0.03
1991	74,058	4	5	20	20	0	0	0.03	0.03
1992	87,752	11	11	50	66	2	4	0.09	0.08
1993	138,848	11	15	93	174	15	18	0.15	0.14
1994	130,069	2	4	21	25	4	5	0.03	0.02
1995	62,272	13	16	117	160	2	4	0.29	0.26
1996	76,219	44	60	100	186	5	14	0.34	0.26
1997	24,186	7	13	59	168	0	0	0.75	0.69
1998	127,939	36	103	164	577	39	150	0.65	0.57
1999	97,600	2	7	5	19	1	3	0.03	0.02
2000	102,099	7	27	53	148	0	0	0.17	0.14
2001	146,922	7	19	53	109	1	1	0.09	0.07
2002	123,586	4	8	60	106	7	19	0.11	0.10
Mean								0.22	0.19
Geometric Mean								0.14	0.12

[WDFW Aug. 2008]

d) Stock productivity (e.g. recruits per spawner)

Table 22. Parent-to-progeny survival estimates of Tucannon River spring Chinook salmon from 1985 through 2003 brood years (2003 incomplete).

	Natural Salmon			Hatchery Salmon			
Brood Year	Number of Spawners	Number of Returns	Return/ Spawner	Number of Spawners	Number of Returns	Return/ Spawner	Hatchery to Natural Advantage
1985	569	392	0.69	9	45	5.00	7.3
1986	520	468	0.90	91	339	3.73	4.1
1987	481	238	0.49	83	190	2.29	4.6
1988	304	527	1.73	87	447	5.14	3.0
1989	276	158	0.57	122	243	1.99	3.5
1990	611	94	0.15	78	28	0.36	2.3
1991	390	7	0.02	72	25	0.35	19.3
1992	564	194	0.34	83	81	0.98	2.8
1993	436	204	0.47	91	207	2.27	4.9
1994	70	12	0.17	69	34	0.49	2.9
1995	11	6	0.55	39	180	4.62	8.5
1996	136	69	0.51	74	260	3.51	6.9
1997	146	799	5.47	89	181	2.03	0.4
1998	51	375	7.35	85	830	9.76	1.3
1999	107	141	1.32	122	29	0.24	0.2
2000	239	446	1.87	73	175	2.40	1.3
2001	894	244	0.27	104	129	1.24	4.5
2002	897	202	0.23	93	133	1.43	6.4
2003	366	122	0.33	75	77	1.03	3.1
Mean			**1.23**			**2.57**	**4.6**
Geometric Mean			**0.56**			**1.69**	**3.1**

[WDFW Aug. 2008]

2. Contributions to harvest and utilization (e.g. food banks)

Based on 1985-2003 brood year CWT recoveries reported to the RMIS database, sport and commercial harvest combined accounted for an average of less than 2% of the adult hatchery fish recovered for the 1985-1996 brood years, but increased fishery impacts occurred for the 1997 through 1999 broods (fishery harvest comprised an average of 20% for recoveries). The subsequent cessation of adipose clipping of hatchery production (Gallinat et al. 2001), and additional fishery restrictions, resulted in a less than 1% fishery impact on the 2000-2003 broods (this includes CWT 63-14-29 from the 2001 BY where the lone recovery was from a commercial gillnet). Conventional supplementation fish are now marked with a CWT and a VIE tag behind the left or right eye. [WDFW Aug. 2008]

3. Contributions to conservation

The supplementation program is part of the LSRCP mitigation program, and will continue as long as mitigation is required under the LSRCP. Conservation and recovery actions described for the Tucannon River play a vital role in the overall duration of the spring Chinook

programs. It is anticipated that spring Chinook survival must be improved to a level where the population can be determined to be at or above the replacement level most years (presumably a requirement which must be met for NMFS to de-list the population).

As described in the Tucannon River Captive Broodstock Master Plan (1999), WDFW collected fish from the 1997-2001 brood years. Fish from the 1997-2001 brood year will be raised to adults and spawned. Fish were also collected from the 2002 brood year in order to have males on hand to spawn with the captive brood females at the end of the program. It is anticipated that the last adult will spawn in 2006 at Age 5, and the final progeny will be released into the Tucannon River in 2008. Hatchery operations for the captive broodstock program will cease following the last release. Monitoring and final evaluation of the captive broodstock program will continue until 2011, when the last captive brood adult should return to the Tucannon River.

[WDFW Aug. 2005c]

4. Other benefits

Limited comprehensive review of the ecological health of the Tucannon River watershed in relation to salmonid population status and recovery has been completed. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin (WDFW unpublished data), but the extent of these problems is un-quantified. State programs provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with U.S. Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Protection Act (NEPA) review.

Most watershed restoration/improvement projects are funded through the Columbia Conservation District Tucannon Model Watershed Management Plan (1996). Efforts include fencing to ensure riparian vegetative recovery, improved fish passage at road crossings and diversions, reduced sediment production from roads and cropland, and screening of irrigation diversions. Taken together, habitat protection and improvement measures have, and will continue to improve habitat for and productivity of the basin's spring Chinook population.

[WDFW Aug. 2005c]

E. Research, monitoring, and evaluation programs

- Differentially mark all hatchery-origin spring Chinook (both supplementation and captive brood progeny) to allow for distinction from natural-origin fish upon return as adults to the spawning grounds. This will be accomplished by coded and agency-only wire tags and visible implant elastomer tagging or another permanent, effective method.

- Conduct broodstock trapping at the Tucannon adult trap to collect broodstock for the mitigation program, enumerate overall returns, and to collect information regarding fish origin for the spawning escapement, and age class composition.

- Conduct spawning ground surveys to estimate number of spawners, and use in conjunction with trapping data to estimate the proportions of natural, supplementation and captive brood-origin spring Chinook in the spawning population.

- Estimate the number of natural, and naturally spawning hatchery-origin spring Chinook contributing to the Tucannon River annual escapement.

- Operate a smolt trap on the Tucannon River to: 1) Estimate the number, timing, and age composition of natural-origin spring Chinook smolts from the river, 2) estimate the migration success to the smolt trap for releases of hatchery-origin spring Chinook from the upper basin, and 3) allow downriver migration comparison between natural and hatchery propagated fish by PIT tagging at the smolt trap.

- Estimated SARs by brood year to determine if fish are surviving – escapement to hatchery and spawning grounds.

- Collect DNA samples to be used for comparison with past collections to monitor changes in allelic characteristics, and with the intent to assess whether the hatchery program negatively affects the genetic diversity of the natural population in the Tucannon River.

- Develop and implement evaluation plans and report findings consistent with the needs of the program for adaptive management.

- Monitor discharge water quality and water withdrawals and report annually on compliance with related permits and criteria, i.e., screening and fish passage criteria.

- Monitor health of adult and juvenile spring Chinook associated with hatchery production.

[WDFW Aug. 2005c]

1. Tucannon River Watershed Characteristics

Evaluation program staff deployed 16 continuous recording thermographs throughout the Tucannon River to monitor daily minimum and maximum water temperatures (temperatures are recorded every hour) from June through October. Data from each of these water temperature recorders are stored as electronic files in our Dayton office. During 2007, maximum water temperatures where spring Chinook juveniles were rearing ranged from 16.3° C (61.4° F) in the upper HMA stratum (rkm 74.5) to 23.6° C (74.5° F) in the lower Hartsock stratum (rkm 43.3).

Recent initiatives to improve habitat within the Tucannon Basin, such as the Tucannon River Model Watershed Program, are intended to: 1) restore and maintain natural stream stability; 2) reduce water temperatures; 3) reduce upland erosion and sediment delivery rates; 4) improve and re-establish riparian vegetation; and 5) increase amounts of large woody debris. Theurer et al. (1985) estimated that improving riparian cover and channel morphology in the Tucannon River mainstem would increase Chinook-rearing capacity present in the early 1980s by a factor of 2.5. Habitat restoration efforts should increase habitat utilization by spring Chinook salmon in the marginal sections of the Hartsock and Marengo strata of the Tucannon River and increase fish survival.

[WDFW Aug. 2008]

2. Broodstock Trapping

The annual collection goal for broodstock was revised, beginning in 2006, to 85 natural and 85 hatchery adults collected throughout the duration of the run to meet the new smolt production/release goal of 225,000. Additional jack salmon may be collected to contribute to the broodstock if necessary. Jack contribution to the broodstock can be no more than their percentage in the overall run. Returning hatchery salmon were identified by coded-wire tag (CWT) in the snout or presence of a visible implant elastomer tag. Adipose clipped fish were killed outright as strays, as we no longer utilize that mark for management within the Tucannon River. [WDFW Aug. 2008]

3. Broodstock Mortality

Five of the 88 salmon collected for broodstock died prior to spawning in 2007. Prespawning mortality in 2007 was low and comparable to the mortality documented since broodstock holding at Lyons Ferry FH began in 1992. Higher mortality was experienced when fish were held at Tucannon FH (1986-1991) due to higher water temperatures. [WDFW Aug. 2008]

4. Natural Spawning

Spawning ground surveys were conducted on the Tucannon River weekly from 29 August to 27 September 2007. Eighty-one redds were counted and 45 natural and 13 hatchery origin carcasses were recovered . Thirty-two redds (39.5% of total) and 14 carcasses (24.1% of total) were found above the adult trap. While conducting redd surveys in 2007, we also snorkeled 11 redds to look for the presence of precocial juveniles spawning with adults. We observed 27 adults (10 females, 17 males) on or near the sampled redds. We observed numerous small fish, and captured with a cast net, 23 juvenile wild and two hatchery spring Chinook in or near the redds. Seventeen of the 23 wild fish (74%) and both hatchery fish were mature males. During 2007, we estimated redd superimposition rates by placing brightly painted washers around completed redds, and documenting multiple redd constructions during subsequent surveys. We placed brightly painted washers (1.59 cm inside diameter; 4.44 cm outside diameter; 32.7 g mean weight) around 43 completed redds and at the end of spawning ground surveys 36 redds were still visible (7 superimposed) for a 16% decrease (Appendix C). All of the superimposed redds were below the Tucannon FH adult trap. Surveyors who participated in this study felt that the washers weren't needed to distinguish between redds since survey protocols require that the same surveyors walk the same sections on a weekly basis. However, if new surveyors were used or surveys weren't conducted as often, bias in redd counts, especially below the adult trap, could easily occur.[WDFW Aug. 2008]

5. Historical Trends

Two general trends were evident (Figure 3) from the program's inception in 1985 through 1999: 1) The proportion of the total number of redds occurring below the trap increased; and 2) The density of redds (redds/km) decreased in the Tucannon River. In part, this resulted from a greater emphasis on broodstock collection to keep the spring Chinook population from

extinction. However, increases in the SAR rates beginning with the 1995 brood have subsequently resulted in increased spawning above the trap and higher redd densities. Also, moving the release location from Tucannon FH upstream to Curl Lake AP in 1999 affected the spawning distribution, with higher numbers of fish and redds in the Wilderness and HMA strata compared to previous years. [WDFW Aug. 2008]

6. Genetic Sampling

During 2007, we collected 147 DNA samples (operculum punches) from adult salmon (95 natural origin, 36 conventional supplementation hatchery, 7 captive brood progeny and 9 hatchery-origin strays) from hatchery broodstock and carcasses collected from the spawning grounds. These samples were sent to the WDFW genetics lab in Olympia, Washington for analysis. A total of 228 Tucannon River spring Chinook samples collected in 2006 were genotyped at 14 microsatellite loci (Ogo-2, Ogo-4, Ots-3M, Ssa-197, Oki-100, Ots-201b, Ots-208b, Ssa-408, Omm-1080, Ots-213, Ots-G474, Ots-9, Ots-211, and Ots-212) using an Applied Biosystems 3730 DNA analyzer. Analysis to date provides evidence that the captive broodstock program has been an effective method of preserving overall genetic variation in Tucannon River spring Chinook while providing additional smolts for release. Genotypes, allele frequencies, and tissue samples are stored at WDFW's Genetics Laboratory in Olympia. [WDFW Aug. 2008]

7. Age Composition, Length Comparisons, and Fecundity

- We determine the age composition of each year's returning adults from scale samples of natural origin fish, and both scales and CWT from hatchery-origin fish. This allows us to annually compare ages of natural and hatchery-reared fish, and to examine trends and variability in age structure. Overall, hatchery origin fish return at a younger age than natural origin fish. This difference is likely due to smolt size-at-release (hatchery origin smolts are generally 25-30 mm greater in length than natural smolts). Age composition for the 2007 run was similar to the historical age composition for both the hatchery and natural components of the population. Slightly higher proportions of age-5 fish were observed in 2007. This may be due to higher survival rates associated with recent improved ocean conditions.

- Fecundities (number of eggs/female) of natural and hatchery origin fish from the Tucannon River program have been documented since 1990. To estimate fecundity, dead eggs were counted for each female and a subsample of 100 live eyed-eggs was weighed. The total volume of live eggs was also weighed, and divided by the average weight per egg to yield total number of live eggs. This estimate was decreased by 4% to compensate for adherence of water on the eggs (WDFW Snake River Lab, unpublished data). The number of live and dead eggs was summed to provide an estimated total fecundity for each fish. We performed an analysis of variance to determine if there were differences in mean fecundities of hatchery and natural origin fish. The significance level for all statistical tests was 0.05. Natural origin females were significantly more fecund than hatchery origin fish for both age-4 ($P < 0.001$) and age-5 fish ($P < 0.001$).

- Mean egg size of natural origin age-4 spring Chinook from the Tucannon River was 0.226 g/egg and hatchery origin eggs averaged 0.235 g/egg. This difference was significant ($P <$

0.05). The larger eggs of the Age 4 hatchery origin females may explain why they are less fecund. Mean egg size in age-5 salmon was 0.270 g/egg for natural origin and 0.282 g/egg for hatchery origin females. Although the difference was not significant ($P = 0.08$), we suspect that egg size contributes to the fecundity difference in age-5 hatchery and natural origin fish as well.

[WDFW Aug. 2008]

8. Coded-Wire Tag Sampling

Broodstock collection, pre-spawn mortalities, and carcasses recovered during spawning ground surveys provide representatives of the annual run that can be sampled for CWT study groups. In 2007, based on the estimated escapement of fish to the river, we sampled approximately 44% of the run. [WDFW Aug. 2008]

9. Arrival and Spawn Timing Trends

We monitor peak arrival and spawn timing to determine whether the hatchery program has caused a shift). Peak arrival dates were based on the greatest number of fish trapped on a single day. Peak spawn in the hatchery was determined by the day when the most females were spawned. Peak spawning in the river was determined by the highest weekly redd count. Peak arrival to the trap during 2007 was similar to the historical mean. Peak spawning date of hatchery fish was within the range found from previous years but the duration of spawning was truncated. The peak of active spawning in the Tucannon River was similar to the historical mean. [WDFW Aug. 2008]

10. Total Run-Size

Redd counts have been directly related to total run-size entering the Tucannon River and passage of adult salmon at the Tucannon FH adult trap. For 2007, we used sex ratios from collected broodstock and sex ratio observations on the spawning grounds to estimate the number of fish/redd. The run-size estimate for 2007 was calculated by adding the estimated number of fish upstream of the Tucannon FH adult trap (130), the estimated fish below the weir (120) calculated from the fish/redd ratio (3.1), the number of observed pre-spawn mortalities below the weir (0), the number of trap mortalities and stray fish killed at the trap (6), and the number of broodstock collected (88) (Table 11). Run-size for 2007 was estimated to be 344 fish (190 natural adults, 8 natural jacks and 113 hatchery-origin adults, 33 hatchery jacks). [WDFW Aug. 2008]

11. Stray Salmon into the Tucannon River

Spring Chinook from other river systems (strays) have periodically been recovered in the Tucannon River, though generally at a low proportion of the total run. However, Umatilla River hatchery strays accounted for 8 and 12% of the total Tucannon River run in 1999 and 2000, respectively. The increased number of strays, particularly from the Umatilla River, is a concern since it exceeds the 5% stray rate of hatchery fish deemed acceptable by NOAA Fisheries, and is contrary to WDFW's management intent for the Tucannon River. In addition,

the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) did not mark a portion of Umatilla River origin spring Chinook with an RV or LV fin clip (65-70% of releases), or CWT for the 1997-1999 brood years. Because of this action, some stray fish that returned from those brood years were physically indistinguishable from natural origin Tucannon River spring Chinook. Scale samples were collected from adults in those brood years to determine hatcheryorigin fish based on scale pattern analysis. However, scale analysis is not as accurate as genetic analysis and in future years we hope to identify a genetic marker that will allow us to separate unmarked Umatilla origin fish (1997-1999 BYs) from natural Tucannon origin fish. Should an accurate marker be identified that allows good separation of Umatilla stock fish, the proportion of hatchery and natural fish may change for the affected years after this analysis is completed. Beginning with the 2000 BY, Umatilla River hatchery-origin spring Chinook were 100% marked. This will help reduce the effect of stray fish by allowing selective removal of strays from the hatchery broodstock. However, strays will still have access to spawning areas below the hatchery trap.

One known origin (CWT) hatchery stray was recovered during 2007. It was an AD clipped Rogue River spring Chinook salmon (CWT 09/20/43) found spawning in the lower Tucannon River. We also recovered nine AD only clipped fish [six (five age-3 and one age-4) that were killed at the adult trap and three (two age-4 and one age-5) recovered below the adult trap on the spawning grounds]. Based on our marks for those age classes (VIE/CWT), and past straying events, we believe those fish were likely Umatilla River strays. After expansions, strays accounted for an estimated 8% of the total 2007 run.

[WDFW Aug. 2008]

12. Adult PIT Tag Returns

Final detections of 15 adult spring Chinook that had been PIT tagged as juveniles from the Tucannon River are summarized in Table 12. It is interesting to note that 53% of the detected returning PIT tagged adults overshot the Tucannon River and were detected at Lower Granite Dam. This "overshooting" does not appear to be a hatchery effect since both hatchery and natural-origin fish bypass the Tucannon River. Non-direct homing behavior has been documented for adult Chinook in the Columbia River System. However, more research into these events should be conducted to examine whether they are natural straying occurrences, or if it is related to hydropower operations. With the addition of the Lower Tucannon PIT tag array in 2005, we should be able to document whether fish that are detected at Lower Granite Dam eventually make it back to the Tucannon River. Returning adults bypassing the Tucannon River is a concern, especially if they are unable to return to the Tucannon River, and may potentially explain why we have had difficulties increasing this population. [WDFW Aug. 2008]

13. Hatchery Rearing and Marking

Conventional supplementation juveniles (2006 BY) were split into two groups for a size at release study (Target: 9 fpp vs. 15 fpp) to evaluate the size at release on survival. Fish were marked with a visible implant elastomer tag (VIE) behind the left eye and tagged with CWTs between 12 and 20 September 2007 (52,929 Blue VIE - 9 fpp target; 54,388 Purple VIE - 15

fpp target). Supplementation fish were transported to Tucannon FH between 5 and 8 October. The 2006 BY captive brood juveniles (78,705 fish) were marked between 11 and 13 September with a CWT in the snout and transported to Tucannon FH on 3 October 2007. Length and weight samples were collected twice on the 2006 BY fish during the rearing cycle (Table 13). During January, fish were sampled for length, weight, precocity and mark quality, and were PIT tagged for outmigration comparisons (2,500 conventional 9 fpp; 2,500 conventional 15 fpp; 1,000 captive brood progeny) before transfer to Curl Lake AP. [WDFW Aug. 2008]

14. Natural Smolt Production

- Evaluation staff operated a 1.5 m rotary screw trap at rkm 3 on the Tucannon River from 6 November 2006 through 30 June 2007 to estimate numbers of migrating juvenile natural and hatchery spring Chinook. Numbers of fish species captured by month during the 2007 outmigration, peak outmigration, efficiency estimates, methods, etc., are available upon request.

- Natural spring Chinook emigrating from the Tucannon River (BY 2005) averaged 109 mm. This is in comparison to an average length of 162 mm for hatchery-origin fish (BY 2005) released from Curl Lake Acclimation Pond. [WDFW Aug. 2008]

- We estimate that 17,579 migrant natural-origin spring Chinook (2005 BY) passed the smolt trap during 2006-2007. We also estimated that 61% of the hatchery fish (conventional hatchery supplementation and captive brood progeny) released from Curl Lake AP (2005 BY) passed the smolt trap.

15. Juvenile Migration Studies

- In 2007, we used passive integrated transponder (PIT) tags to study the emigration timing and relative success of our conventional supplementation and captive brood progeny. We tagged 1,002 conventional supplementation and 1,000 captive brood hatchery-origin fish during early February before transferring them to Curl Lake AP for acclimation and volitional release. No fish were killed during PIT tagging, though some minor delayed mortality may have occurred after transfer. Cumulative PIT tag detections at hydroelectric projects downstream of the Tucannon River were 47% for conventional supplementation fish (compared to 33% in 2006) and 41% for captive brood origin fish (compared to 28% in 2006). The smolts were released at a larger size in 2007 compared to 2006 (57 g vs. 35 g). [WDFW Aug. 2008]

- Survival probabilities were estimated by the Cormack Jolly-Seber methodology using the Survival Under Proportional Hazards (SURPH) computer model. The data files were created using the PitPro version 4.8 computer program to translate raw PIT Tag Information System (PTAGIS) data of the Pacific States Marine Fisheries Commission (PSMFC) into usable capture histories for the SURPH program. Estimated survival probabilities from Curl Lake to Lower Monumental Dam were 0.68 (± 0.05) and 0.61 (± 0.06) for supplementation and captive brood progeny, respectively. While survival estimates were slightly lower for captive brood progeny fish the differences were not significant ($P > 0.05$).

16. Survival Rates

- Point estimates of population sizes have been calculated for various life stages of natural and hatchery-origin spring Chinook from spawning ground and juvenile midsummer population surveys, smolt trapping, and fecundity estimates. Survivals between life stages have been calculated for both natural and hatchery salmon to assist in the evaluation of the hatchery program. These survival estimates provide insight as to where efforts should be directed to improve not only the survival of fish produced within the hatchery, but fish in the river as well. As expected, juvenile (egg-parr-smolt) survival rates for hatchery fish are considerably higher than for naturally reared salmon because they have been protected in the hatchery. However, smolt-to-adult return rates (SAR) of natural salmon were over five times higher than for hatchery-reared salmon. Hatchery SARs (mean = 0.22%; geometric mean = 0.14%) documented from the 1985-2002 broods were well below the LSRCP survival goal of 0.87%. Hatchery SARs for Tucannon River salmon need to substantially improve to meet the mitigation goal of 1,152 hatchery adult salmon. As reported earlier in this report, we are experimenting with size at release (9 fpp vs. 15 fpp) to improve hatchery SARs.

- As previously stated, overall survival of hatchery salmon to return as adults was higher than for naturally reared fish because of the early-life survival advantage. With the exception of the 1988 and 1997-2000 brood years, naturally produced fish have been below the replacement level. Based on adult returns from the 1985-2003 broods, naturally reared salmon produced only 0.6 adults for every spawner, while hatchery reared fish produced 1.7 adults.

- Beginning with the 2006 brood year, the annual smolt goal was increased from 132,000 to 225,000 to help offset for the higher mortality of hatchery-origin fish after they leave the hatchery. This should increase adult salmon returns back to the Tucannon River. However, based on current hatchery SARs the increase in production would still not produce enough adult returns to reach the LSRCP mitigation goal. In conjunction with increased smolt production, we are conducting an experiment to examine size at release as a possible means to improve SAR of hatchery fish. These changes in the hatchery production program will likely result in a Proportionate Natural Influence (PNI) of less than 0.5. That level is generally not acceptable for supplementation programs and the Tucannon Spring Chinook Program has generally been above 0.5. The fishery managers will need to decide whether the hatchery supplementation program is worth the potential adverse genetic risk to the population.

[WDFW Aug. 2008]

17. Fishery Contribution and Out-of-Basin Straying

An original goal of the LSRCP supplementation program was to enhance natural returns of salmon to the Tucannon River by providing 1,152 hatchery-reared fish (the number estimated to have been lost due to the construction of the Lower Snake River hydropower system) to the river. Such an increase would allow for limited harvest and increased spawning. However hatchery and natural adult returns have always been below the mitigation goal. Based on 1985-2003 brood year CWT recoveries reported to the RMIS database, sport and commercial harvest combined accounted for an average of less than 2% of the adult hatchery fish

recovered for the 1985-1996 brood years, but increased fishery impacts occurred for the 1997 through 1999 broods (fishery harvest comprised an average of 20% for recoveries). The subsequent cessation of adipose clipping of hatchery production, and additional fishery restrictions, resulted in a less than 1% fishery impact on the 2000-2003 broods (this includes CWT 63-14-29 from the 2001 BY where the lone recovery was from a commercial gillnet). Conventional supplementation fish are now marked with a CWT and a VIE tag behind the left or right eye. Captive brood progeny are marked only with agency-only wire tags or CWTs to distinguish them from supplementation origin fish.

Out-of-basin stray rates of Tucannon River spring Chinook have been low, with an average of 2.5% of the adult hatchery fish straying to other river systems/hatcheries for brood years 1985-2003 (range 0-20%).

[WDFW Aug. 2008]

18. Adjusted Hatchery SAR

Using CWT recoveries from the RMIS database we adjusted Tucannon River spring Chinook hatchery SARs to include all known recoveries from outside the basin. Even after adjustment, hatchery SARs for the 1985-2002 brood years were still well below the LSRCP survival goal of 0.87%. Increased fishing mortality resulted in higher adjusted SARs for the 1997 and 1998 brood years. Since then, management changes (eliminating the adipose finclip, fishery restrictions) should allow more fish to escape back to the Tucannon River. [WDFW Aug. 2008]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

We continue to see annual differences in phenotypic characteristics of returning salmon (i.e., hatchery fish are generally younger in age and less fecund than natural origin fish), yet other traits such as run and spawn time are little changed over the program's history. Further, genetic analysis to date indicates little change in the natural population as a result of hatchery actions.

The success of hatchery origin fish spawning in the river has become an important topic among managers within the Snake River Basin and with NOAA Fisheries. Little data exists on this subject. With the hatchery population in the Tucannon River intermixing with the natural population, we have an opportunity to study the effects of the hatchery spawners in the natural environment.

Subbasin and recovery planning for ESA listed species in the Tucannon River will identify factors limiting the spring Chinook population and strategies to recover the population. Development of a recovery goal for the population that is consistent with NOAA's Viable Salmonid Population criteria would be helpful in developing and evaluating recovery strategies for habitat, hydropower, harvest, and hatcheries.

We have documented that hatchery juvenile (egg-parr-smolt) survival rates are considerably higher than naturally reared salmon, and hatchery smolt-to-adult return rates are much lower. We need to identify and address the factors that limit hatchery SARs in order to meet mitigation goals. Beginning with the 2006 brood year, the annual hatchery smolt goal was increased from 132,000 to 225,000 to help offset the higher mortality of hatchery-origin fish after they leave the hatchery. This should increase adult salmon returns back to the river, however, based on current hatchery SARs this would still not produce enough adult returns to reach the LSRCP mitigation goal.

Adult Tucannon River spring Chinook appear to be "overshooting" or bypassing the Tucannon River based on limited PIT tag returns. This is occurring for both hatchery and natural origin fish, and thus it does not appear to be a hatchery effect.

[WDFW Aug. 2008]

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

Based on 1985-2003 brood year coded-wire tag recoveries reported to the RMIS database, sport and commercial harvest combined accounted for an average of less than 2% of the adult Tucannon River hatchery fish recovered for the 1985-1996 brood years, but increased fishery impacts occurred for the 1997 through 1999 broods (fishery harvest comprised an average of 20% for recoveries). The subsequent cessation of adipose clipping of hatchery production, and additional fishery restrictions, resulted in a less than 1% fishery impact on the 2000-2003 Tucannon Spring Chinook broods. Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by agencies other than WDFW (sport, treaty, and commercial fisheries) averaged 15.3 fish per broodyear (range 0-191) for broodyears 1985-2003. Estimated total harvest (based on data downloaded from RMIS database on 5/9/08) of Tucannon River hatchery Chinook harvested in fisheries reported by WDFW (sport, treaty, and commercial fisheries) averaged 1.4 fish per broodyear (range 0-14) for broodyears 1985-2003.

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

- The comparatively low recruit to spawner ratio for naturally spawning fish coupled with the high proportion of hatchery-origin spring Chinook spawning in the Tucannon River inhibits development of a properly integrated program, which poses a genetic domestication risk to the Tucannon River spring Chinook population, although PNI is slightly greater than 0.5

- Removal of a substantial proportion of naturally produced Tucannon spring Chinook at the hatchery weir for the integrated broodstock program reduces the size of the

naturally spawning population reproducing in the natural habitat posing genetic and demographic risks to the natural population.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

None identified.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

The supplementation and captive broodstock program will incidentally affect Tucannon river bull trout, summer steelhead and fall Chinook. Juvenile hatchery and natural origin spring Chinook may compete for food and space with naturally rearing bull trout and summer steelhead of the same size. [Tucannon River Spring Chinook HGMP]

Summer Steelhead Programs at Lyons Ferry Complex

The LFC currently uses four summer steelhead stocks to produce smolts for release into the Snake (60,000 smolts of Lyons Ferry FH stock), Tucannon (100,000 smolts of Lyons Ferry FH stock, 50,000 smolts of Tucannon Endemic stock), Grande Ronde (160,000 smolts of Wallowa Stock), Walla Walla (100,000 smolts of Lyons Ferry FH stock), and Touchet (85,000 smolts of Lyons Ferry FH stock, 50,000 smolts of Touchet Endemic stock) rivers to enhance recreational opportunities for steelhead anglers and for ESA recovery purposes. All steelhead smolts for the program are planned for a release size of 4.5 fish/lb (100.8g/fish). Current releases of summer steelhead smolts are lower than originally specified by the LSRCP program. Releases have been reduced through the years in partial response to ESA concerns and documented smolt-to-adult returns (SAR) back to the project area (above Ice Harbor Dam) that far exceeded the original SAR goal of 0.5%.

IIC. Lyons Ferry Hatchery Summer Steelhead

A. General information

Lyons Ferry (Phase I) included rearing of summer steelhead for release into southeast Washington and was designed to produce 814,800 summer steelhead smolts at 7 fpp for a total of 116,400 pounds. As indicated above, these production goals and size of fish have been changed since program inception for a variety of reasons. All adult trapping for the program was originally designed to occur at Lyons Ferry FH, with additional eggs provided by ODFW for the Wallowa Stock program. Since then, we trap adults for the current four stocks at Lyons Ferry FH (Lyons Ferry FH stock), Cottonwood Creek (Wallowa Stock), Tucannon River (Tucannon Stock) and Touchet River (Touchet Stock). Originally, steelhead smolts were to be released from three acclimation facilities (Cottonwood Pond on the lower Grande Ronde River, Curl Lake on the Tucannon River, and Dayton Pond on the Touchet River) and direct stream released into several southeast Washington rivers. Steelhead were released into the Walla Walla River at several direct stream release sites and at Dayton Pond due to limited anadromous waters in southeast Washington. Currently, we still utilize Cottonwood Pond and Dayton Pond for acclimated releases. All other releases of steelhead from the program occur by direct stream release. [USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase I) was constructed in 1983 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. The purpose of the Lyons Ferry FH stock program was to provide for lost harvest opportunities caused by additional mortality from the dams. [USFWS May 1990]

2. Goals of program

The goal of the entire summer steelhead program at Lyons Ferry Hatchery is to return 4,656 summer steelhead to the project area to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]. The current goal of the Lyons Ferry FH stock releases of summer steelhead are: 60,000 smolt @ Lyons Ferry to return 630 adults to the project area, 100,000 smolts in the Tucannon River to return 875 adult to the project area, 85,000 smolt in the Touchet River to return 750 adult to the project area, and 100,000 smolts in the Walla Walla River to return 900 adults to the project area. [WDFW Jan. 2009]

3. Objectives of program

- The Lyons Ferry FH stock program was initiated to provide sport fishery opportunities for summer steelhead in the Snake River, its tributaries, and also includes off-site mitigation in the Walla-Walla Basin.

- The Lyons Ferry FH stock adults are trapped on-station from volunteers that swim into the fish ladder. The Lyons Ferry FH trapping goal is to operate between 1 September and 15 November, which provides adequate adults for the program. Trapping protocols have been set to collect 1,650 fish (~150 fish/week over the time period cited). Lyons Ferry stock fish that are trapped come from not only the on-station release, but also include fish that were released into the Tucannon, Touchet, and Walla Walla rivers.

- Spawning will occur in January-February on a weekly basis. Spawning protocol calls for a 2:1 male to female spawner ratio, with each male only being used one time. The intent is to increase the genetic diversity (effective population size N_e) of the hatchery-reared population, and ensure successful fertilization of eggs. Due to lower IHN virus detection and improved egg survival over the past few years, about 106 females will be spawned to produce approximately 460,000 green eggs. This amount is lower than the previous egg goal of 530,000. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish will be buried on site. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information.

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Mitigation / Isolated Harvest: Continue to provide compensation as specified under the LSRCP program (USACE 1975) while meeting conservation and recovery criteria established for the Snake River summer steelhead ESU. Provide harvest opportunities established under *US v Oregon* for tribal and recreational fisheries.[WDFW July 2005b]

5. Alignment of program with ESU-wide plans

LFC and the resulting production of Lyons Ferry FH stock steelhead is part of legally required compensation provided to Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." As such, managers will have to identify their legal mandates, and do their best to provide fish for harvest, while protecting naturally spawning populations. WDFW believes they have taken such actions with the proposed program outlined in this HGMP to be consistent with the Policy Recommendations in the APR.

In the 2 April, 1999 Biological Opinion, NMFS cited "great concern" regarding the large number of Snake River steelhead reported spawning in other rivers (specifically of the Wallowa Stock fish in the Deschutes River, Oregon – See Wallowa Stock HGMP). NMFS based their ruling on preliminary data analysis that suggested Wallowa Stock and other Snake River origin hatchery steelhead stocks were straying above the 5% rate. However, analysis by

ODFW (Carmichael et al 2004) indicates that the Lyons Ferry FH stock of fish released from Lyons Ferry FH does not show a high stray rate into the Deschutes River. A separate analysis conducted by WDFW for the on-station releases indicates the same. Of the 51 total CWT's recovered in the Deschutes River from on-station releases, only three have been recovered in upper reaches of the basin (two from Warm Springs NFH, one from Kloan - below Sherars Falls). All others have been recovered in the fishery at the mouth of the Deschutes from July to October.

[WDFW July 2005b]

6. Habitat description and status where fish are released.

Human development and land management impacts consistent with those identified across the Columbia and Snake River basins have affected natural steelhead production in the Snake River. Impact to the Snake River along Washington borders has been most affected from the construction of the four Lower Snake River Dams, and to a lesser extent from urban development and water usage. Current habitat conditions for salmonids can be described by the following taken from *Salmonid Habitat Limiting Factors Water Resource Inventory Areas 33, 34, & 35*).

"The four lower Snake River dams have inundated mainstem salmonid habitat from the mouth of the Snake River upstream to the city of Asotin, Washington. …. Passage of salmonids through the four lower Snake River dams and their associated reservoirs is the primary issue on the Washington portion of the mainstem Snake River. Adult fish passage facilities were originally incorporated into each dam when constructed…. juvenile passage was not well understood until 1997. Juvenile salmonid bypass and transportation systems are currently operated at each dam (to improved downstream survival). The reservoirs impounded by each dam have slowed river currents thereby increasing the outmigration time of juvenile salmonids……have also improved habitat for predatory fish species including northern pikeminnow, smallmouth bass, and channel catfish." In addition, the reservoirs have increased water temperatures in the lower Snake River.

There are currently very limited plans in place to restore the habitat in the lower Snake River for salmonids. The only possible one has been the breaching alternative by the Corps of Engineers. This option has not been proven the best alternative, and is currently not favored by society. Recovery strategies have not been identified at this time. State programs in place provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and NOAA Fisheries as well as National Environmental Protection Act (NEPA) review.

[WDFW July 2005b]

7. Size of program and production goals (No. of spawners and smolt release goals)

- The Lyons Ferry FH stock adults are trapped on-station from volunteers that swim into the fish ladder. The Lyons Ferry FH trapping goal is to operate between 1 September and 15 November, which provides adequate adults for the program. Trapping protocols have been set to collect 1,650 fish (~150 fish/week over the time period cited). [WDFW Sept. 2008]

- The current goal of the Lyons Ferry FH stock releases of summer steelhead are: 60,000 smolt @ Lyons Ferry to return 630 adults to the project area, 100,000 smolts in the Tucannon River to return 875 adult to the project area, 85,000 smolt in the Touchet River to return 750 adult to the project area, and 100,000 smolts in the Walla Walla River to return 900 adults to the project area. [WDFW Jan. 2009]

C. Description of program and operations

1. Broodstock goal and source

The Lyons Ferry FH Stock steelhead was originally derived in the early 1980's from a combination of Wells Hatchery and Wallowa Hatchery steelhead stocks released at Lyons Ferry FH, the Tucannon River, the Touchet River and the Walla Walla river The adult returns from those releases that returned to and were captured at Lyons Ferry Hatchery were then used to create the Lyons Ferry FH stock currently used. The Lyons Ferry FH stock is considered an "A" run steelhead, typical of most Columbia River stocks

The proposed use of 106 females captured in the Lyons Ferry FH adult trap will provide program needs for each release location (Lyons Ferry FH on-station, Tucannon River, Touchet River, Walla Walla River). Additional females may also be spawned for extra eggs in case IHNV is detected in the broodstock, or in case pre-spawn loss is higher than expected. Eggs in excess of program needs will be destroyed once virology results have been confirmed, or progeny from excess eggs may be stocked into area lakes for put-take fisheries. Eggs from all non-IHNV positive spawned adults are represented in the yearling program.

[WDFW July 2005b]

Table 8. Proposed 2008 LFH stock summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
LFH on station release into the Snake River	40,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 1,500	April 2009
Dayton AF release into the Touchet River	65,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	Transfer to Dayton AF in Feb, release in April 2009
Direct stream release into the Tucannon River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2009
Direct stream release into the Walla Walla River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2009

[WDFW Sept. 2008]

2. Adult collection procedures and holding

The Lyons Ferry FH stock adults are trapped on-station from volunteers that swim into the fish ladder. The Lyons Ferry FH trapping goal is to operate between 1 September and 15 November, which provides adequate adults for the program. Trapping protocols have been set to collect 1,650 fish (~150 fish/week over the time period cited). Fish are held in large adult holding raceways adjacent to the trap until sorting and spawning. All retained steelhead will be sorted in late November each year. Fish not needed for broodstock or CWT recoveries will be returned to the Snake River for the active sport fishery. We generally retain between 400-450 fish each year for broodstock needs. [WDFW Sept. 2008]

3. Adult spawning

a) Spawning protocols

Spawning will occur in January-February on a weekly basis. Spawning occurs no earlier than the middle of January. There has been a shift to earlier spawning timing over the years, so a few years ago managers decided to spawn no earlier than the middle of January. Spawning protocol calls for a 2:1 male to female spawner ratio, with each male only being used one time. The intent is to increase the genetic diversity (effective population size N_e) of the hatchery-reared population, and ensure successful fertilization of eggs. However, in 2009, we are participating in a genetic pedigree study for stock contribution at Lower Granite Dam, so fertilization is occurring on a 1:1 basis. Due to lower IHN virus detection and improved egg survival over the past few years, 106 females will be spawned to produce approximately 460,000 green eggs. This amount is lower than the previous egg goal of 530,000. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish

will be buried on site. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information. [WDFW Sept. 2008]

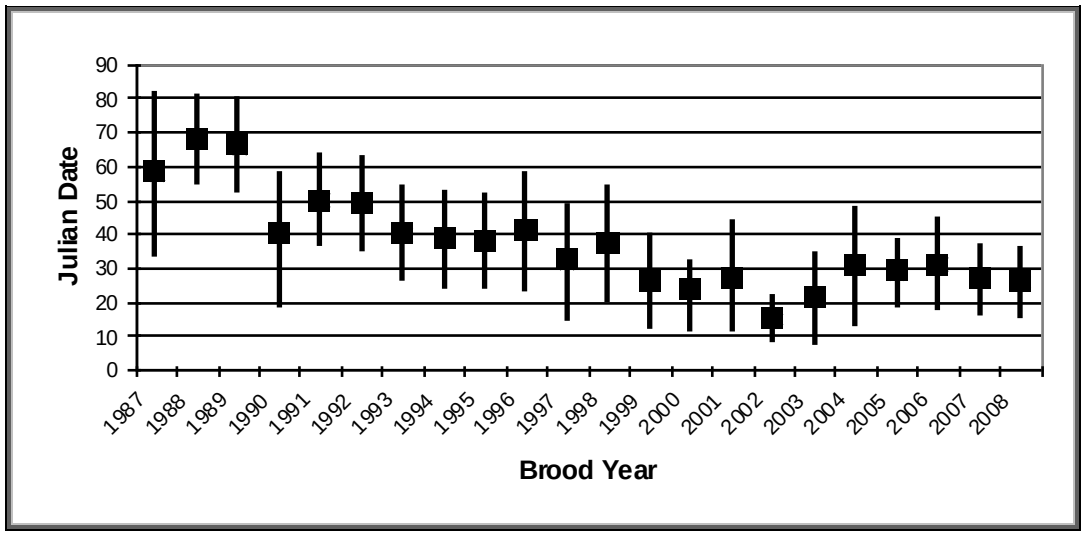


Figure. Range and mean spawn dates of Lyons Ferry stock summer steelhead, 1987-2008. Bars indicate first and last date of spawning; square indicates the average spawn date.

[WDFW Jan. 2009]

b) No. of males and females spawned each year over past 10 years (table)

Table. Number of Lyons Ferry stock steelhead spawned at Lyons Ferry FH from 1998 through 2008.

Year	Females	Males	Total
2008	116	193	309
2007	123	245	368
2006	120	241	361
2005	133	263	396
2004	129	259	388
2003	126	257	383
2002	194	231	425
2001	151	242	393
2000	183	188	371
1999	227	253	480
1998	279	280	559

[WDFW Jan. 2009]

4. Fertilization

a) Protocols

Spawning will occur in January-February on a weekly basis. Spawning protocol calls for a 2:1 male to female spawner ratio, with each male only being used one time. The intent is to increase the genetic diversity (effective population size N_e) of the hatchery-reared population, and ensure successful fertilization of eggs. Due to lower IHN virus detection and improved egg survival over the past few years, 106 females will be spawned to produce approximately 460,000 green eggs. This amount is lower than the previous egg goal of 530,000. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish will be buried on site. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information. [WDFW Sept. 2008]

b) Number of eggs collected and fertilized each year over past 10 years (table)

Table. Numbers of males and females spawned, eggs taken, and survival by life state of Lyons Ferry FH stock summer steelhead spawned at Lyons Ferry FH, 1987 to 2008 brood years.

	Spawned						Egg to fry		Fry to smolt
BY	Female	Male	Eggs taken	Eggs retained [a]	Percent retained	Fry	survival	Smolts	survival
1987	250	Not	1,111,506	1,095,906	98.6	983,901	89.8	665,658	85.3 [b]
1988	267	Applicable	941,756	818,148	86.9	793,240	96.9	526,541	80.2 [c]
1989	243	Not	1,263,237	957,074	75.8	*941,000*	98.3	0	0.0 [d]
1990	439	Applicable	2,570,676	1,483,485	57.7	1,002,320	67.6	635,635	82.1 [e]
1991	261	576	1,296,249	1,165,315	89.9	1,115,368	95.7	407,422	47.9 [f]
1992	240	955	1,239,055	905,438	73.1	431,405 [g]	46.0	398,926	95.8 [h]
1993	234	532	1,211,053	940,022	77.6	860,983	91.6	*585,837*	70.0 [i]
1994	253	100	1,352,296	899,350	66.5	845,316	94.0	543,627	65.4 [j]
1995	343	100	1,772,477	929,597	52.4	895,882	96.4	604,756	67.9 [k]
1996	330	Not	1,614,636	1,151,363	71.3	1,148,114	99.7	596,834	63.6 [l]
1997	217	Applicable	1,090,638	962,705	88.3	809,845	84.1	554,057	100.0 [m]
1998	279	Not	1,460,967	934,247	63.9	768,522	82.3	567,732	73.9
1999	227	Applicable	1,140,813	807,374	70.8	807,374	100.0	495,864	61.4 [n]
2000	183	Not	871,856	650,867	74.7	617,380	94.9	381,686	61.8 [o]
2001	151	Applicable	800,350	636,727	79.6	505,451	79.4	423,065	83.7
2002	194	246	941,223	768,832	81.6	*732,566*	95.3	378,917	60.4 [p]
2003	126	280	483,462	418,195	86.5	408,944	97.8	310,209	75.9
2004	129	253	494,380	414,258	83.8	408,462	98.7	355,362	87.0
2005	133	188	571,185	452,011	79.1	439,803	97.2	350,028	79.6
2006	120	242	529,379	430,667	81.4	423,397	98.3	341,424	84.2 [q]
2007	123	231	558,683	507,688	90.9	502,766	99.0	351,510	82.8 [r]
2008	116	257	563,765	507,791	90.1	496,183	*97.7*		
		259							
		263							
		241							
		245							
		193							

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).
[b] A total of 203,857 fry/parr/fingerlings were planted into area lakes/rivers from over production.
[c] A total of 137,021 fry/parr/fingerlings were planted into area lakes/rivers from over production.
[d] Losses due to IHNV outbreak of entire production.
[e] A total of 227,733 fry/parr/fingerlings were planted into area lakes from over production.
[f] A total of 92,116 fry/parr/fingerlings were planted into area lakes, plus an estimated 172,000 fish lost to bird predation
[g] A total of 378,257 destroyed to infection with IHNV
[h] A total of 15,140 fish retained in Curl Lake from residualism.
[i] A total of 23,898 fish retained in Curl Lake from residualism.
[j] A total of 14,212 fish retained in Curl Lake from residualism.
[k] A total of 5,244 fish retained in Curl Lake from residualism.
[l] A total of 191,100 fry/parr/fingerlings were planted into area lakes from over production, and 19,319 fish retained in Curl Lake from residualism.
[m] A total of 259,148 fry/parr/fingerlings were planted into area lakes from over production.
[n] Survival was low due to excessive bird predation.
[o] A total of 42,548 fry/parr/fingerlings were planted into area lakes from over production.
[p] A total of 105,502 fry/parr/fingerlings were planted into area lakes from over production.
[q] A total of 17,815 fry/parr/fingerlings were planted into area lakes from over production.
[r] A total of 78,334 fry/parr/fingerlings were planted into area lakes from over production.

[WDFW Jan. 2009]

5. Incubation

- Lyons Ferry FH stock steelhead females have averaged 5,130 eggs (224/oz) between the 1990 and 2002 spawning years (Total Samples = 2,803 females). After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling iso-incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. [WDFW Sept. 2008]

- Incubation, as with rearing, occurs with sediment free, 51-53 ^{0}F (11 ^{0}C) well water. The incubation building is fitted with back-up pumps to maintain flow through the troughs in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical. [WDFW July 2005b]

6. Ponding

a) Protocols

- After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling iso-incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. After hatch and swim-up, they are introduced to feed, and transferred to outside raceways at roughly 500 fpp in April. They are reared in these raceways until marking (tagging is completed later) and transferred to Lake One. [WDFW Sept. 2008]

- Fish hatch in shallow trough baskets and drop from the baskets into the troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways. By late August when fish are about 30-40 fish/lb), they are adipose fin clipped, and placed into the 2.1 acre rearing pond. [WDFW July 2005b]

b) Number of fry ponded each year, including % hatch each year (See Table in section 4(b) above)

7. Rearing/feeding protocols

Fry/fingerling will be fed an appropriate commercial dry or moist steelhead/salmon diet. Fry feeding starts at ~8 times daily and is reduced as the fish increase in size. Range of feeding varies between 0.5 – 2.8% B.W./day. Feed conversion is expected to fall in a range of 1.1:1 (dry feed)– 1.4:1 (moist feed) pounds fed to pounds produced. Feeding frequency, percent BWD and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals. [WDFW July 2005b]

8. Fish growth profiles

Table. Growth and size of Lyons Ferry FH Stock Steelhead at Lyons Ferry FH for the 1999-2001 Brood Years.

Month/Year	FPP	g/fish	**Month/Year**	FPP	g/fish	Month/Year	FPP	g/fish
2/99	Not Applicab	**Not Applica**	**2/00**	1,200.0	**0.4**	**2/01**	**Not Appli**	**Not Applica**
3/99	1,100.0	**0.4**	**3/00**	700.0	**0.6**	**3/01**	**1,218**	**0.4**
4/99	349.0	**1.3**	**4/00**	341.0	**1.3**	**4/01**	**330.0**	**1.4**
5/99	195.8	**2.3**	**5/00**	177.0	**2.6**	**5/01**	**141.0**	**3.2**
6/99	103.8	434	6/00	90.0	5.0	6/01	69.0	6.6
7/99	49.9	9.1	7/00	42.2	10.7	7/01	42.6	10.6
8/99	36.0	12.6	8/00	31.1	14.6	8/01	34.0	13.3
9/99	17.2	26.4	9/00	16.1	28.2	9/01	20.7	21.9
10/99	12.2	37.2	10/00	12.1	37.5	10/01	13.0	34.9
11/99	9.6	47.3	11/00	8.1	56.0	11/01	9.1	49.8
12/99	7.1	63.9	12/00	7.0	64.8	12/01	8.4	54.0
1/00	6.2	73.2	1/01	4.6	98.6	1/02	6.9	65.7
2/00	5.5	82.5	2/01	4.1	110.6	2/02	4.2	108
3/00	4.9	92.6	3/01	3.9	116.3	3/02	3.4	133.4
4/00	4.2	108.0	4/01	3.2	141.8	4/02	3.4	133.4

[WDFW July 2005b]

9. Fish health protocols and issues

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Fish Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining when fish are removed. Water quality in the lakes is not affected due to low stocking density. [WDFW July 2005b]

10. Chemotherapeutant use

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by hand picking with egg pickers or bulb-syringe. [WDFW July 2005b]

11. Tagging and marking of juveniles

At this time, there is no direct research associated with the Lyons Ferry FH stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc.). However, starting in 2008, all Lyons Ferry FH stock release groups received PIT tags (roughly based on proportional release size and expected number of adults returning). Returns from these PIT tags groups will be analyzed separately or as an aggregate to estimate total returns for mitigation accounting purposes. This is partially in response to an anticipated lack of creel personnel in the future to recover CWT's from the summer steelhead fishery. [WDFW Sept. 2008]

12. Fish Release

a) Protocols

In August, all Lyons Ferry FH stock summer steelhead are adipose fin clipped and transferred to Lake One. In mid-winter, some of these fish are transferred back to raceways to receive additional marks or tags, as determined by WDFW evaluation and Fish Management staff. [WDFW Sept. 2008]

Table 8. Proposed 2008 LFH stock summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
LFH on station release into the Snake River	40,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 1,500	April 2009
Dayton AF release into the Touchet River	65,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	Transfer to Dayton AF in Feb, release in April 2009
Direct stream release into the Tucannon River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2009
Direct stream release into the Walla Walla River	80,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 3,500	April 2009

[WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

- All summer steelhead released as part of the Lyons Ferry stock are released as yearling smolts, about 12-14 months after the fish were initially spawned. The following table shows releases of Lyons Ferry stock steelhead smolts from the last ten years by release location.

- *Table. Lyons Ferry stock smolt releases, 1998-2008, by release location.*

Year	On-Station	Tucannon	Touchet	Walla Walla
1998	93,845	160,068	125,127	165,855
1999	87,992	179,089	124,651	176,000
2000	59,942	145,768	124,654	165,500
2001	53,551	121,390	103,681	103,980
2002	62,612	135,203	125,112	99,859
2003	60,001	115,496	100,445	102,975
2004	59,993	83,726	86,347	80,143
2005	63,036	102,029	86,270	104,027
2006	61,431	101,724	85,528	100,345
2007	59,983	96,690	86,985	97,766
2008	60,360	102,313	87,160	101,677

[Pers. Com. WDFW Dayton Lab Office, 2009]

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Table. Contribution of Lyons Ferry stock (Lyons Ferry FH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

Run Year	Lyons Ferry FH	Tucannon	Touchet	Walla Walla	Grande Ronde	Total	**Percent of goal**
Adult Goal	630	875	750	900	1,500	4,655	
1984	1,137	762	680	1,078	0	3,657	***79%***
1985	2,456	1,686	1,699	2,201	0	8,042	***173%***
1986	4,834	1,712	2,961	3,045	1,945	14,496	***311%***
1987	3,657	685	1,851	2,046	1,817	10,056	***216%***
1988	5,563	1,257	2,577	2,933	3,057	15,388	***331%***
1989	4,955	1,837	3,326	4,620	5,157	19,896	***427%***
1990	1,007	786	1,140	1,365	2,044	6,342	***136%***
1991	1,104	1,658	1,373	1,277	3,451	8,862	***190%***
1992	877	2,037	1,924	3,155	4,559	12,552	***270%***
1993	651	1,085	1,679	2,578	3,167	9,160	***197%***
1994	2,386	914	1,177	655	2,895	8,026	***172%***
1995	5,832	1,861	3,326	4,817	9,173	25,009	***537%***
1996	3,050	1,779	3,754	4,359	7,819	20,762	***446%***
1997	2,112	1,311	2,696	3,676	5,301	15,095	***324%***
1998	718	568	1,246	1,978	1,456	5,966	***128%***
1999	1,169	2,235	2,128	3,444	1,799	10,775	***231%***
2000	1,422	3,283	2,802	4,584	4,730	16,820	***361%***
2001	2,254	4,488	3,839	5,996	10,919	27,497	***591%***
2002	928	1,712	1,237	1,517	5,435	10,833	***233%***
2003	842	1,469	1,440	988	3,925	8,865	***186%***
2004	944	1,601	1,148	1,284	3,441	8,418	***181%***
2005	901	1,256	1,165	1,424	2,905	7,651	***164%***
Average	***2,218***	***1,636***	***2,053***	***2,683***	***4,250***	***12,453***	***268%***
Percent of goal	**352%**	**187%**	**274%**	**298%**	**283%**	**268%**	

[WDFW Jan. 2009]

b) Return timing and age-class structure of adults

Table. Age class structure of Lyons Ferry stock steelhead based on CWT recaptures at Lyons Ferry FH.

Run Year	I	II	III
2007	90.4%	9.6%	
2006	81.8%	18.9%	
2005	73.3%	26.7%	
2004	78.7%	21.3%	
2003	88.4%	11.6%	
2002	76.7%	23.3%	
2001	84.2%	15.6%	0.2%
2000	57.6%	42.1%	0.3%
1999	93.3%	6.7%	
1998	71.7%	28.1%	0.2%

[WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002]

c) Smolt-to-adult return rates

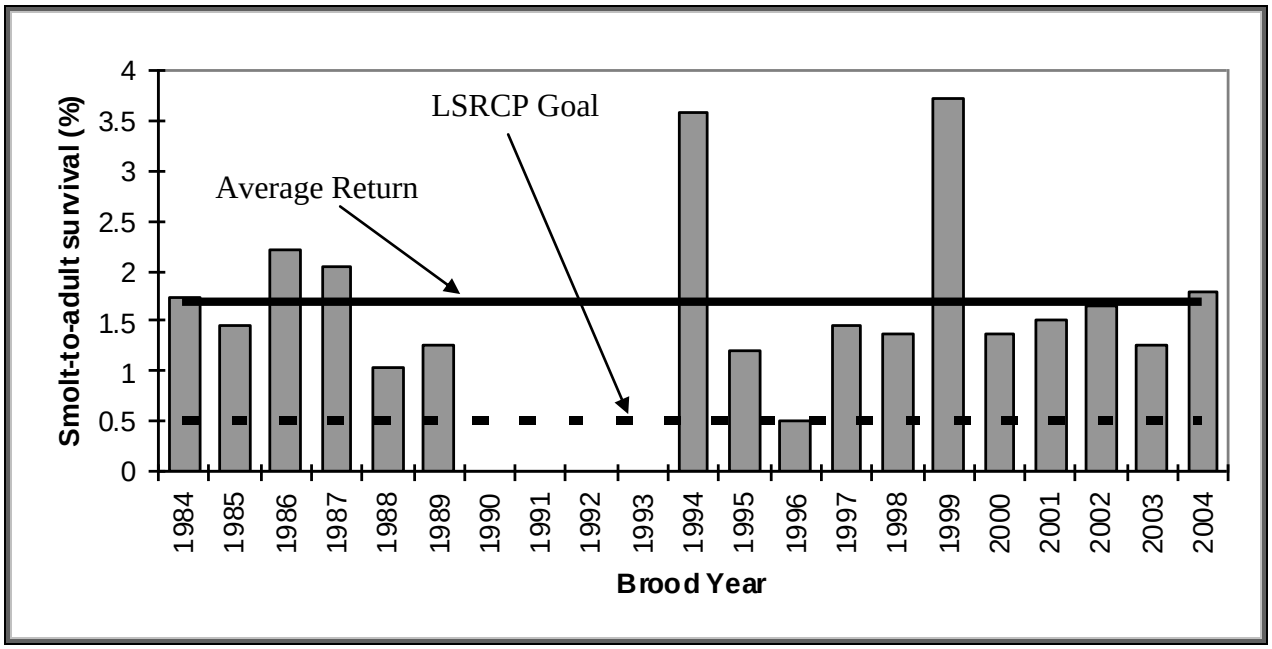


Figure. Estimated smolt-to-adult survival of summer steelhead released directly into the Snake River at Lyons Ferry Hatchery. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

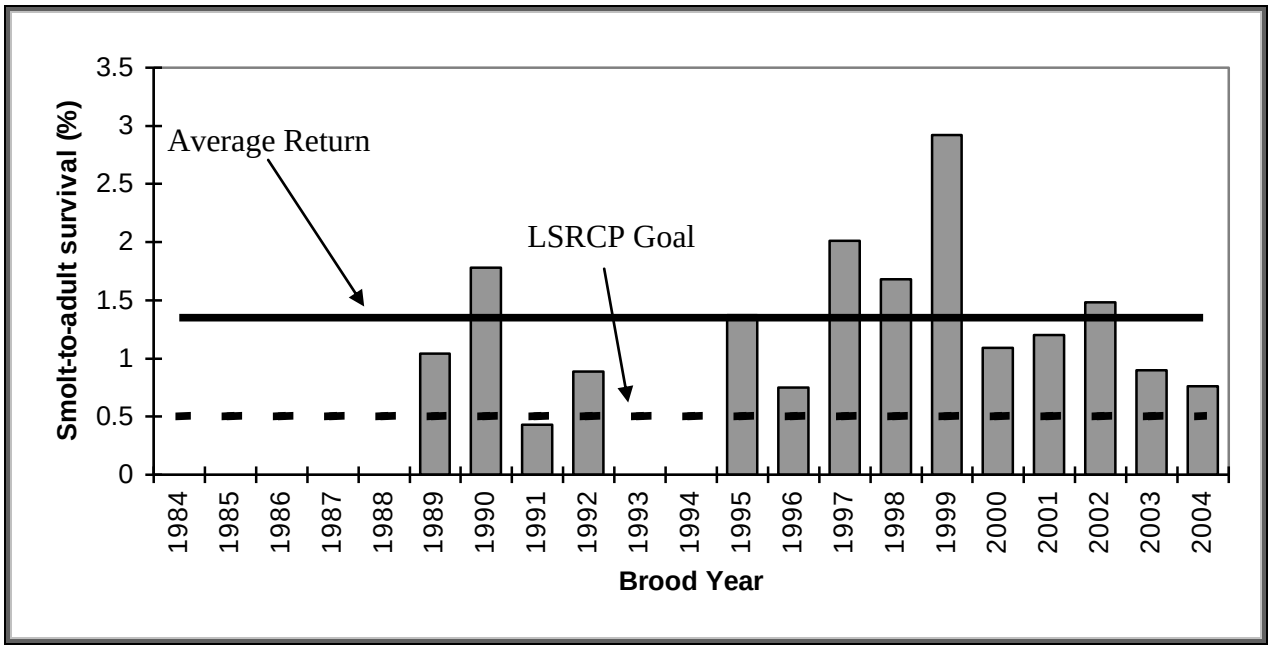


Figure. Estimated smolt-to-adult survival (to the LSCRP project area) of summer steelhead released directly into the middle or lower Tucannon River. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

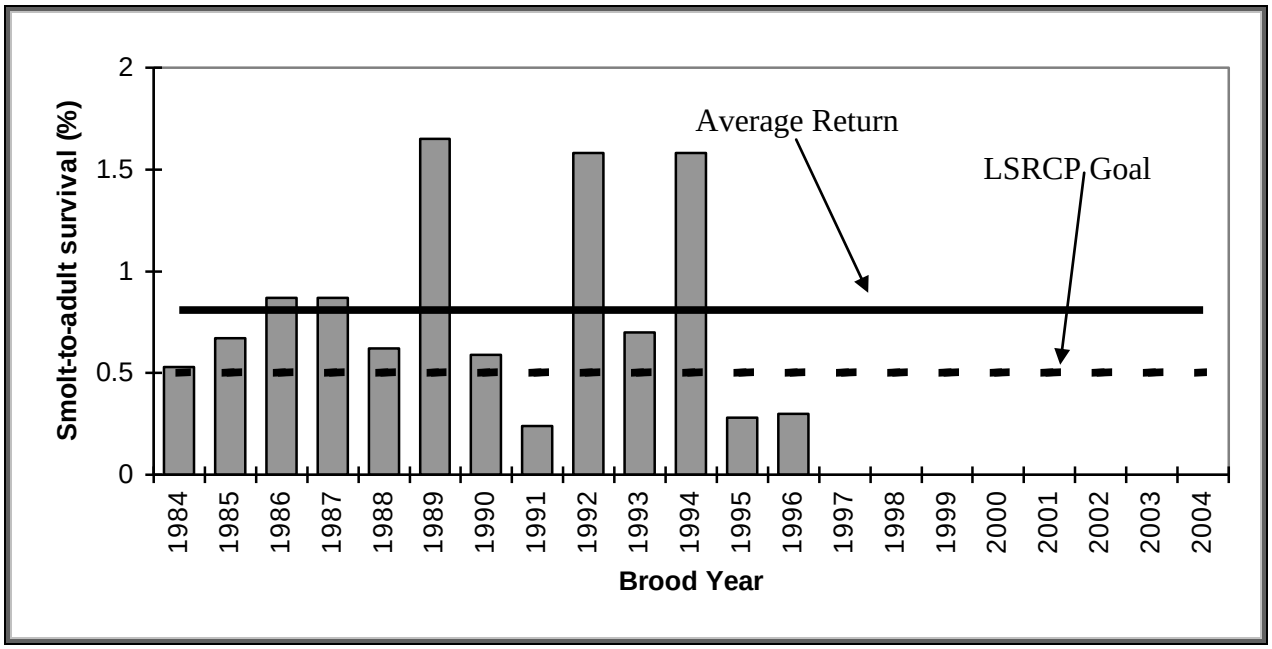


Figure. Estimated smolt-to-adult survival (to the LSRCP project area) of summer steelhead released from Curl Lake Acclimation Pond in the upper Tucannon River. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

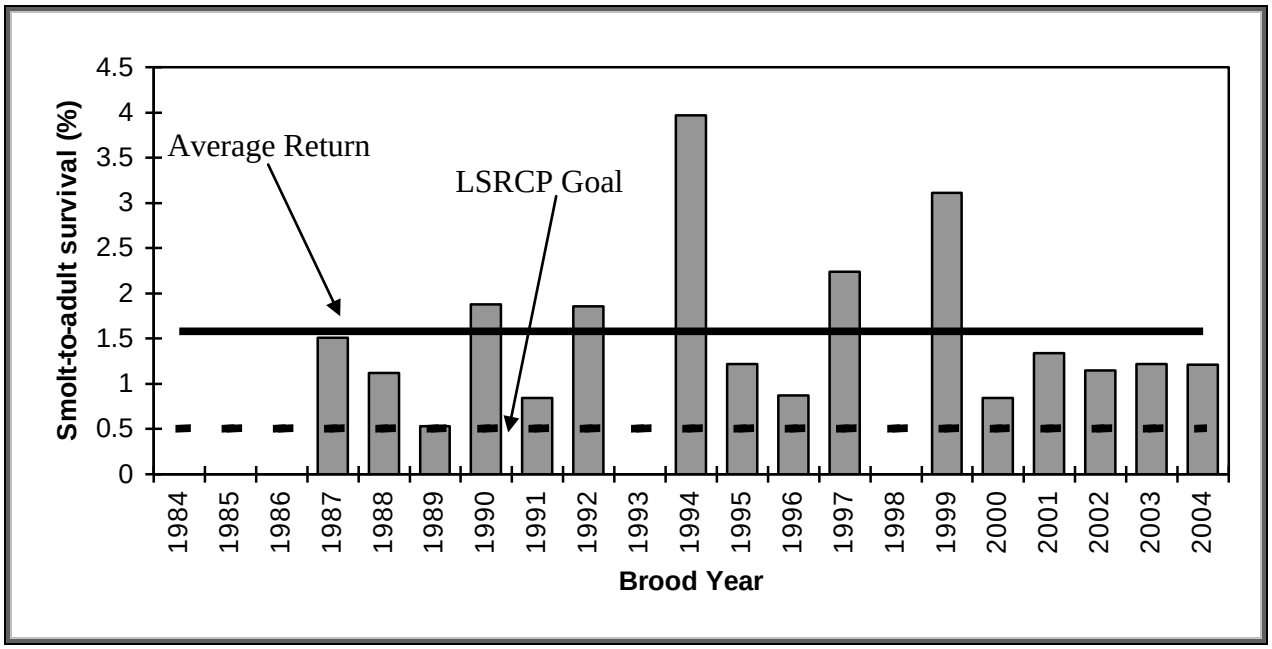


Figure. Estimated smolt-to-adult survival of summer steelhead released from Dayton Acclimation Pond in the upper Touchet River. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

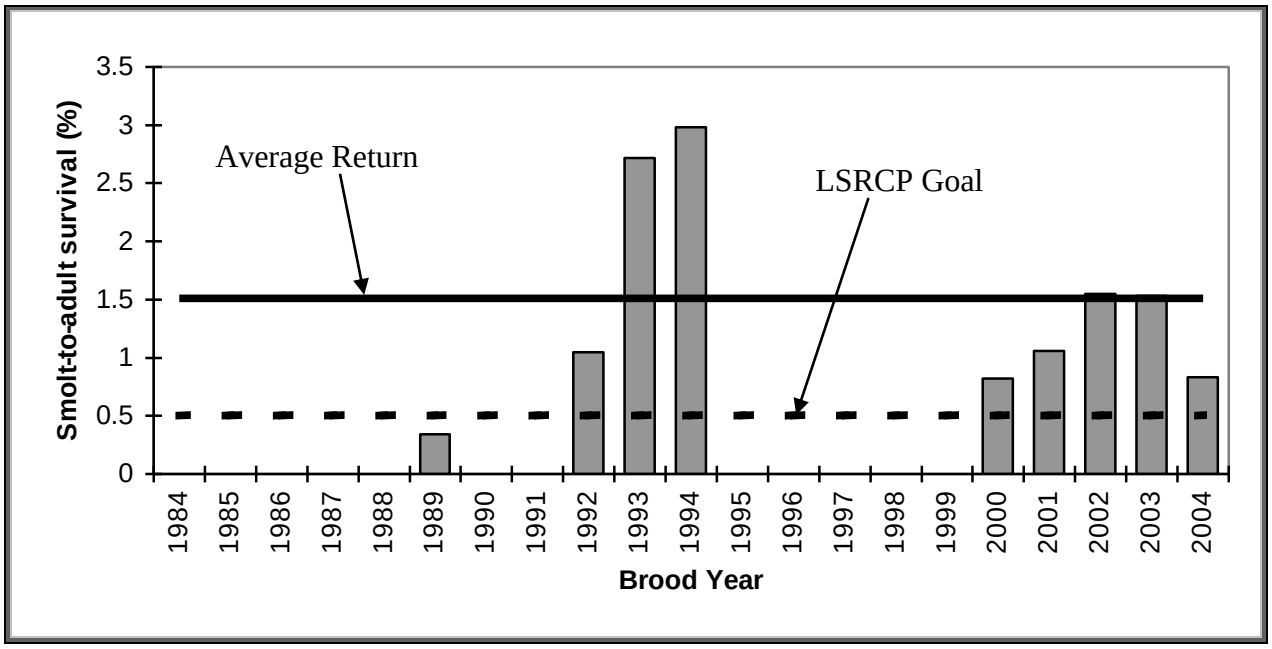


Figure. Estimated smolt-to-adult return rates of summer steelhead released directly into the lower Walla Walla River. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

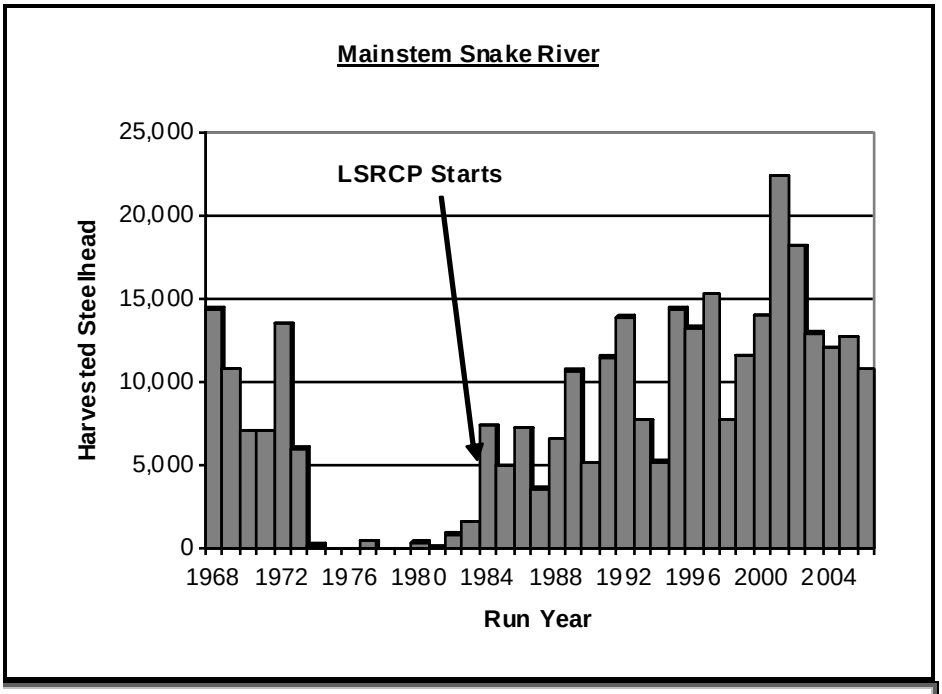
d) Stock productivity (e.g. recruits per spawner)

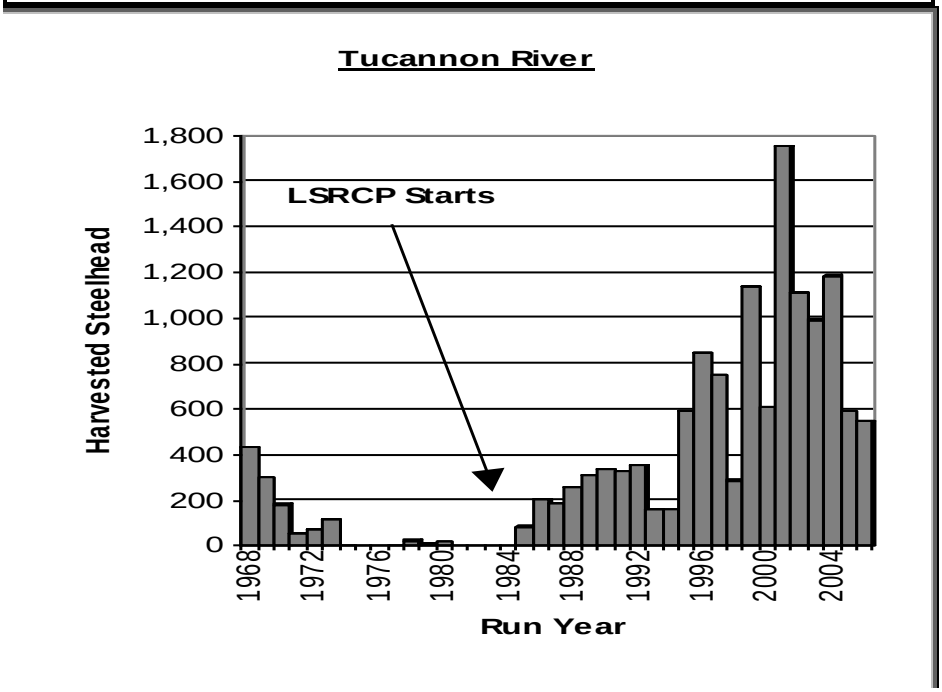
The estimate for stock productivity on the Lyons Ferry stock has been difficult to calculate as our estimates for contribution are incomplete since we have incomplete accounting for all fish that might escape to the spawning grounds. However, based on the average number of broodstock needed to produce the Lyons Ferry stock program, the estimated contributions to harvest and to the hatchery, we believe the recruits per spawner is around 20-25:1

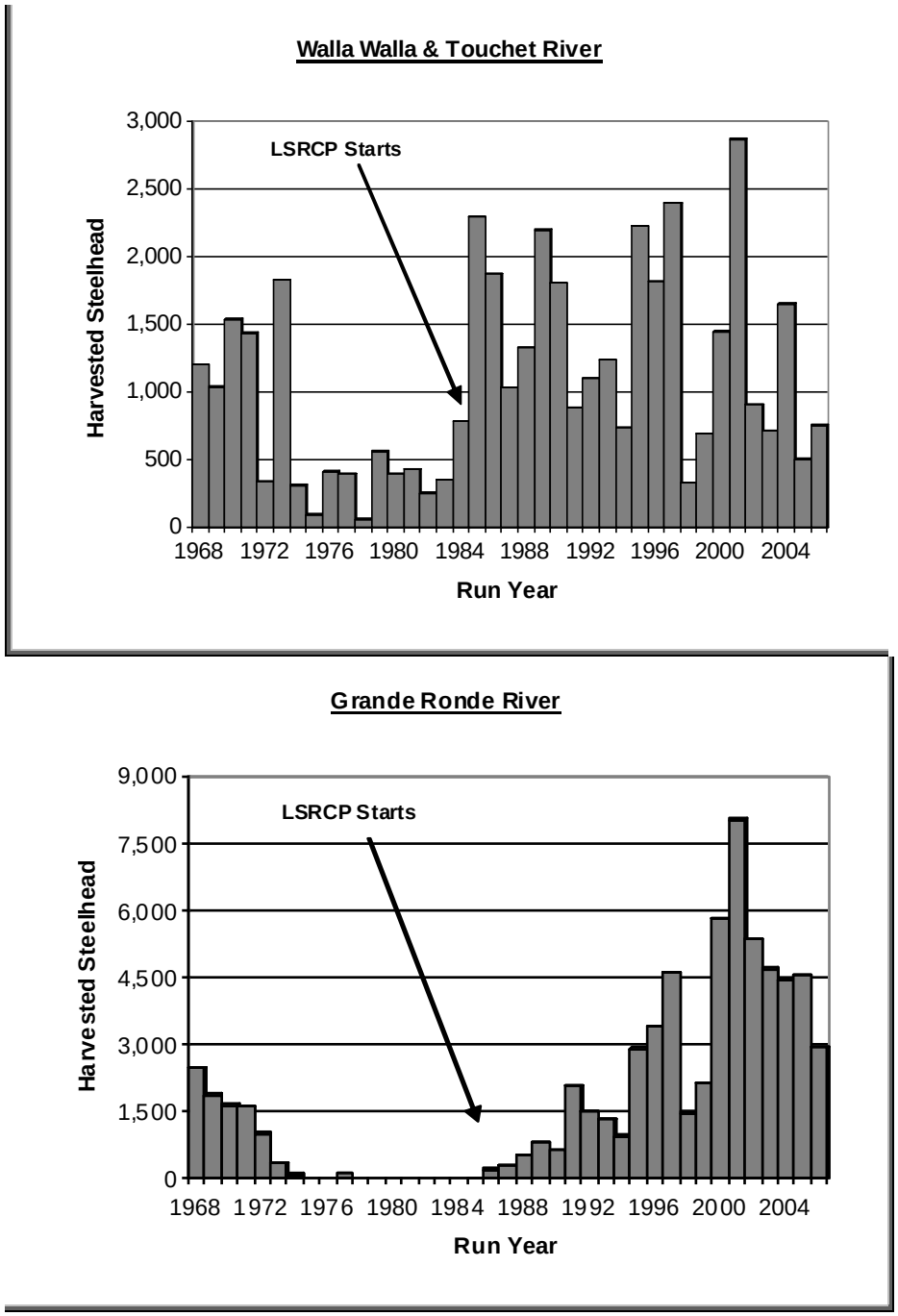
2. Contributions to harvest and utilization (e.g. food banks)

- The Lyons Ferry FH stock adults are trapped on-station from volunteers that swim into the fish ladder. Fish not needed for broodstock or CWT recoveries will be returned to the Snake River for the active sport fishery. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish will be buried on site. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information. Food banks are not currently utilized to dispose of carcasses, and due to disease concerns from IHNV the carcasses are not used for nutrient enhancement in local rivers. [WDFW Sept. 2008]

- Lyons Ferry stock contribute substantially to harvest in SE Washington. While the mainstem Snake river fishery is composed of Washington, Oregon and Idaho hatchery steelhead releases, catches of steelhead in the Tucannon River, Touchet River and Walla Walla have been almost exclusively from Lyons Ferry stock steelhead. Contributions to harvest may be best presented in the following graphs and table. [WDFW Jan. 2009]







Figures. Harvested summer steelhead (from WDFW Catch Record Card Estimates) for the mainstem of the Snake River (Sections 640-650 – mouth of the Snake River to the Oregon Border), Tucannon River (Section 653), Walla Walla and Touchet rivers (Section 657 and 659), and Grande Ronde River (Section 592). Note: Many of the fish captured in the mainstem Snake River and Grande Ronde River are hatchery fish from Idaho and Oregon LSRCP summer steelhead programs.

[WDFW Jan. 2009]

- Contribution of Lyons Ferry stock (Lyons Ferry FH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

Run Year	Lyons Ferry FH	Tucannon	Touchet	Walla Walla	Grande Ronde	Total	**Percent of goal**
Adult Goal	630	875	750	900	1,500	4,655	
1984	1,137	762	680	1,078	0	3,657	***79%***
1985	2,456	1,686	1,699	2,201	0	8,042	***173%***
1986	4,834	1,712	2,961	3,045	*1,945*	14,496	***311%***
1987	3,657	685	1,851	2,046	1,817	10,056	***216%***
1988	5,563	1,257	2,577	2,933	3,057	15,388	***331%***
1989	4,955	1,837	3,326	4,620	5,157	19,896	***427%***
1990	1,007	786	1,140	1,365	2,044	6,342	***136%***
1991	1,104	1,658	1,373	1,277	3,451	8,862	***190%***
1992	877	2,037	1,924	3,155	4,559	12,552	***270%***
1993	651	1,085	1,679	2,578	3,167	9,160	***197%***
1994	2,386	914	1,177	655	2,895	8,026	***172%***
1995	5,832	1,861	3,326	4,817	9,173	25,009	***537%***
1996	3,050	1,779	3,754	4,359	7,819	20,762	***446%***
1997	2,112	1,311	2,696	3,676	5,301	15,095	***324%***
1998	718	568	1,246	1,978	1,456	5,966	***128%***
1999	1,169	2,235	2,128	3,444	1,799	10,775	***231%***
2000	1,422	3,283	2,802	4,584	4,730	16,820	***361%***
2001	2,254	4,488	3,839	5,996	10,919	27,497	***591%***
2002	928	1,712	1,237	1,517	5,435	10,833	***233%***
2003	842	1,469	1,440	988	3,925	8,865	***186%***
2004	944	1,601	1,148	1,284	3,441	8,418	***181%***
2005	901	1,256	1,165	1,424	2,905	7,651	***164%***
Average	***2,218***	***1,636***	***2,053***	***2,683***	***4,250***	***12,453***	***268%***
Percent of goal	**352%**	**187%**	**274%**	**298%**	**283%**	**268%**	

[WDFW Jan. 2009]

3. Contributions to conservation

The Lyons Ferry FH and Wallowa stocks are both non-endemic stocks that were originally collected from outside their respective release points. The Wallowa stock was originally collected by Oregon Dept of Fish and Wildlife from Lower Snake River dams (likely comprised of both A- and B-run fish from Oregon and Idaho), and then released in the Wallowa River in the Grande Ronde Basin. The Lyons Ferry FH stock was derived primarily from a combination of Wells (upper Columbia River) and returning Wallowa stock fish to Lyons Ferry FH. [WDFW Sept. 2008] Neither of these stocks is currently being used as a conservation tool for steelhead in SE Washington streams, though in the past they were treated as such [pers. comm. Joe Bumgarner, WDFW, 2009].

4. Other benefits

None identified here.

E. Research, monitoring, and evaluation programs

At this time, there is no direct research associated with the Lyons Ferry FH stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc.). However, starting in 2008, all Lyons Ferry FH stock release groups received PIT tags (roughly based on proportional release size and expected number of adults returning). Returns from these PIT tags groups will be analyzed separately or as an aggregate to estimate total returns for mitigation accounting purposes. This is partially in response to an anticipated lack of creel personnel in the future to recover CWT's from the summer steelhead fishery. [WDFW Sept. 2008]

Other WDFW evaluation activities in SE Washington include:

- WDFW operate a rotary screw trap in the Tucannon River to estimate the number of migrating natural steelhead smolts and other salmonids.

- As part of our annual broodstock collection and research activities, WDFW hatchery and evaluation staffs operate a series of adult steelhead traps in SE Washington.

- Evaluation and fish management staffs conduct spawning ground surveys for steelhead in the Walla Walla and Touchet rivers, the Tucannon River, and Asotin Creek.

- WDFW personnel surveyed steelhead sport anglers within the LSRCP area of Washington to recover CWTs from tagged steelhead.

- In addition, we cooperate with ODFW in conducting a joint survey of anglers on the lower Grande Ronde River of Washington and Oregon. Angler effort, catch rates, and harvest that were estimated by ODFW staff are presented.

- WDFW used to electrofish index sites to estimate natural juvenile steelhead densities, derive population estimates for specific river reaches, and to estimate residual hatchery steelhead. In addition, we conducted mark/recapture tests to compare with our standard electrofishing methods to examine bias in the estimates. These surveys have been discontinued due to the wide variance in population estimates, and their relative lack of use as part of the hatchery evaluation program.

- Since 1998, the Snake River Lab and WDFW's Fish Management staff have periodically collected samples from SE Washington summer steelhead populations (adult and juvenile) for genetic stock analysis. Samples have been collected from the Walla Walla, Touchet and Tucannon River basins, the Lyons Ferry FH stock, and portions of the Grande Ronde. During the fall of 2006, WDFW genetics staff, in cooperation with the Snake River Lab and WDFW Fish Management for SE Washington assembled a summer steelhead genetics summary that includes most samples collected through 2005. [WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002] The following diagram shows the genetic relationships between Lyons Ferry stock steelhead and natural origin Tucannon River and Touchet River adult steelhead. The diagram following that shows

additional relationships that include Walla Walla river steelhead (adults and juveniles) and additional juvenile steelhead from the upper Touchet River drainage.

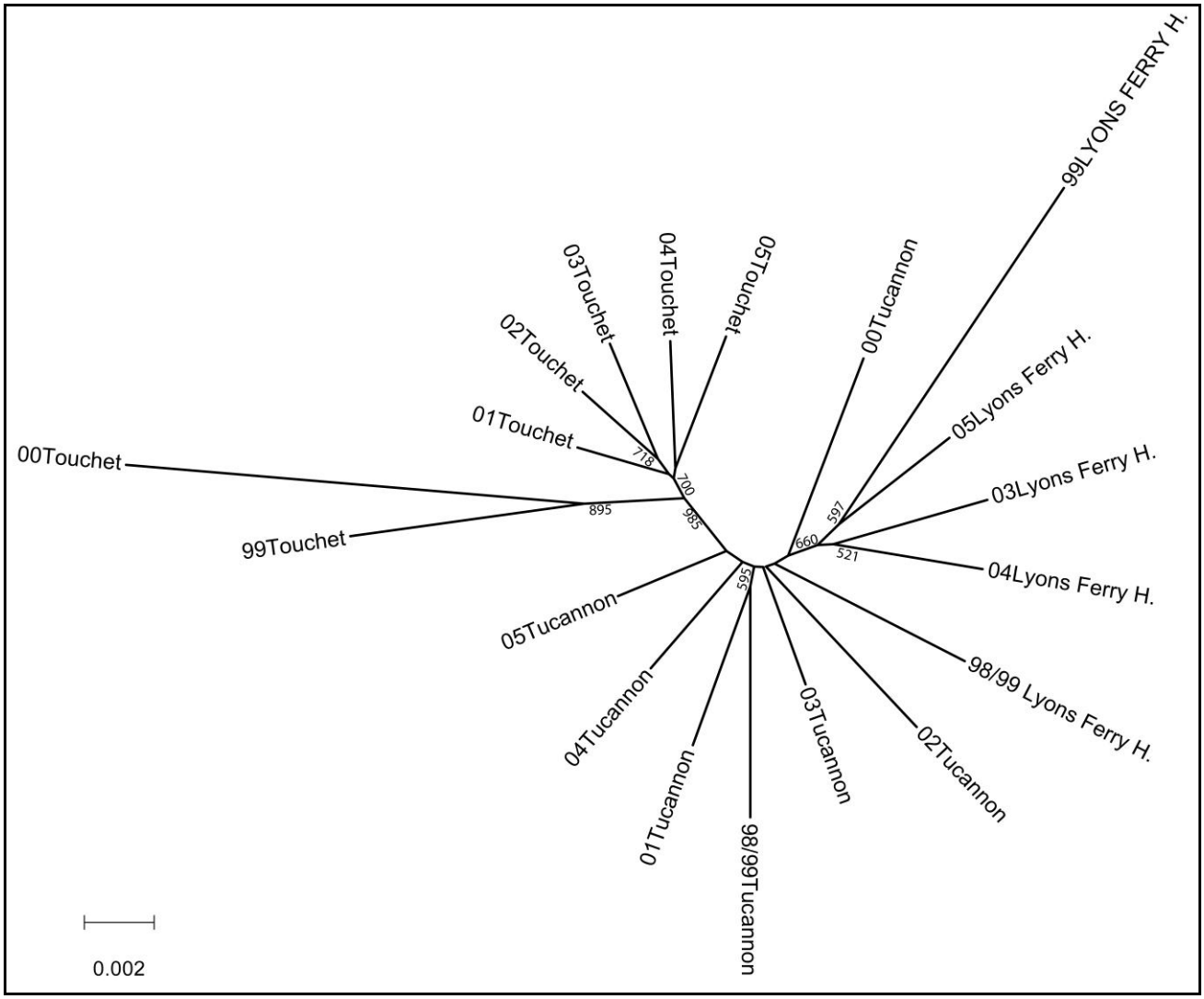


Figure. Chord-distance tree for temporally stratified adult samples. Node support numbers are values from bootstrap analysis (1000 bootstraps). Note: only 1999 Lyons Ferry FH samples were from juveniles.

[WDFW Jan. 2009]

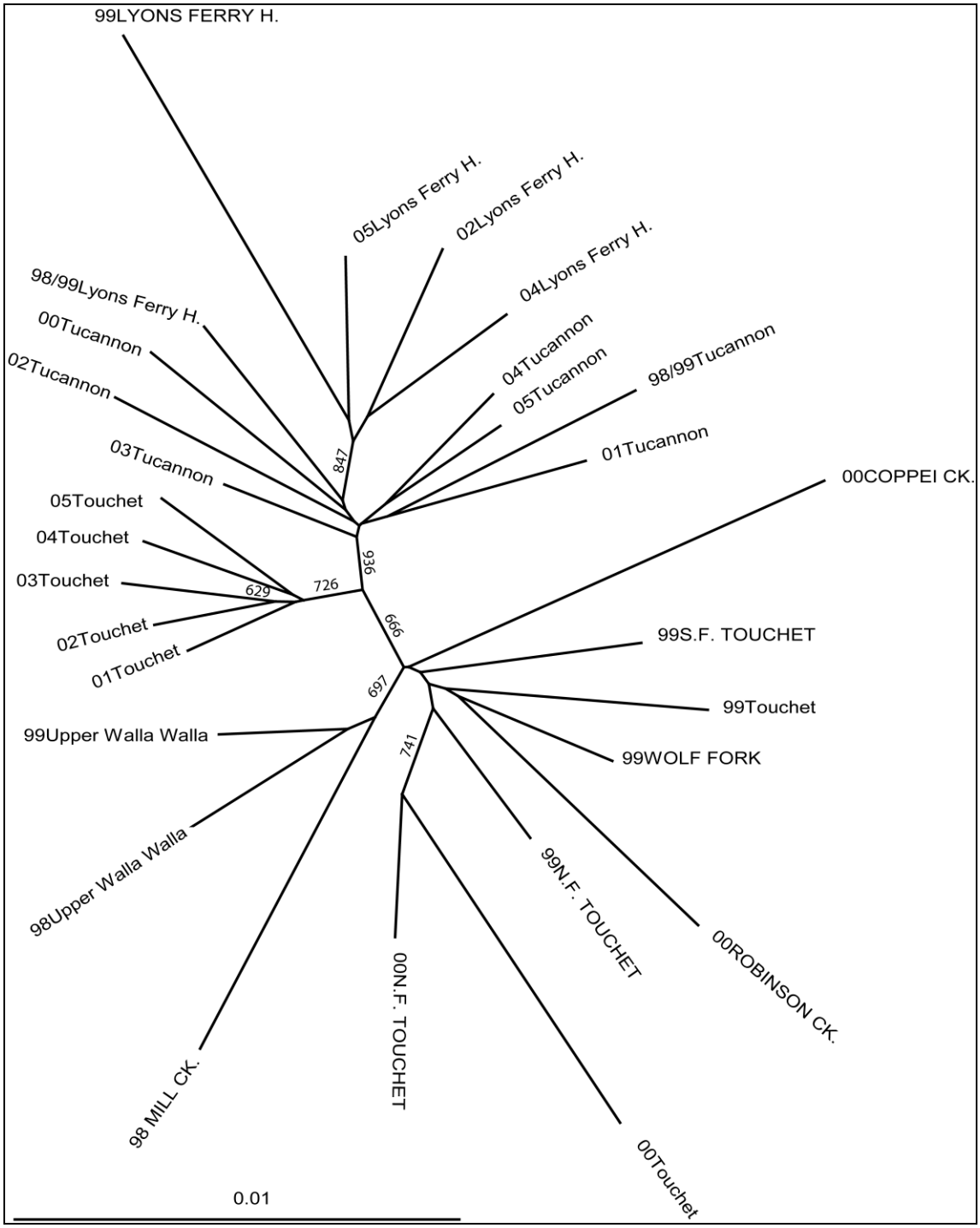


Figure. Chord distance tree that includes temporally stratified samples, plus samples from Touchet River tributaries, Mill Creek, and Walla Walla River. Sample labels with all letters capitalized are juvenile samples. Node support numbers are values from bootstrap analysis (1000 bootstraps).
[WDFW Jan. 2009]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

Currently, the sport fishery on steelhead is a mixed stock fishery. Wild fish are encountered, but cannot be retained by anglers. There is likely some level of hooking mortality to wild origin steelhead. These impacts have been estimated and presented to NOAA Fisheries as part of our FMEP to operate fisheries in SE Washington

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

The NOAA Fisheries ruled that LSRCP hatchery steelhead jeopardized listed steelhead populations within the Snake and Columbia river basins (NMFS 1999), and called for the development of new endemic broodstocks for the hatchery steelhead program. Initial efforts in the Tucannon and Touchet rivers appear to be somewhat successful, but more data about the demonstration of acceptable adult returns are needed before concluding that the program is successful and should be expanded. Documenting stray rates and estimating the proportions of hatchery steelhead in the natural spawning areas for steelhead is problematic given stream flow conditions in the spring time, and that very few carcasses are ever recovered from stream surveys. The use of adult traps and creel information has provided the general data to which we attempt to estimate proportions of hatchery fish on the spawning grounds. The following graphs are the most current data we have for these estimates in the Tucannon and Touchet rivers. Note the number of endemic hatchery stock fish from the Tucannon and Touchet programs have added to the number of hatchery fish on the spawning grounds in more recent years.

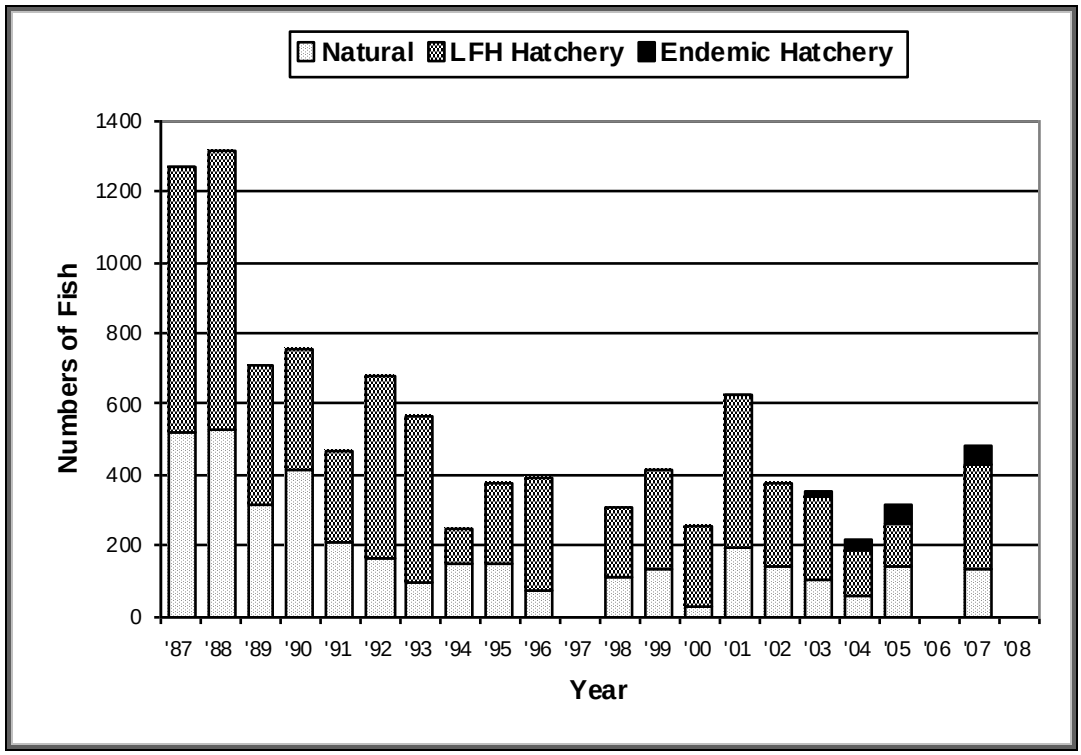


Figure. Estimated number of natural and hatchery origin fish spawning in index areas of the Tucannon River, 1987-2008. Flood conditions or high stream flows precluded spawning survey estimate of redds in some years, which are the basis for escapement estimates. Note: The percent of hatchery fish on the spawning grounds is related to the index spawning areas surveyed and hatchery fish release locations which have been moved to downstream locations in more recent years. Releases of hatchery steelhead occurred in the upper 1/3 of the basin through the mid-1990's, about ½ way up the basin from the mid-1990's to mid 2000's, and have been below the index spawning areas for the last four years.

[WDFW Dec. 2008]

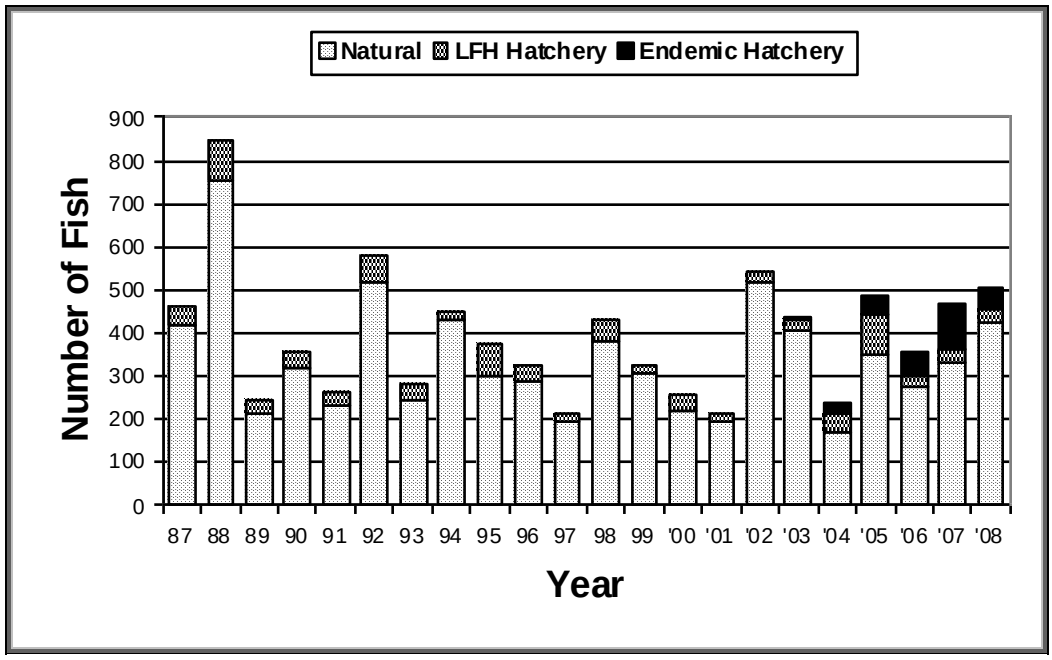


Figure. Estimated number of natural and hatchery origin fish spawning in index areas (North, South, Wolf, and Robinson forks) of the Touchet River, 1987-2007. Note: the percent of hatchery fish on the spawning grounds is related to the index spawning areas surveyed and hatchery release location. All Lyons Ferry FH stock hatchery releases occur about 1 mile below the lowest spawning ground index area, and are released from Dayton Acclimation Pond. Endemic stock steelhead are released about 1 mile above the mouth of the North Fork Touchet River, in the lower section of the index spawning area.

[WDFW Dec. 2008]

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- The transfer and release of Lyons Ferry stock steelhead pose inherent ecological risks (e.g. competition, predation, disease) to natural-origin steelhead and local populations of redband rainbow trout in the basin in which they are released. This risk is reduced by releasing full-term smolts from locations with adult recapture facilities.

- Since steelhead are more likely to residualize than hatchery-reared salmon stocks, ecological risks are increased.

- Steelhead that residualize pose ecological risks to other species including bull trout.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams pose a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

- The incidental hooking mortality of endemic hatchery stock and natural-origin steelhead and local populations of redband rainbow trout in fisheries targeting Lyons Ferry stock steelhead poses demographic risks to those non-targeted stocks.

- Harvest targeting Lyons Ferry stock steelhead poses a demographic risk to bull trout.

IID. Cottonwood Creek Hatchery Summer Steelhead (Wallowa Stock)

A. General information

Lyons Ferry (Phase I) included rearing of summer steelhead for release into southeast Washington and was designed to produce 814,800 summer steelhead smolts at 7 fpp for a total of 116,400 pounds. All adult trapping for the program (Lyons Ferry stock only) was designed to occur at Lyons Ferry FH. Wallowa stock eggs were to provide by Oregon Dept of Fish and Wildlife for the Lyons Ferry Wallowa stock program. In 1992, a trap was set up on Cottonwood Creek (site of the acclimation pond), and broodstock have been collected there every year since (when stream flows allow) Steelhead smolts from the Wallowa stock program were to be released from Cottonwood Pond on the lower Grande Ronde River [USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase I) was constructed in 1983 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 116,400 pounds (814,800 smolts) of summer steelhead (7 fpp) for release. [USFWS May 1990]

2. Goals of program

The goal of the Wallowa stock program is to return 1,501 summer steelhead to the project area to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]

3. Objectives of program

- The Wallowa stock program was initiated to provide a sport fishery for summer steelhead in the Grande Ronde River (for both Oregon and Washington anglers). It has been an extremely successful program in that regard, and adult returns have warranted a program reduction from a 250,000 yearling release goal to the current program of 160,000 yearlings. Due to successful SAR survival, another program reduction may be an option to reduce the number of excess returning adults.

- Trapping of returning Wallowa stock adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River) beginning in March each year. This creek also supplies water to the Cottonwood Acclimation Pond. Trapping occurs from March through April. Because of potential low egg survival and/or IHN virus (both of which

have been experienced in the past), about 50 complete spawned females are needed to provide 220,000 green eggs for the program of 160,000 smolts. Unmarked steelhead are not retained for spawning, but passed upstream to spawn naturally. All spawned carcasses will be taken above the trap in Cottonwood Creek and scattered for nutrient enhancement, or returned to Lyons Ferry FH to be buried.

- Spawning generally occurs in late March and early April on a weekly basis. All fish are spawned at the Cottonwood Creek trap site, with the gametes transported to Lyons Ferry FH for fertilization, incubation, and rearing. A 1:1 male to female mating ratio will continue to be employed whenever possible (see research section below). If low water flows in the creek do not allow returning adults access to the trap, two alternate strategies may be employed. First, the acclimation pond outlet creek can be modified to allow adult capture there. Second, excess adults from ODFW's Wallowa Hatchery may be used to provide eggs for this program, as occurred in 2005. Eggs/fry excess to projected program needs will be destroyed or planted in area lakes.

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Mitigation / Isolated Harvest: Continue to provide compensation as specified under the LSRCP program (USACE 1975) while meeting conservation and recovery criteria established for the Snake River summer steelhead ESU. Provide harvest opportunities established under US v Oregon for tribal and recreational fisheries.[WDFW July 2005a]

5. Alignment of program with ESU-wide plans

LFC and the resulting production of steelhead is part of legally required compensation provided to Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated "Management objectives such as for harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." As such, managers will have to identify their legal mandates, and do their best to provide fish for harvest, while protecting naturally spawning populations. WDFW believes they have taken such actions with the proposed program outlined in this HGMP to be consistent with the Policy Recommendations in the APR.

In the 2 April, 1999 Biological Opinion, NMFS cited "great concern" regarding the large number of Wallowa Hatchery steelhead reported spawning in other rivers (specifically in the Deschutes River, Oregon). NMFS based their ruling on preliminary data analysis that suggested Wallowa Stock steelhead were straying above the 5% rate. Further analyses completed by ODFW in 2004 for Wallow hatchery steelhead have confirmed that early analysis [pers. comm. Rich Carmichael, ODFW, 2009]. Another analysis by WDFW of Wallowa stock fish released from Cottonwood AP also show fish straying into the Deschutes River. Regardless, according to the BiOP (1999), NMFS proposed elimination of the Wallowa Stock by 2008, concurrent with development of a new stock from local populations. However, a recent analysis by Chilcote (2002) suggests that hatchery fish, whether from a local or non-native broodstock, can still reduce the reproductive success of natural populations if they are allowed to intermix on the spawning grounds.

Unfortunately, WDFW did not re-initiate releases of coded-wire tagged fish in the Grande Ronde until the 1997 release year. However, between 1985 and 1989, WDFW released tagged fish from Cottonwood AP. Adult return data from those releases showed that only a few of them strayed into the upper Deschutes River. [WDFW July 2005a]

6. Habitat description and status where fish are released.

Human development and land management impacts consistent with those identified across the Columbia and Snake River basins affects natural steelhead production in the Grande Ronde. Loss of channel diversity, sedimentation, reduced stream flows, habitat constriction due to effects of irrigation withdrawn, water temperature and fragmentation of habitat all affect productivity of natural steelhead populations within the watershed. However, portions of the Grande Ronde Basin (i.e. Wenaha River within Washington) are within the Wenaha-Tucannon Wilderness Areas and are protected from negative human impacts in many ways.

Only one comprehensive review of the ecological health of the Grande Ronde River in Washington in relation to salmonid population status and recovery has been completed (Kuttle, M. 2002). Limiting factors such as water temperature, channel stability, sediment, and instream habitat (in tributaries to the mainstem) are known to exist in the basin, but the extent of these problems are still relatively un-quantified due to data limitations. In addition, the Grande Ronde Subbasin Summary (2001), completed for Northwest Power and Conservation Council (NPCC) planning efforts, identified parameters of concern within the basin but was not specific on the extent of the problems. State programs in place provide standards for activities on private land that might otherwise contribute to the problems listed above. Activities on public lands or federally funded actions must additionally meet Endangered Species Act listed species protection criteria developed through consultation with US Fish and Wildlife Service and National Marine Fisheries Service as well as National Environmental Protection Act (NEPA) review.

Most watershed restoration/improvement projects are funded through the Grande Ronde Model Watershed Program, (funded by BPA's Fish and Wildlife Program - 1992), and Asotin County Conservation District. Efforts include fencing to ensure riparian vegetative recovery, improved fish passage at road crossings and diversions, and reduced sediment production from roads and cropland, and screening of irrigation diversions. Taken together, habitat protection and improvement measures have, and will continue to improve habitat for and productivity of the basin's natural summer steelhead populations.

[WDFW July 2005a]

7. Size of program and production goals (No. of spawners and smolt release goals)

Trapping of returning Wallowa stock adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River) beginning in March each year. This creek also supplies water to the Cottonwood AF. Trapping occurs from March through April. Because of potential low egg survival and/or IHN virus (both of which have been experienced in the past), about 50 complete spawned females are needed to provide 220,000 green eggs for the program of 160,000 smolts.

Table 11. Proposed BY 2008 Wallowa stock summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Cottonwood AF on the Grande Ronde River	140,000 20,000	150,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 4,000	Transfer to Cottonwood AF in Feb, release in April 2009

Note: an additional 2,000 PIT tags will be added to the Cottonwood AF release groups as part of the PSMFC CSS study for steelhead above Lower Granite Dam.

[WDFW Sept. 2008]

C. Description of program and operations

1. Broodstock goal and source

- The Wallowa Stock (currently used by both WDFW and ODFW) steelhead was originally derived in the early 1980's from trapping steelhead at Ice Harbor and Little Goose dams. The stock is therefore likely made up of both "A" and "B" run steelhead from the Snake River basin, and could include fish from Clearwater, Salmon and Grande Ronde basins. A permanent adult trapping site was installed in Cottonwood Creek to trap hatchery broodstock beginning in 1992. Prior to that and for a few years following, WDFW received eggs from ODFW in order to reach program goals. [WDFW July 2005a]

- Because of potential low egg survival and/or IHN virus (both of which have been experienced in the past), about 50 complete spawned females are needed to provide 220,000 green eggs for the program of 160,000 smolts. [WDFW Sept. 2008] Survival of gametes collected from Cottonwood has increased substantially in recent years due to a change in spawning protocols. Mortality to eye-up is now averaging about 5%, where it used to be 25-30% [pers. comm. Joe Bumgarner, WDFW, 2009].

2. Adult collection procedures and holding

- Trapping of returning Wallowa stock adults occurs on Cottonwood Creek (a small tributary to the Grande Ronde River) beginning in March each year. This creek also supplies water to the Cottonwood AF. Trapping occurs from March through April. Unmarked steelhead are not retained for spawning, but passed upstream to spawn naturally. All spawned carcasses will be taken above the trap in Cottonwood Creek and scattered for nutrient enhancement, or returned to Lyons Ferry FH to be buried. [WDFW Sept. 2008] The adult holding area is limited, so we allow generally no more than 300 adults to be held at any one time. Additional fish that arrive in excess of that are passed upstream to spawn naturally. All CWT fish are retained and are either spawned or killed outright to obtain the tag information [pers. comm. Joe Bumgarner, WDFW, 2009].

3. Adult spawning

a) Spawning protocols

- Spawning generally occurs in late March and early April on a weekly basis. All fish are spawned at the Cottonwood Creek trap site, with the gametes transported to Lyons Ferry FH for fertilization, incubation, and rearing. A 1:1 or 2:1 male to female mating ratio will continue to be employed whenever possible (see research section below). If low water flows in the creek do not allow returning adults access to the trap, two alternate strategies may be employed. First, the acclimation pond outlet creek can be modified to allow adult capture there. Second, excess adults from ODFW's Wallowa Hatchery may be used to provide eggs for this program, as occurred in 2005. Eggs/fry excess to projected program needs will be destroyed or planted in area lakes. [WDFW Sept. 2008]

- All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness. Fish will be selected at random during the sorting process. The first 15 or 16 ripe hatchery females selected for the day will comprise the egg collection. The same will be true for the first 30-32 ripe hatchery males (if possible). Only some of the ripe fish will be spawned and the remaining (those fish that don't have a coded-wire tag) will be passed upstream to spawn naturally.

- Spawned females are individually sampled for IHNV. Samples are sent to WDFW virology lab for culturing. Eggs from individual females with IHNV positive results for the virus will be discarded. In addition, eggs from females that visually appear over-ripe will be immediately discarded and replaced with eggs from new females.

b) No. of males and females spawned each year over past 10 years (table)

Year	Females	Males	Total
2008	85	85	170
2007	106	97	203
2006	120	115	335
2005	60	70	130
2004	68	105	173
2003	65	65	130
2002	82	87	169
2001	94	108	202
2000	105	116	221
1999	126	116	242
1998	173	164	337

[WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002]

4. Fertilization

a) Protocols

In the past, females were spawned directly into colanders and the ovarian fluid was drained off. This was done to prevent possible vertical transmission of IHNV into the egg from the sperm. Gametes were then hauled back to Lyons Ferry FH in numbered buckets before fertilization took place. Semen was added to the eggs and water was used to activate the semen to complete the fertilization process. Generally less than one minute was given for fertilization before the eggs were rinsed again with iodine solution, and then water hardened in iodine (100 ppm) for one hour.

Two parts of the fertilization process have recently been questioned by hatchery personnel; 1) should the ovarian fluid be drained, and 2) should more time be allowed for the semen to complete fertilization. It was believed that one or both of these may be contributing to the poor green-egg to shock loss that has been documented for both the Wallowa and Lyons Ferry FH stocks. As such, an experiment was conducted in 2003 with the Lyons Ferry FH stock fish to determine if changes in the fertilization/spawning process would increase fertilization success. Results from the Lyons Ferry FH experiment were presented (Bumgarner et al 2003) and determined future fertilization procedures for all steelhead stocks at LFC. We continue to evaluate the success of fertilization following this experiment in 2003. Green egg to eyed-egg survival rates have appeared to improve with mortality from green egg to eye-up has decreased from 25% to only 5%. As such, the number of males and females required to meet broodstock (presented in this HGMP) have been altered based on the most recent survival data from the last few years.

After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and to remove unwanted organics from the fertilized eggs. They are then water hardened for one hour in the same solution. The volume of iodine solution to eggs should be at least 3:1.

[WDFW July 2005a]

b) Number of eggs collected and fertilized each year over past 10 years (table)

Table. Numbers of males and females spawned, eggs taken, and estimated survival by life stage of Wallowa stock summer steelhead spawned at Cottonwood Creek and transferred to Lyons Ferry FH, 1992 to 2008 brood years.

	Spawned								
BY	Female	Male	Eggs taken	Eggs retained [b]	Percent retained	Fry	Egg to fry survival	Smolts	Fry to smolt survival
1992	113	225	558,437	198,747	35.6	186,656	93.9	160,017	85.7
1993	96	206	533,995	289,198	54.1	271,970	94.0	165,630	60.9
1994	118	204	644,886	366,115	56.8	302,397	82.6	144,503	47.8
1995	99	61	511,283	335,489	65.6	321,050	95.7	263,449	82.0
1996	124	109	301,979	430,394	71.5	447,569	100.0	274,886	64.1
1997	92	92	536,723	401,270	74.8	317,590	79.1	252,211	79.4

1998	173	164	868,973	479,606	55.2	475,181	99.1	268,803 [b]	77.1
1999	126	116	601,699	389,664	64.8	389,664	100.0	274,146 [c]	79.7
2000	105	116	523,011	322,238	61.6	322,238	100.0	215,584 [d]	79.3
2001	94	108	504,182	381,427	75.7	253,743	66.5	182,722	72.0
2002	82	87	422,441	319,479	75.6	261,335	81.8	236,627	90.5
2003	65	65	301,090	215,097	71.4	206,062	95.8	137,915 [e]	100.0
2004	68	105	318,430	290,391	91.2	286,536	98.7	150,442 [f]	100.0
2005	60	70	282,675	274,586	97.1	273,608	96.8	169,390	61.9 [g]
2006	120	115	316,059	290,903	92.0	287,761	98.9	159,242 [h]	91.0
2007	106	97	340,589	242,710	71.3	233,704	96.3	175,961	75.3
2008	85	85	275,958	214,695	77.8	213,319	99.4		

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).

[b] A total of 126,361 fry/parr/fingerlings were planted into area lakes from over production.

[c] A total of 45,824 fry/parr/fingerlings were planted into area lakes from over production.

[d] Program production was changed during the rearing cycle, a total of 50,270 fish were planted in to area lakes to support the rainbow trout catchable program.

[e] A total of 70,455 fry/parr/fingerlings were planted into area lakes from overproduction, that created a fry-smolt survival of >100%.

[f] A total of 146,481 fry/parr/fingerlings were planted into area lakes from overproduction, that created a fry-smolt survival of >100%.

[g] High fry to smolt loss attributed to excessive bird predation at Lyons Ferry Hatchery

[h] A total of 112,751 fry/parr/fingerlings were planted into area lakes from over production.

[WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002]

5. Incubation

- Wallowa stock steelhead females from Cottonwood Creek Adult Trap have averaged 5,200 eggs (250/oz) between the 1997 and 2001 spawning years (N= 561 females). After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling iso-incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. [WDFW Sept. 2008]

- Incubation, as with rearing, occurs with sediment free, 52 0F (11 0C) well water. The incubation building is fitted with back-up pumps to maintain flow through the troughs in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical. [WDFW July 2005a]

6. Ponding

a) Protocols

Fish hatch in shallow trough baskets and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways. By August (fish are 30-40 fish/lb), all Wallowa Stock

production are adipose fin clipped, and placed into one of the three 2.1 acre rearing ponds. [WDFW July 2005a]

b) Number of fry ponded each year, including % hatch each year

See previous table in section 4(b)

7. Rearing/feeding protocols

Lyons Ferry FH raceway rearing density index criteria for steelhead will not exceed 0.25 lbs fish/ft3. Where steelhead are reared in the large rearing ponds at Lyons Ferry FH or in the acclimation ponds, densities can be as low as 10% of maximum.

Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000-gpm (23 minute exchange rate) of water enters each north side raceway through secondary degassing cans. The north side of the hatchery has historically been used to raise steelhead, but south side raceways will likely be included for steelhead rearing in the future due to program changes. South side raceways receive about 650 gpm (33.5 minute exchange rate) each through a manifold. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Similar data are expected in the 2.1 acre rearing ponds (17.5 hour water exchange rate), but dissolved oxygen may be different upon exit due to lower densities, slower exchange rate, and greater amounts of algae in lake compared to raceways. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. In the 2.1 acre lake and at Cottonwood AP, feed is dispersed from truck mounted blower feeders.

[WDFW July 2005a]

8. Fish growth profiles

Growth and size of Wallowa Stock Steelhead at Lyons Ferry FH for the 1999-2001 Brood Years.

Month/Year	**fpp**	**G/fish**	Month/Year	**fpp**	**G/fish**	**Month/Year**	**fpp**	**G/fish**
5/99	Not Applicable	**Not Applicable**	5/00	940.0	**0.5**	5/01	**800.0**	**0.6**
6/99	1090.0	0.4	**6/00**	500.0	0.9	**6/01**	409.0	1.1
7/99	285.0	1.6	**7/00**	205.6	2.2	**7/01**	181.4	2.5
8/99	113.0	4.0	**8/00**	109.9	4.1	**8/01**	85.9	5.3
9/99	37.0	12.3	**9/00**	37.8	12.0	**9/01**	43.5	10.4
10/99	26.1	17.4	**10/00**	19.7	23.0	**10/01**	21.0	21.6
11/99	15.8	28.7	**11/00**	12.9	35.2	**11/01**	14.5	31.3
12/99	9.6	47.3	**12/00**	12.2	37.2	**12/01**	11.9	38.1
1/00	7.0	64.8	**1/01**	7.0	64.8	**1/02**	10.5	43.2

2/00	6.3	72.0	**2/01**	6.2	73.2	**2/02**	7.4	61.3
3/00	4.6	98.6	**3/01**	5.5	82.5	**3/02**	5.4	84.0
4/00	5.5	82.5	**4/01**	5.0	90.7	**4/02**	4.5	100.8

. [WDFW July 2005a]

9. Fish health protocols and issues

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. The size and depth of the 2.1 acre lakes precludes cleaning other than yearly draining when fish are removed. Water quality in the lakes is not affected due to low stocking density. [WDFW July 2005a]

10. Chemotherapeutant use

Eggs are examined daily by hatchery personnel. Prophylactic treatment of eggs with formalin (37% @1:600) for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with other accepted fungicides as will. Non-viable eggs and sac-fry are removed by bulb-syringe and the loss recorded. [WDFW July 2005a]

11. Tagging and marking of juveniles

In September 2008, these fish were all adipose fin clipped, and 20,000 received left ventricle clips and a coded wire tag. After marking and tagging, they are transferred to Lake Three at the Lyons Ferry FH. In February, they are transferred to the Cottonwood AF for final rearing and release into the Grande Ronde River. A total of 6,000 juveniles will be PIT tagged prior to release in April, 2,000 of those PIT tags will be used as part of the Comparative Survival Study (CSS) for steelhead production above Lower Granite Dam. (Fish Passage Center). [WDFW Sept. 2008]

12. Fish Release

a) Protocols

- On September 8, 2008 Lyons Ferry FH had 176,191 (BY08) Wallowa stock summer steelhead juveniles on hand. These fish were marked and moved to Lake #3 on September 4th. In February, these fish will be transferred to the Cottonwood AF. After acclimation at the Cottonwood AF, they are released as yearlings at 4.5 fpp into the Grande Ronde River in April. [WDFW Sept. 2008]

Table 11. Proposed BY 2008 Wallowa stock summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Cottonwood AF on the Grande Ronde River	140,000 20,000	150,000 20,000	4.5	1+	AD Only ADLV CWT	-0- 4,000	Transfer to Cottonwood AF in Feb, release in April 2009

An additional 2,000 PIT tags are planned as part of the release for the CSS study on steelhead above Lower Granite Dam [pers. comm. Joe Bumgarner, WDFW, 2009].

b) Number of fish released each year (subyearlings?; yearlings?; other?)

All Wallowa stock steelhead are released as yearling smolts from the acclimation pond at Cottonwood Creek. The number of fish released since 1998 are provided in the following table. Note, the program size was reduced in 2002 following an evaluation on smolt-to-adult survival and that we were far exceeding program goals back to the project area which could impact ESA listed steelhead in the area.

Year	Cottonwood AF Release Numbers
1998	252211
1999	268803
2000	274146
2001	215584
2002	182722
2003	237516
2004	138179
2005	150442
2006	169390
2007	159242
2008	175961

[WDFW Sept. 2008] P 26]

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Table. Contribution of Lyons Ferry stock (Lyons Ferry FH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

Run Year	Lyons Ferry FH	Tucannon	Touchet	Walla Walla	Grande Ronde	Total	**Percent of goal**
Adult Goal	630	875	750	900	1,500	4,655	
1984	1,137	762	680	1,078	0	3,657	***79%***
1985	2,456	1,686	1,699	2,201	0	8,042	***173%***
1986	4,834	1,712	2,961	3,045	*1,945*	14,496	***311%***
1987	3,657	685	1,851	2,046	1,817	10,056	***216%***
1988	5,563	1,257	2,577	2,933	3,057	15,388	***331%***
1989	4,955	1,837	3,326	4,620	5,157	19,896	***427%***
1990	1,007	786	1,140	1,365	2,044	6,342	***136%***
1991	1,104	1,658	1,373	1,277	3,451	8,862	***190%***
1992	877	2,037	1,924	3,155	4,559	12,552	***270%***
1993	651	1,085	1,679	2,578	3,167	9,160	***197%***
1994	2,386	914	1,177	655	2,895	8,026	***172%***
1995	5,832	1,861	3,326	4,817	9,173	25,009	***537%***
1996	3,050	1,779	3,754	4,359	7,819	20,762	***446%***
1997	2,112	1,311	2,696	3,676	5,301	15,095	***324%***
1998	718	568	1,246	1,978	1,456	5,966	***128%***
1999	1,169	2,235	2,128	3,444	1,799	10,775	***231%***
2000	1,422	3,283	2,802	4,584	4,730	16,820	***361%***
2001	2,254	4,488	3,839	5,996	10,919	27,497	***591%***
2002	928	1,712	1,237	1,517	5,435	10,833	***233%***
2003	842	1,469	1,440	988	3,925	8,865	***186%***
2004	944	1,601	1,148	1,284	3,441	8,418	***181%***
2005	901	1,256	1,165	1,424	2,905	7,651	***164%***
Average	***2,218***	***1,636***	***2,053***	***2,683***	***4,250***	***12,453***	***268%***
Percent of goal	**352%**	**187%**	**274%**	**298%**	**283%**	**268%**	

[WDFW Jan. 2009]

b) Return timing and age-class structure of adults

Year	I	II	III
2008	86.1	13.9	
2007	55.0	43.7	1.3
2006	48.1	51.9	
2005	69.8	30.2	
2004	66.2	33.8	
2003	39.5	60.5	
2002	75.2	24.8	
2001	71.4	28.6	
2000	83.7	16.3	
1999	84.8	15.2	

[WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002]

c) Smolt-to-adult return rates

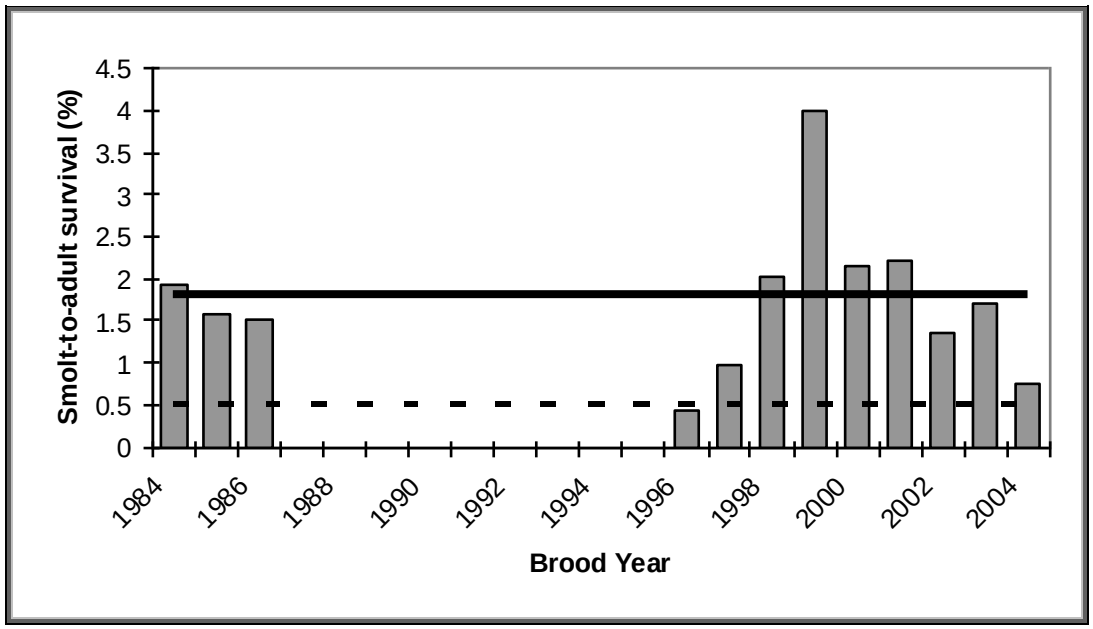


Figure. Estimated smolt-to-adult survival (to the LSRCP project area) of summer steelhead released from Cottonwood Acclimation Pond in the lower Grande Ronde River. Note: 2004 Brood returns are incomplete at this time (one-salt returns only), and were not used to calculate the average return.

[WDFW Jan. 2009]

d) Stock productivity (e.g. recruits per spawner)

The estimate for stock productivity on the Wallowa stock has been difficult to calculate as our estimates for contribution are incomplete since we have incomplete accounting for all fish that might escape to the spawning grounds. However, based on the average number of broodstock needed to produce the Wallowa stock program, the estimated contributions to

harvest and to the hatchery, we believe the recruits per spawner is around 30:1 [pers. comm. Joe Bumgarner, WDFW, 2009]

2. Contributions to harvest and utilization (e.g. food banks)

The Wallowa stock adults are trapped at Cottonwood Creek from volunteers that swim into the fish trap. Fish not needed for broodstock or CWT recoveries are passed upstream for natural spawning. Eggs or fry excess to projected program needs will continue to be destroyed or planted as fry in area lakes. All carcasses from spawned fish are either used as nutrient enhancement in Cottonwood Creek, or buried back at Lyons Ferry Hatchery. All unspawned fish that were retained for broodstock are sacrificed to obtain coded-wire tag or run information. Food banks are not currently utilized to dispose of carcasses.

Wallowa stock contribute substantially to harvest in the Grande Ronde River. Contributions to harvest may be best presented in the following graph and table.

[WDFW Jan. 2009]

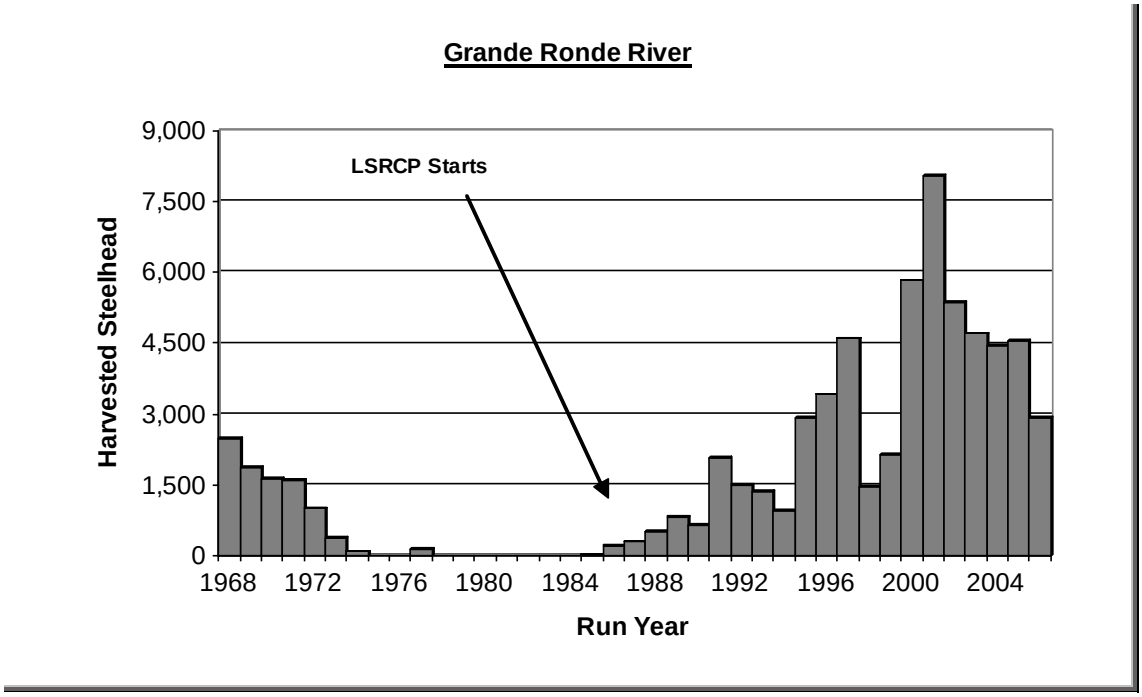


Figure. Harvested summer steelhead (from WDFW Catch Record Card Estimates) for the Grande Ronde River (Section 592). Note: Many of the fish captured in the Grande Ronde River are hatchery fish from Oregon LSRCP summer steelhead programs.

[WDFW Jan. 2009]

Table. Contribution of Lyons Ferry stock (Lyons Ferry FH, Tucannon, Touchet, Walla Walla release groups) or Wallowa stock (Grande Ronde release group) summer steelhead back to the lower Snake River project area.

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2002	928	1,712	1,237	1,517	5,435	10,833	***233%***
2003	842	1,469	1,440	988	3,925	8,865	***186%***
2004	944	1,601	1,148	1,284	3,441	8,418	***181%***
2005	901	1,256	1,165	1,424	2,905	7,651	***164%***
Average	***2,218***	***1,636***	***2,053***	***2,683***	***4,250***	***12,453***	***268%***
Percent of goal	**352%**	**187%**	**274%**	**298%**	**283%**	**268%**	

[WDFW Jan. 2009]

3. Contributions to conservation

The Lyons Ferry FH and Wallowa stocks are both non-endemic stocks that were originally collected from outside their respective release points. The Wallowa stock was originally collected by Oregon Dept of Fish and Wildlife from Lower Snake River dams (likely comprised of both A- and B-run fish from Oregon and Idaho), and then released in the Wallowa River in the Grande Ronde Basin. The Lyons Ferry FH stock was derived primarily from a combination of Wells (upper Columbia River) and returning Wallowa stock fish to Lyons Ferry FH. [WDFW Sept. 2008] This stock is not contributing to the conservation of the ESA listed fish with the Grande Ronde Basin.

4. Other benefits

None identified here.

E. Research, monitoring, and evaluation programs

WDFW has a growing concern that because of the success of the program, and the resultant cuts in production, we have limited the number of fish contributing to the broodstock of the Wallowa program. As such, in 2009, similar to the past three years, we will conduct a small-scale experiment on the broodstock at Cottonwood Creek to examine the effects of partially spawning females, and then releasing them to continue spawning in the stream. Results from the past three years have been very encouraging, with additional information gained each year. In 2008, 13 treatment and 4 control redds were covered and 11 treatment and 2 control redds were excavated at a later date. High stream flows or lost flags prevented us from excavating all marked redds. Preliminary results show that 91% of the study fish redds examined had growing embryos, and both of the control redd eggs were developing. High stream flows and turbid waters hampered us from getting more samples, and more conclusive results, hence the desire to repeat the experiment for one more year. For better control of the fish in the stream, we're also proposing only releasing experiment fish upstream to spawn. This will make locating and marking redds from study fish considerably easier on survey crews.

With this spawning strategy we will increase and maintain a healthy effective population size for the Wallowa stock program, and gain some valuable insights into the spawning success of females after being partially stripped of their eggs. If documented as successful, this could become a valuable tool for the endemic programs in the Tucannon and Touchet Rivers where founding population size for each of these programs is low, and could be increased to more desirable levels. This spawning study will conclude in 2009. A proposal to kill all marked, unspawned surplus fish for BY09 may be implemented by AOP committee following release of this report. Any unmarked fish will continue to be passed upstream.

[WDFW Sept. 2008]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

None.

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

Currently, the sport fishery on steelhead is a mixed stock fishery. Wild fish are encountered, but cannot be retained by anglers. There is likely some level of hooking mortality to wild

origin steelhead. These impacts have been estimated and presented to NOAA Fisheries as part of our FMEP to operate fisheries in SE Washington

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

- Wallowa steelhead released in the Grande Ronde River are recovered in areas outside the Grande Ronde River basin, including natural production reaches of the Deschutes and John Day rivers. These strays pose a genetic risk to other steelhead stocks in the Columbia River basin.

- The NOAA Fisheries ruled that LSRCP hatchery steelhead jeopardized listed steelhead populations within the Snake and Columbia river basins (NMFS 1999), and called for the development of new endemic broodstocks for the hatchery steelhead program. Initial efforts in the Tucannon and Touchet rivers appear to be somewhat successful, but more data about the demonstration of acceptable adult returns are needed before concluding that the program is successful and should be expanded. Currently, WDFW has not proceeded with a development of a new endemic broodstock to be used in the Grande Ronde River. ODFW has been experimenting with an early returning Wallowa stock study, to see if they can alter their hatchery broodstock (still using Wallowa stock) to reduce the number of fish that enter the Deschutes River basin. If successful, WDFW could adopt their program for use in the lower Grande Ronde as well.

- Out planting Wallowa stock steelhead into the Lower Grande Ronde River poses genetic risks to the natural-origin Grande Ronde River steelhead populations. Nearby Joseph Creek and the Wenaha River are of special concern because they are managed as wild fish areas with no hatchery supplementation.

- Allowing large numbers of adult hatchery steelhead passage above the weir in Cottonwood Creek poses genetic risks to the unmarked, naturally produced steelhead returning to spawn in the Creek.

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- The transfer and release of Wallowa stock steelhead pose inherent ecological risks (e.g. competition, predation, disease) to natural-origin steelhead and local populations of redband rainbow trout in the basin in which they are released. Nearby Joseph Creek and the Wenaha River are of special concern because they are managed as wild fish areas with no hatchery supplementation. This risk is reduced by acclimating and releasing full-term smolts from a location with an adult recapture facility.

- Since steelhead are more likely to residualize than hatchery-reared salmon stocks, ecological risks are increased.

- Steelhead that residualize pose ecological risks to other species.

- Allowing large numbers of adult hatchery steelhead passage above the weir in Cottonwood Creek poses fish health and competition risks to the unmarked, naturally produced steelhead returning to spawn in the Creek.

- Allowing large numbers of steelhead passage above the weir in Cottonwood Creek may result in excessive organic material compared to what the small creek system is capable of handling and could result in substantial changes to the natural ecology of the creek.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

- Harvest targeting Wallowa stock steelhead poses a demographic and genetic risk to natural-origin steelhead and local populations of redband rainbow trout in the Grande Ronde River.

- Harvest targeting Wallowa stock steelhead poses a demographic risk to bull trout.

IIE. Touchet River Summer Steelhead

A. General information

Legislation under the Water Resources Development Act of 1976 authorized implementation of the Lower Snake River Compensation Plan (LSRCP). The plan was to provide hatchery compensation for Snake River salmon and steelhead juvenile and adult mortalities caused by the construction and operation of the four lower Snake River hydropower projects (USACE 1975, 1976). As a result, the Washington Department of Fish and Wildlife's (WDFW) Lyons Ferry Hatchery (Lyons Ferry FH) was constructed and Tucannon Hatchery (Tucannon FH) was modified as a satellite facility. One objective of these LSRCP hatcheries is to compensate for the loss of 4,656 (LSRCP mitigation goal) summer steelhead (*Oncorhynchus mykiss*) to the project area. Of that number, an estimated 750 hatchery fish were designated to the Touchet River as off-site (out of Snake River basin) mitigation, and an estimated 875 hatchery fish were destined for the Tucannon River. Concurrent with providing the hatchery compensation levels of adult steelhead to both rivers, the LSRCP and WDFW intended to maintain or increase the number of natural origin steelhead in each area as an equally important management goal.

Since 1982, WDFW has evaluated the success of these two LSRCP hatcheries in meeting the summer steelhead mitigation goal within these two rivers. Production adjustments have been identified, and modified rearing and release strategies to improve performance of the program have been implemented. From the program's inception, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry FH stocks). While steady progress occurred toward meeting the LSRCP hatchery fish goal in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in Endangered Species Act (ESA) protections being invoked by NOAA Fisheries in the late 1990s; including the mid-Columbia River and Snake River summer steelhead Evolutionary Significant Units (ESU's). In 1999 NOAA Fisheries ruled that continued use of Lyons Ferry FH stock in the Touchet and Tucannon rivers jeopardized ESA listed natural mid-Columbia River and Snake River summer steelhead. As a result of that ruling, an endemic broodstock program was initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers (Bumgarner et al 2002). The WDFW proposed that these new endemic stock programs (if proven successful) could be used in combination with, or eventually replace the existing Lyons Ferry FH stock summer steelhead hatchery program in each river, thereby reducing risk to the natural populations in each ESU.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetics Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Each year since, a portion of the natural origin fish trapped have been collected, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into their respective rivers. Returns from the first few years of releases were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program.

[pers. comm. Joe Bumgarner, WDFW, 2009]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section "A. General Information" above for a description of the program's purpose.

2. Goals of program

The WDFW goal for this program (if successful) would be to replace the current use of Lyons Ferry stock fish in the Touchet River. This programs main purpose would be to provide harvest mitigation in the Touchet River as originally designed under the LSRCP program. Use of a local stock may have less detrimental effects to listed steelhead in the Touchet River should these fish return to the spawning grounds. [pers. comm. J. Bumgarner, WDFW, 2009].

3. Objectives of program

- The Touchet River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage broodstock. These adults are trapped on the Touchet River at the Dayton AF intake structure and transferred to Lyons Ferry FH for holding and spawning. Their progeny are planted in the North Fork of the Touchet River as yearlings each spring.

- Based on fecundity survival estimates, Lyons Ferry FH typically spawns 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 50,000 smolts) will be planted into the Touchet River as fingerlings in the fall.

- Trapping of BY09 Touchet River endemic stock begins in January or February (depending on seasonal weather) at the Dayton AF adult trap, located adjacent to the pond intake, and is completed by mid-April. WDFW evaluation staff checks the trap daily, transferring only a portion of unmarked adults to Lyons Ferry FH based on broodstock needs. Trapped Lyons Ferry FH stock steelhead will be returned downstream of the ladder.

- Based on fecundity survival estimates, Lyons Ferry FH typically spawns 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 75,000 smolts) will be planted into the Touchet River as fingerlings in the fall.

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Integrated Harvest. Mitigation: Continue to provide mitigation as specified under the LSRCP program while meeting conservation and recovery criteria established for the Touchet River population and Mid-Columbia River ESU. Provide harvest opportunities established under US v Oregon for tribal and recreational fisheries. Conservation: Contribute to the population of naturally reproducing Touchet River summer steelhead that produce viable progeny, and

which contribute to the conservation and recovery of the Touchet River population and Mid-Columbia River ESU. [WDFW July 2005c]

5. Alignment of program with ESU-wide plans

Lyons Ferry Complex is part of the LSRCP Program. The current program's steelhead actions were stated as causing jeopardy to the listed natural population of summer steelhead under the NMFS Biological Opinion, and actions proposed under this HGMP are consistent with the Reasonable and Prudent Actions suggested by NMFS. Implementation of this HGMP will result in the development of a new endemic stock of steelhead for release into the Touchet River. Depending on success of this stock and decisions to be made in the future the program may eventually drastically reduce, or eliminate, the current releases of Lyons Ferry FH stock steelhead in the Touchet River. If that occurs, eventually all releases of hatchery-origin summer steelhead into the Touchet River will be derived from the endemic broodstock proposed within this HGMP. [WDFW July 2005c]

6. Habitat description and status where fish are released.

Limited comprehensive review of the ecological health of the Touchet River watershed in relation to salmonid population status and recovery has been completed. Limiting factors such as water temperature, channel stability, sediment, and instream habitat are known to exist in the basin (WDFW unpublished data), but the extent of these problems is unquantified to date. Bonneville Power Administration is presently funding a review of the habitat and fishery resources of the Walla Walla basin. [WDFW July 2005c]

7. Size of program and production goals (No. of spawners and smolt release goals)

- Based on fecundity survival estimates, Lyons Ferry FH typically spawns 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 75,000 smolts) will be planted into the Touchet River as fingerlings in the fall. [WDFW Sept. 2008]

Table 9. Proposed BT 2008 Touchet River summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Touchet	50,000	45,000	4.5	1+	CWT Only	8,000	Apr – May 2009
River	5,000	5,000	4.5	2+	CWT Only	5,000	Apr – May 2010

[WDFW Sept. 2008]]

- Note: For the 2008 Brood Year, we have proposed a 2-year smolt program. Since this program began, it has been difficult to obtain a 1-year smolt that has met program targets. We feel this could be hindering the overall success of the Touchet Endemic program, and feel that by having a least a portion of each year's brood reared as a 2-year smolt could address some of the problems [pers. comm. Joe Bumgarner, WDFW, 2009].

C. Description of program and operations

1. Broodstock goal and source

Natural-origin steelhead captured in the Touchet River adult trap, or those captured hook and line above the city of Waitsburg will be used for broodstock. Propagation and release of the Lyons Ferry FH stock summer steelhead will continue for several more years until the endemic stock can be documented as performing as expected. [WDFW July 2005c]

2. Adult collection procedures and holding

- Trapping of BY09 Touchet River endemic stock begins in January or February (depending on seasonal weather) at the Dayton AF adult trap, located adjacent to the pond intake, and is completed by mid-April. WDFW evaluation staff checks the trap daily, transferring only a portion of unmarked adults to Lyons Ferry FH based on broodstock needs. Trapped Lyons Ferry FH stock steelhead will be returned downstream of the ladder.

- Current survival estimates indicate that 15 spawned females should provide enough eggs to meet the smolt production goal. Therefore, WDFW evaluation staff target collecting 16 females and 20 males for the broodstock (natural origin), with all other wild fish passed upstream for natural spawning. Hatchery fish (Lyons Ferry FH stock) are returned to the stream below the trap, to spawn naturally or contribute to the local sport fishery. Hatchery fish (endemic origin) are passed above the trap to spawn naturally in the Touchet River. We will spawn a minimum of three (3) females, or the progeny will be released as unmarked/untagged fry.

[WDFW Sept. 2008]

3. Adult spawning

a) Spawning protocols

- Based on fecundity survival estimates, Lyons Ferry FH typically spawns 15 females to provide 65,000 green eggs for the program. Fish in excess to the interim program smolt goals (maximum 75,000 smolts) will be planted into the Touchet River as fingerlings in the fall. Spawning usually occurs in March and April. Matrix spawning is employed, due to the relatively small founding population for this program. The intent of this protocol is to spawn two males with each female, increasing genetic diversity and successful fertilization of eggs. If not enough males are ripe to achieve this goal; a 1:1 spawning matrix is employed. A minimum of three spawned females are needed for each production cycle to occur. [WDFW Sept. 2008]

- All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe. The priority will be to use any males that have not yet contributed in spawning. All males are PIT tagged for identification purposes after they have been

spawned to track the number times a particular male may contribute. [WDFW July 2005c]

- Mating occurs in a 2x2 factorial cross to ensure the highest likelihood of fertilization. Jack or precocious steelhead (<20" TL) are generally not seen in the population. Likewise, repeat spawners are not known to exist in significant numbers in the population (about 5%). WDFW has investigated the possibility of rejuvenating spawners at Lyons Ferry FH and re-using them in the next brood year, with no success. This proposed action is experimental at this time, and WDFW will not likely attempt rejuvenation until more positive results are obtained from other researchers. [WDFW July 2005c]

b) No. of males and females spawned each year over past 10 years (table)

Table. Number of males and females collected, number of fish spawned, pre-spawning loss, and effective population size for the Touchet and Tucannon rivers Endemic Stock programs, 2000-2008 brood years.

Year	Collected		Spawned		Pre-spawn Loss	% Loss	Not Spawned	Effective Breeder Size
	Males	Females	Males	Females				
Touchet River Stock								
2000	7	13	7	12	1	5.0	0	17
2001	20	15	11	14	10	28.6	0	24
2002	19	16	16	14	5	14.3	0	30
2003	18	18	*17*	16	*3*	*8.3*	0	33
2004	14	16	10	15	2	6.7	3	24
2005 [a]	18	21	16	18	1	2.6	4	34
2006 [b]	20	19	18	18	1	2.6	2	36
2007	18	17	17	16	1	2.9	1	33
2008	14	14	11	13	1	3.6	3	24
Average	**16.8**	**16.9**	**14**	**15.4**	**2.8**	**8.3**	**1.4**	**28.3**

[a] Five of the 18 females spawned were IHNV positive.
[b] Three of the 18 females spawned were IHNV positive.

[WDFW Dec. 2008]

4. Fertilization

a) Protocols

Equal sex ratios in the spawning population were originally identified as a goal for the program. However, problems getting enough ripe males to spawn with females was a problem. Further, fecundity has generally been greater than originally planned. As such current program goals can be reached by spawning on 13-15 females. As such, additional males will be collected, or live spawned and released at the adult trap to ensure adequate number of males are available. During spawning, a 2x2 factorial spawning occurs (or a 1x2 when only one female is available) to increase the number of crosses. The small number of fish ripe on individual days usually limits spawning options. Males are usually limited to primary status on one half the eggs from two females. Where insufficient males

are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution. [WDFW July 2005c]

b) Number of eggs collected and fertilized each year over past 10 years (table)

Table. Numbers of males and females spawned, eggs taken, and survival by life state of Touchet River endemic stock summer steelhead spawned at Lyons Ferry FH, 2000 to 2008 brood years.

	Spawned						Egg to		
	Female	Male	Eggs	Eggs	Percent		fry		Fry to smolt
BY			taken	retained [a]	retained	Fry	survival	Smolts	survival
2000	12	7	53,139	43,572	82.0	43,296	99.4	36,487	84.3
2001	14	11	67,861	52,116	76.8	52,116	100.0	45,501	87.3
2002	14	19	70,843	*66,460*	93.8	31,715	47.7	31,440	99.1
2003	16	17	82,602	75,059	90.9	70,198	93.5	58,733	83.7
2004	15	10	66,125	59,644	90.2	55,358	92.8	55,706	100.0
2005	18	17	79,540	52,195	63.6	49,870	95.5	52,476	100.0
2006	18	18	88,668	73,633	83.0	61,141	83.0	58,989	96.5
2007	16	17	73,101	69,626	95.2	68,626	98.6	48,298	70.4 [b]
2008	14	12	66,928	57,279	85.6	57,111	99.7		

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).

[b] High fry-smolt loss was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.

[WDFW Jan. 2009]

5. Incubation

- After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling iso-incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. [WDFW Sept. 2008]

- Estimated egg take and fecundity is based on six years of spawning data. Egg survival to eye-up was is higher than what we observe for the existing Lyons Ferry FH stock of steelhead used. Number of eggs collected from adults trapped and ultimately the number of fry could exceed program needs. Furthermore, the disease history of natural broodstock is not known. Eggs in excess of the program needs will be retained to ensure the goal is met in case of unexpected loss from IHNV or other unexpected circumstances. (Note: present disease control protocol requires the disposal of eggs from IHNV positive female to control outbreaks of the disease within the hatchery). Because of the limited supply of endemic Touchet River fish, an exception from that protocol may be likely. Lyons Ferry FH staff will work with the WDFW fish health specialist to ensure appropriate measures are taken to disinfect eggs and isolate fish from known IHNV positive females. Excess fingerlings above the smolt production goal would eventually be released within the

Touchet River basin in areas of underseeded habitat. Any fingerling plants outside the Touchet River (or its tributaries) will be agreed to by the co-managers. [WDFW July 2005c]

- Incubation, as with rearing, occurs with pathogen free, sediment free, 51-53 0 F well water. The incubation building is fitted with back-up pumps to maintain flow through the troughs in emergency situations, and with secondary packed columns to maintain water oxygenation above 10 ppm. Flow monitors will sound an alarm if flow through the incubation troughs is interrupted. IHOT incubation protocols will be followed where practical. [WDFW July 2005c]

6. Ponding

a) Protocols

- After hatch and swim-up, they are introduced to feed, and transferred to intermediate raceways at around 500 fpp in June. They are transferred again to outside raceways at roughly 200 fpp in July. In January, these fish will be size selected into three rearing groups (larges, smalls, and two-year – see below in Research). By sorting into different size groups, culturists can adjust growth rates to minimize size variance at release. Additionally, a number of non-traditional fish culture techniques are being employed on this stock to ensure release size goals are met. [WDFW Sept. 2008]

- Fish hatch from baskets and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred. [WDFW July 2005c]

b) Number of fry ponded each year, including % hatch each year

See table in section 4(b) above.

7. Rearing/feeding protocols

Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Feeding occurs several times daily as necessary to provide the diet at a range of 0.7 – 1.1% B.W./day. Feed conversion is expected to fall in a range of 1.1 – 1.4 pounds fed to pounds produced. Due to the duration of spawning time from the natural steelhead, a variety of starter diets and feed schedules may be used to achieve a similar size among the fish before they are moved outside to the rearing raceways. This strategy will reduce the variation (CV's) in size of juveniles within the population, and may reduce the number of residuals observed when fish are eventually released as smolts. [WDFW July 2005c]

8. Fish growth profiles

Fish per pound by month for BY05 and BY06 Touchet steelhead.

Month	BY05	BY06
January	8	6
February	6.5	6
March	5.5	5
April	4.8	Na
May	593	548
June	130	300
July	150	200
August	67	Na
September	40	47
October	30	28
November	12	Na
December	10	14

[USFWS May 2009]

9. Fish health protocols and issues

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [WDFW July 2005c]

10. Chemotherapeutant use

Monthly fish health inspections occur at Lyons Ferry FH. Because of very low numbers of adults held in broodstock raceways, raceway cleaning is unnecessary. Treatments for fungal infections are applied as chemical flushes through the raceways. [WDFW July 2005c]

11. Tagging and marking of juveniles

In January, all Touchet River endemic stock steelhead are CWT, with no external fin clips. They are reared in the raceways until release in April or May at Baileysburg Bridge on the North Fork of the Touchet River. Prior to release, evaluation staff PIT tags 8,000 fish in this group. This will allow for improved data gathering, as these fish are currently not marked for harvest in the sport fishery. The use of PIT tags is an alternate means to calculate smolt-to-adult survivals for program evaluation text. [WDFW Sept. 2008]

12. Fish Release

a) Protocols

- These fish will ultimately be direct stream released into the Touchet River at Baileysburg Bridge, roughly 1.5 miles upstream from the Dayton AF. [WDFW Sept. 2008]

- Direct Stream release have occurred at RM 57.2 each year to date. Release dates have varied from early April to early May based on stream flow conditions and expected size of fish at release. [WDFW July 2005c]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Table. Number of yearling Touchet summer steelhead released from 2001-2008.

Release Year	Smolts Released
2001	36,500
2002	45,500
2003	31,400
2004	58,700
2005	55,700
2006	52,500
2007	59,000
2008	48,298

[WDFW Dec. 2008]

D. Program benefits and performance

Since the 2001 release year, WDFW has also produced smolts from two endemic stock programs. The co-managers agreed to an interim smolt production goal of 50,000 smolts annually for each stock as the program went through a 5-year evaluation stage. Current size and date of release is programmed for 4.5 fish/lb in mid-April. Limited, but an increasing amount of information on the success of this program is currently available. Since these fish are not marked for harvest, our evaluations have centered on adult trapping and adult PIT tag recoveries. Survivals have been estimated from the total release number. However, we believe that many of the fish never migrate because of death immediately following release, residualism, or they were too small at release to leave the river and did not survive until the following spring.

Estimated survivals derived from captures at adult traps have been less than desired. With the exception of the Asotin Creek adult trap, the lower trap on the Tucannon River, and Touchet Adult trap in Dayton are not efficient even under moderate flows, hence the numbers collected to date from these location are likely underestimated. Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern. [WDFW Dec. 2008]

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Table. Estimated smolt-to-adult survival rate of hatchery endemic summer steelhead smolts from the Touchet River based on adult PIT tag detections at Columbia and Snake River dams.

Smolt Migration Year	Release Location	Number of PIT Tags	Bonneville Dam or above	Percent Survival	McNary Dam or above	Percent Survival
Touchet River						
2001	N.F. Touchet	507	0	0.00	0	0.00
2002	N.F. Touchet	800	0	0.00	0	0.00
2004	N.F. Touchet	9,920	44	0.44	35	0.35
2005	N.F. Touchet	9,993	26	0.26	22	0.22
2006	N.F. Touchet	8,987	38	0.42	31	0.34
			Average (all)	**0.22**		**0.18**
			Average ('04-'06)	**0.37**		**0.30**

[WDFW Dec. 2008]

b) Return timing and age-class structure of adults

Table. The number of adult Touchet River endemic stock PIT tagged fish detected from the 2004-2005 release years.

Site	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Bonneville	2	26	35	6	1							70
McNary	1	2	2	17	23	9		1			2	59
Ice Harbor	1			6	14	2			1			24
Lower Granite a				1	2	1				1	1	6
Tucannon					1	1	1			6	6	15
Walla Walla					1	4	2		1	3		11
Upper Columbia		1	1	*1*								3

[a] Of the 6 fish detected at Lower Granite Dam, none have made it back downstream.

[b] Of the 15 fish detected in the Tucannon River, none have made it back downstream to be detected in the Walla Walla River.

[WDFW Dec. 2008]

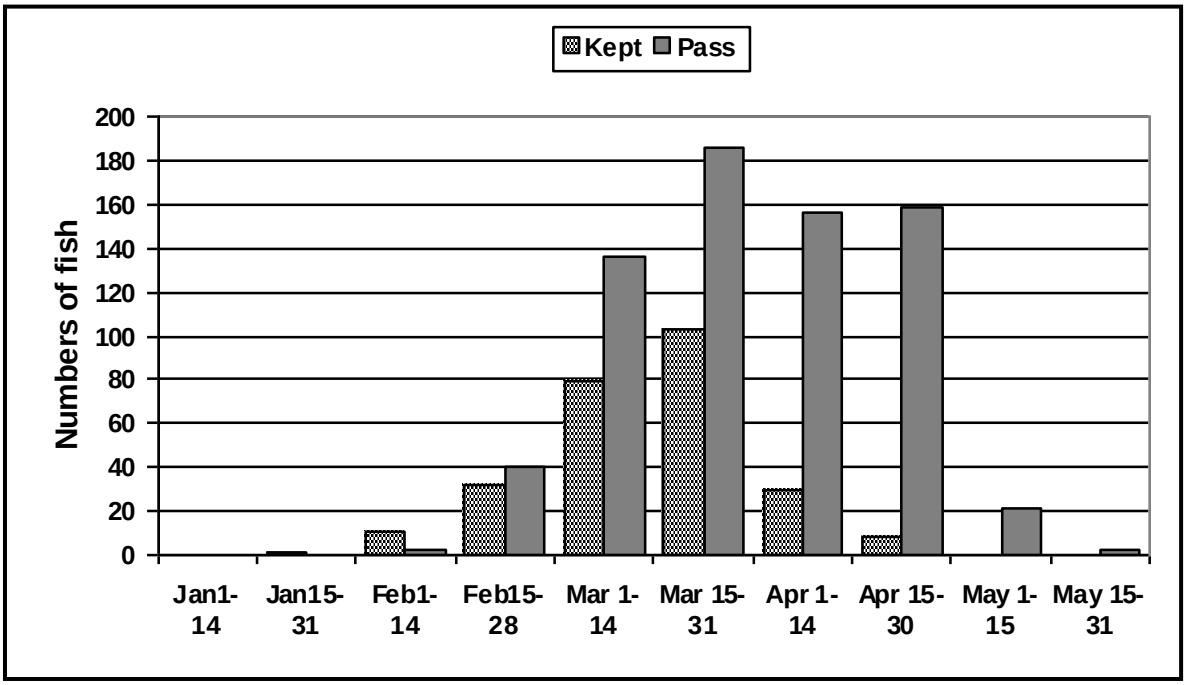

Figure. Timing of Touchet River endemic steelhead collected for broodstock or passed upstream at the Dayton Adult Trap, 2001-2007.

[WDFW Dec. 2008]

c) Smolt-to-adult return rates

Table. Estimated smolt-to-adult survival rate of hatchery endemic summer steelhead smolts from the Touchet River based on adult PIT tag detections at Columbia and Snake River dams.

Smolt Migration Year	Release Location	Number of PIT Tags	Bonneville Dam or above	Percent Survival	McNary Dam or above	Percent Survival
Touchet River						
2001	N.F. Touchet	507	0	0.00	0	0.00
2002	N.F. Touchet	800	0	0.00	0	0.00
2004	N.F. Touchet	9,920	44	0.44	35	0.35
2005	N.F. Touchet	9,993	26	0.26	22	0.22
2006	N.F. Touchet	8,987	38	0.42	31	0.34
			Average (all)	**0.22**		**0.18**
			Average ('04-'06)	**0.37**		**0.30**

[pers. comm. Joe Bumgarner, WDFW, 2009]

d) Stock productivity (e.g. recruits per spawner)

Limited information is available at this time, so our estimates should be used with caution. Based on the PIT tag information, we think the recruit: spawner ratio is about 5-6:1, which is much lower than we observe for Lyons Ferry or Wallowa stock program produced at Lyons Ferry Hatchery.

2. Contributions to harvest and utilization (e.g. food banks)

Touchet River steelhead are not adipose fin clipped for harvest.

3. Contributions to conservation

Development of a hatchery stock based on endemic steelhead from the Touchet River for mitigation production may not increase natural productivity, but will serve several purposes. Primarily, the program as designed within this HGMP will continue to provide harvest mitigation under LSRCP while complying with NMFS's Reasonable and Prudent Actions as listed in their Biological Opinion. Washington Department of Fish and Wildlife desires to maintain healthy, abundant populations of steelhead within the Columbia River, but also wants to provide abundant fishery opportunities as provided for under the LSRCP mitigation program.

As a secondary benefit, this program will attempt to maintain or increase numbers of naturally reproducing Touchet River steelhead. This will be accomplished by allowing Touchet River endemic stock returning hatchery adults to spawn in prime rearing areas. This should help conserve and/or rebuild the existing natural population to a healthy status. The program will also minimize the potential for genetic introgression and depression that may occur with continued use of the existing Lyons Ferry FH stock. Interbreeding between Lyons Ferry FH stock steelhead and natural steelhead may be reducing productivity and fitness within the natural population. Lastly, this program may also reduce straying of Touchet River steelhead. Lyons Ferry stock steelhead released into the Touchet have been shown to stray into other Columbia and Snake River basin rivers. While this program will produce hatchery-reared fish, straying may be reduced because the new hatchery stock will be developed from the endemic population, which may stray to a lesser extent. WDFW realizes that straying of Lyons Ferry FH stock adult steelhead from past Touchet River releases is likely environmentally related (i.e. low river flows and high water temperature which restrict returning passage in the lower Walla Walla River), and regardless of the stock used, straying into other basins may still occur**.**

[WDFW July 2005c]

4. Other benefits

None identified here.

E. Research, monitoring, and evaluation programs

Over the last few years, evaluation staff have annually PIT tagged portions of the Touchet River endemic stock group (by size) prior to release. PIT tags are being used to document smolt-to-adult survival rates. Results to data show that the group that is released per program goals and release time, have survived nearly twice the rate as those released later and sometimes at a smaller size. This, and trapping data, suggests this could be a continual problem in the Touchet River stock. As such, we are proposing to conduct a two-year smolt program on a portion of the population to see if they can survive better. We propose retaining 10-20% of the 2008 population. These will be reared in other rearing containers currently not being used for the other priority stocks at Lyons

Ferry FH. We propose this research for 2-3 years, and will continue to PIT tag both one and two-year smolt programs for the comparison.

[WDFW Sept. 2008]

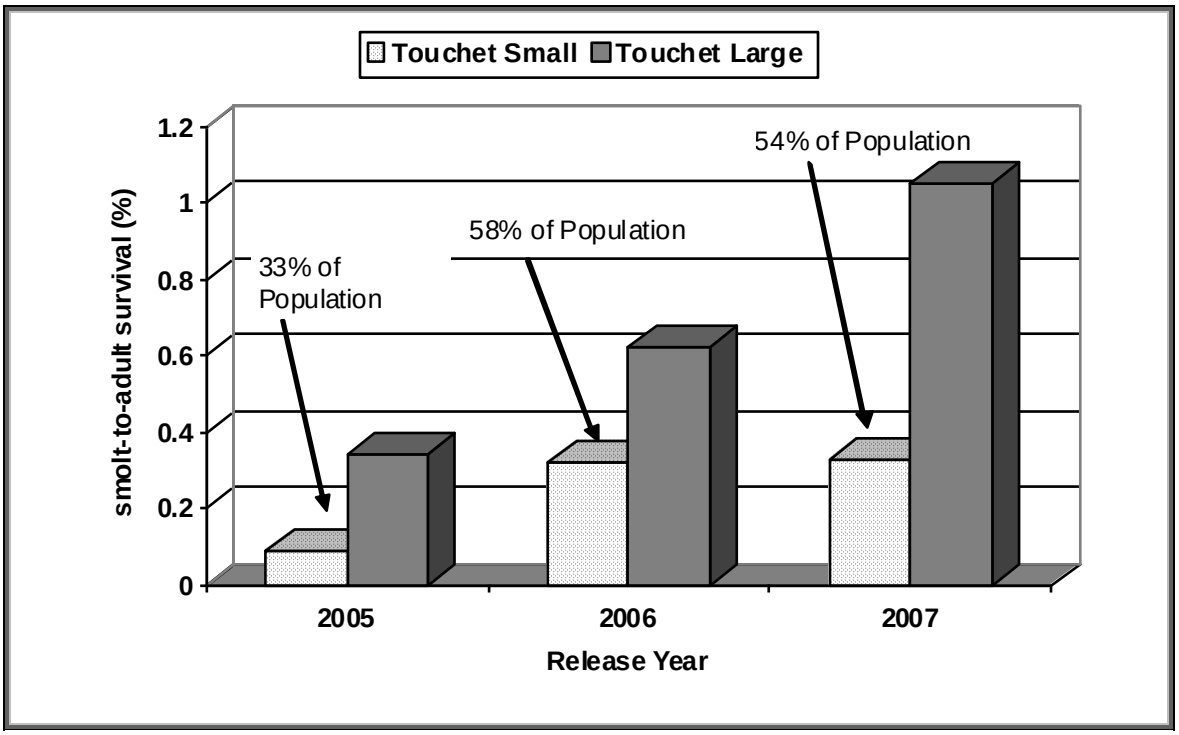

Figure. Smolt-to-adult survival estimated from PIT tags in large or small fish size (and % of release group) from the Touchet River hatchery endemic stock releases from 2005-2007.

[WDFW Dec. 2008]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

- Since the 2001 release year, WDFW has also produced smolts from two endemic stock programs. The co-managers agreed to an interim smolt production goal of 50,000 smolts annually for each stock as the program went through a 5-year evaluation stage. Current size and date of release is programmed for 4.5 fish/lb in mid-April. Limited, but an increasing amount of information on the success of this program is currently available. Since these fish are not marked for harvest, our evaluations have centered on adult trapping and adult PIT tag recoveries. Survivals have been estimated from the total release number. However, we believe that many of the fish never migrate because of death immediately following release, residualism, or they were too small at release to leave the river and did not survive until the following spring.

- Estimated survivals derived from captures at adult traps have been less than desired. With the exception of the Asotin Creek adult trap, the lower trap on the Tucannon River, and Touchet Adult trap in Dayton are not efficient even under moderate flows, hence the numbers collected to date from these location are likely underestimated. Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern.

- Recent estimated smolt-to-adult survivals derived from PIT tags have been more encouraging compared to the adult trap data. In the Touchet River, survival may be approaching 0.5%. However, the PIT tag detections from the endemic stock groups are showing some disturbing patterns. Touchet River endemics have been detected at the PIT tag array in the lower Tucannon River in March and April; presumably they are spawning there as well. These data are very preliminary, and the efficiency of the arrays in the Tucannon and Walla Walla are unknown at this time. Regardless, these are disturbing trends that need further investigation.

Table. Disposition of PIT tagged Touchet River Endemic stock summer steelhead that crossed McNary Dam. Note: not all fish that crossed McNary Dam are shown in the table, a few were also detected at Priest Rapids Dam and Rock Island Dam in the upper Columbia River.

						Enter	Percent of those that passed McNary Dam			
Release Year	Pass McNary	Enter Walla2	Pass Ice	Pass Granite	Enter Tucannon	Tucannon Mar-Apr	% into Walla2	% above Ice	% above Granite	% Into Tucannon
2004	35	3	15	2	11	9	8.6	42.9	5.7	31.4
2005	22	6	9	2	4	3	27.3	40.9	9.1	18.2
2006	30	3	21	7	4	2	10.0	70.0	23.3	13.3
Totals	**87**	**12**	**45**	**11**	**19**	**14**	**13.8**	**51.7**	**12.6**	**21.8**

- Problems/concerns encountered with the endemic stock program have been 1) not achieving the planned release number or size of 4.5 fish/lb, 2) difficulties in operating the trap for broodstock collection during high spring flows, 3) extended spawn timing of wild broodstock (February – May) making randomized spawning crosses and hatchery rearing difficult, 4) the juvenile progeny (especially from the Touchet stock) are "spooky" and conventional feeding approaches have not worked well, 5) low numbers of founding broodstock prevents future collection of their progeny for the endemic broodstock, and 6) detection of IHN virus in the broodstock (Touchet) that have created problems with broodstock collection.

- Great strides have been made in getting the endemic progeny to meet, or at least get closer to, program size goals. Both endemic stocks are now graded early in the rearing cycle in an attempt to prevent the bi-modal length distribution that was observed during the first few years. In addition, alternative feeding techniques (e.g. hiding from the fish while feeding so they aren't as easily frightened), and in-raceway cover structures (aqua-mats),

have been utilized to make the rearing more successful. Even with all of these improvements, we still generally have two sub-groups of fish (large and small) at time of release. These two groups have then been released at different times in an attempt to reach the final program fish size goal. Over the last few years, we have proportioned out PIT tags in each of the large and small sized fish released. Adult returns from fish released in 2005 and 2006 indicate that the smaller sized fish and/or those that are released at a later date but close to program releases size goals do not perform as well as large fish released earlier. Both endemic stock groups generally have higher K-factors as compared to the Lyons Ferry FH stock fish. So fish size, overall fish condition, release date, or some combination of factors is limiting the survival and/or migratory ability of the smaller fish, and perhaps even the larger sized fish in some years.

- Production levels continue to vary, but for varying reasons. In the Touchet, production has fluctuated due to difficulties in trapping broodstock or because of IHNV detected in the spawned females. Progeny from these females have been released back into the Touchet River as eggs or fry to reduce the risk of a possible outbreak in the hatchery. While the strategy is not consistent with the FMEP, this is has been the preferred alternative agreed to by WDFW hatchery, evaluation, and fish management staff, co-manager (Umatilla Tribe) and NOAA Fisheries personnel. Production in the Tucannon stock has been more stable, with large fluctuation occurring from high egg mortality in fish that were over-ripe, generally from the first part of the spawning season.

- Natural origin broodstock collections, and their resultant spawn timing, for each endemic stock has been skewed towards the beginning for each stock. This strategy has been done for two reasons: 1) for each stock this allowed for additional rearing time to get the fish to program size within one-year, 2) in the Tucannon River this was done because the adult trap can easily be disabled by high spring flows in the Tucannon River. In the long-term, this strategy may have to be reconsidered, or a two-year smolt program might have to be considered if additional rearing time is considered best for the stock (this applies mainly to the Touchet River program).

[WDFW Dec. 2008]

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

- None

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

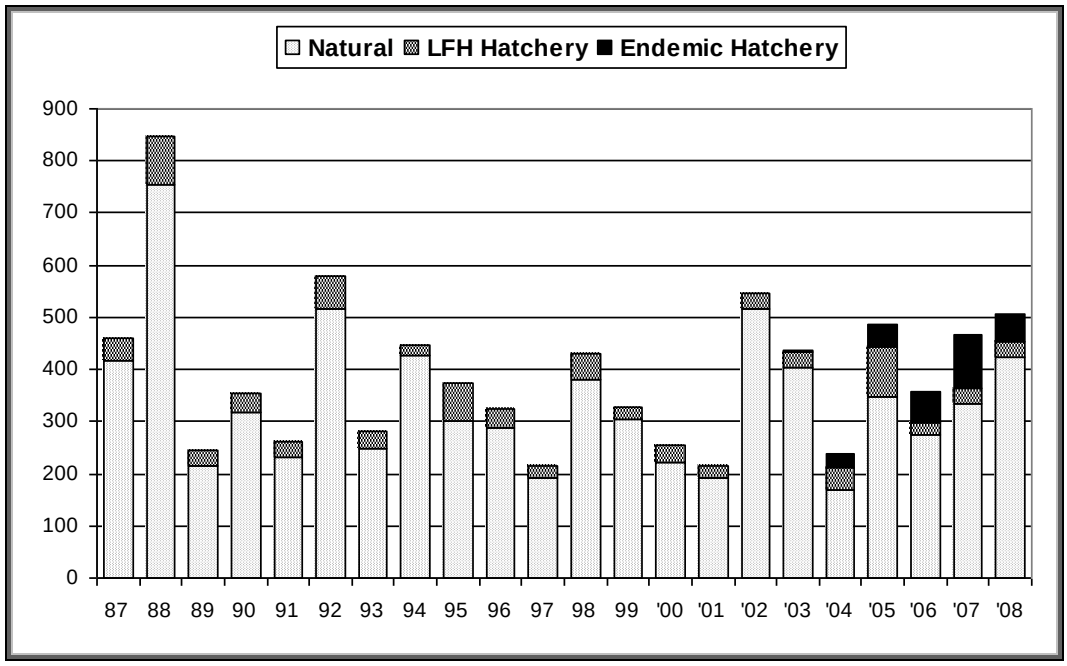

Figure. Estimated number of natural and hatchery origin fish spawning in index areas (North, South, Wolf, and Robinson forks) of the Touchet River, 1987-2007. Note: the percent of hatchery fish on the spawning grounds is related to the index spawning areas surveyed and hatchery release location. All Lyons Ferry FH stock hatchery releases occur about 1 mile below the lowest spawning ground index area, and are released from Dayton Acclimation Pond. Endemic stock steelhead are released about 1 mile above the mouth of the North Fork Touchet River, in the lower section of the index spawning area.

[WDFW Dec. 2008]

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- Amplification of disease within the hatchery poses a disease risk to the propagated stock.
- Adult male steelhead held for broodstock and returned to the Touchet River may transmit diseases from Lyons Ferry FH to the natural population in the Touchet River.
- The release of fry that are progeny of IHN virus positive females may pose fish health risks to the Touchet River natural population, although the risk is considered low due to egg disinfection.
- Touchet stock steelhead are held in the same adult holding pond as Tucannon stock steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus between stocks.
- Hatchery-origin steelhead that residualize pose ecological risks to the natural-origin Touchet River population.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IIF. Tucannon River Summer Steelhead

A. General information

Legislation under the Water Resources Development Act of 1976 authorized implementation of the Lower Snake River Compensation Plan (LSRCP). The plan was to provide hatchery compensation for Snake River salmon and steelhead juvenile and adult mortalities caused by the construction and operation of the four lower Snake River hydropower projects (USACE 1975, 1976). As a result, the Washington Department of Fish and Wildlife's (WDFW) Lyons Ferry Hatchery (Lyons Ferry FH) was constructed and Tucannon Hatchery (Tucannon FH) was modified as a satellite facility. One objective of these LSRCP hatcheries is to compensate for the loss of 4,656 (LSRCP mitigation goal) summer steelhead (Oncorhynchus mykiss) to the project area. Of that number, an estimated 750 hatchery fish were designated to the Touchet River as off-site (out of Snake River basin) mitigation, and an estimated 875 hatchery fish were destined for the Tucannon River. Concurrent with providing the hatchery compensation levels of adult steelhead to both rivers, the LSRCP and WDFW intended to maintain or increase the number of natural origin steelhead in each area as an equally important management goal.

Since 1982, WDFW has evaluated the success of these two LSRCP hatcheries in meeting the summer steelhead mitigation goal within these two rivers. Production adjustments have been identified, and modified rearing and release strategies to improve performance of the program have been implemented. From the program's inception, releases of hatchery summer steelhead into the Touchet and Tucannon rivers have consisted of non-native origin steelhead (Wells, Wallowa, and Lyons Ferry FH stocks). While steady progress occurred toward meeting the LSRCP hatchery fish goal in both rivers, natural populations of steelhead throughout the Columbia and Snake river basins declined alarmingly, resulting in Endangered Species Act (ESA) protections being invoked by NOAA Fisheries in the late 1990s; including the mid-Columbia River and Snake River summer steelhead Evolutionary Significant Units (ESU's). In 1999 NOAA Fisheries ruled that continued use of Lyons Ferry FH stock in the Touchet and Tucannon rivers jeopardized ESA listed natural mid-Columbia River and Snake River summer steelhead. As a result of that ruling, an endemic broodstock program was initiated by WDFW and the co-managers to assess the feasibility of creating new broodstocks for use in the Touchet and Tucannon rivers (Bumgarner et al 2002). The WDFW proposed that these new endemic stock programs (if proven successful) could be used in combination with, or eventually replace the existing Lyons Ferry FH stock summer steelhead hatchery program in each river, thereby reducing risk to the natural populations in each ESU.

The two endemic stock programs began in 2000 under a 5-year study plan by trapping natural origin summer steelhead from each river for broodstock. These actions were approved through submission of Hatchery and Genetics Management Plans to NOAA Fisheries under the provisions of Section 4(d) of the ESA. Each year since, a portion of the natural origin fish trapped have been collected, transported, and spawned at Lyons Ferry FH. Progeny have been reared at Lyons Ferry FH, and then released as smolts into their respective rivers. Returns from the first few years of releases were not encouraging; although performance was based on very limited adult capture and/or tag data. WDFW and the co-managers agreed that additional years were needed to evaluate each program

[pers. comm. Joe Bumgarner, WDFW, 2009]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

See section "A. General Information" above for a description of the program's purpose.

2. Goals of program

The WDFW goal for this program (if successful) would be to replace the current use of Lyons Ferry stock fish in the Tucannon River. This programs purpose would be to provide conservation too, as well as provide some harvest mitigation in the Tucannon River as originally designed under the LSRCP program. Use of a local stock may have less detrimental effects to listed steelhead in the Tucannon River should these fish return to the spawning grounds.

3. Objectives of program

- The Tucannon River summer steelhead is considered an endemic program, meaning all production is derived from natural parentage. The adults for this program are collected at a temporary trap on the lower Tucannon River, and their progeny planted in the upper Tucannon River as yearlings.

- Current survival estimates indicate that 13 spawned females should provide enough eggs to meet the smolt production goal. Therefore, we will collect 15 females and 21 males (natural origin) for the broodstock at the lower Tucannon Trap, with all other fish (natural, Lyons Ferry FH hatchery stock, Tucannon River Endemic Stock) passed upstream for natural spawning. Some wild fish may also be collected at the Tucannon FH adult trap (RM 36) if broodstock collection in the lower river fails. As in the past, all hatchery origin fish (Lyons Ferry FH stock) collected at the Tucannon FH adult trap will not be passed upstream. Instead they will be marked and released downstream (or taken back downriver below Marengo if the lower trap is moved upstream) to spawn naturally. All endemic and wild fish captured at the Tucannon FH will be passed upstream for natural spawning

- Because in-hatchery survival of endemic origin fish is unknown, up to 75,000 smolts may be released in any given year. If greater than 75,000 smolts are anticipated to be released, up to 25,000 fingerlings could be released into the upper Tucannon River basin in the fall before normal migration.

- The number of eggs per female is approximately 6,100. Based on fecundity survival estimates, Lyons Ferry FH typically spawns 13 females to provide 79,300 green eggs for the program.

[WDFW Sept. 2008]

4. Type of program (Integrated or Segregated)

Integrated Recovery / Harvest: Artificially maintain and/or increase numbers of naturally reproducing Tucannon River steelhead that successfully produce viable progeny which contribute to the conservation and recovery of the Tucannon River population and Snake River ESU. Continue to provide mitigation as specified under the LSRCP program for losses to Tucannon River steelhead due to construction of Snake River Dams while meeting conservation and recovery criteria established for the Tucannon River population and Snake River ESU. Provide harvest opportunities established under *US v Oregon* for tribal and recreational fisheries. [WDFW July 2005d]

5. Alignment of program with ESU-wide plans

Lyons Ferry Complex is part of the LSRCP Program. The current program's steelhead actions were stated as causing jeopardy to the listed natural population of summer steelhead under the NMFS Biological Opinion, and actions proposed under this HGMP are consistent with the Reasonable and Prudent Actions suggested by NMFS. Implementation of this HGMP will result in the development of a new endemic stock of steelhead for release into the Tucannon River. Depending on success of this stock and decisions to be made in the future the program may eventually drastically reduce, or eliminate, the current releases of Lyons Ferry FH stock steelhead in the Tucannon River. If that occurs, eventually all releases of hatchery-origin summer steelhead into the Tucannon River will be derived from the endemic broodstock proposed within this HGMP. [WDFW July 2005d]

6. Habitat description and status where fish are released.

The Tucannon Model Watershed Management Plan (CCD 1996) reviewed the ecological health of the Tucannon Watershed in relation to salmonid population status and recovery. Limiting factors such as water temperature, channel stability, sediment, and instream habitat were addressed. Fish & Wildlife and land managers, in association with private landowners and the Columbia Conservation District, described approaches to habitat improvement, both instream and upland, that are required as part of salmonid recovery in the Columbia basin. The plan has been used as a template to guide actions taken by multiple agencies to request funds for habitat improvement. Short and long term goals included bank stabilization, constructing instream fish habitat, riparian re-vegetation, meander reconstruction, construction of sediment basins, and altered farming practices to decrease sediment delivery to the river. This suite of actions will have increasing benefits (e.g.: maturing trees planted in riparian areas) over time. Managers were committed to improving habitat as fish and wildlife programs strive to increase escapement of salmon and steelhead to spawning/rearing areas. This management approach has been updated most recently with completion of the Tucannon Subbasin and Snake River Salmon Recovery plans. These plans capture current knowledge and best management practices into cohesive, locally implemented habitat and population recovery strategies. [WDFW July 2005d]

7. Size of program and production goals (No. of spawners and smolt release goals)

Based on fecundity survival estimates, Lyons Ferry FH typically spawns 13 females to provide 79,300 green eggs for the program. The program goal is 50,000 smolts released. Because in-hatchery survival of endemic origin fish is unknown, up to 75,000 smolts may be released in any given year. If greater than 75,000 smolts are anticipated to be released, up to 25,000 fingerlings could be released into the upper Tucannon River basin in the fall before normal migration. [WDFW Sept. 2008]

Table 10. Proposed BY 2008 Tucannon River summer steelhead tagging, transfers and releases.

Site	BY08 Goal	Expected at release	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Tucannon River	50,000	2,344	300	0+	Unmarked	-0-	August 28, 2008

[WDFW Sept. 2008]

Note: For the 2008 brood year, we were unable to capture natural origin adults at the temporary trap or the Tucannon FH trap due to high stream flows and an apparent lack of fish in last year's run. Production that was taken was returned to the river as fry. In a normal production year, about 8,000 PIT tags would be used to evaluation the program for smolt-to-adult survival rates. [pers. comm. Joe Bumgarner, WDFW, 2009]

C. Description of program and operations

1. Broodstock goal and source

Only natural steelhead captured within the Tucannon River above RM 11 will be used for broodstock. A combination of fish captured hook and line, trapped at a lower-river temporary adult trap, or trapped at Tucannon Hatchery may be used in some years. Propagation and release of Lyons Ferry FH stock will continue for several more years until the local stock can be documented to be performing as expected.

Mitigation production releases into the Tucannon River began in 1983. Broodstock originated from the Wells Hatchery (upper Columbia) and/or the Wallowa Hatchery (Snake River) programs through 1986. Returns of both Wells and Wallowa stock hatchery fish to Lyons Ferry Hatchery were used to define the Lyons Ferry stock. Complete losses at Lyons Ferry FH of the BY1989 production because of IHNV caused the release of Idaho origin (Pahsimeroi Hatchery) steelhead in 1990. Since 1991, only Lyons Ferry FH origin broodstock have been used for Tucannon River releases. Because of the inconsistent and incompatible nature of broodstock used in the past, as well as generally poor stock performance in the Tucannon River from releases at Curl Lake, WDFW and co-managers desire to transition to a local broodstock to continue mitigation and assist with recovery under ESA. In 1999-2000 broodstock were taken randomly from the endemic population, so no direct or unintentional selection is believed to have occurred. Samples for DNA characterization were collected from

the endemic broodstock and other natural origin adults for the past five years. These samples will serve as a baseline to measure potential future genetic changes in the stock.

[WDFW July 2005d]

2. Adult collection procedures and holding

The adults for this program are collected at a temporary trap on the lower Tucannon River or from the Tucannon FH. Current survival estimates indicate that 13 spawned females should provide enough eggs to meet the smolt production goal. Therefore, we will collect 15 females and 21 males (natural origin) for the broodstock at the lower Tucannon Trap, with all other fish (natural, Lyons Ferry FH hatchery stock, Tucannon River Endemic Stock) passed upstream for natural spawning. Some wild fish may also be collected at the Tucannon FH adult trap (RM 36) if broodstock collection in the lower river fails. As in the past, all hatchery origin fish (Lyons Ferry FH stock) collected at the Tucannon FH adult trap will not be passed upstream. Instead they will be marked and released downstream (or taken back downriver below Marengo if the lower trap is moved upstream) to spawn naturally. All endemic and wild fish captured at the Tucannon FH will be passed upstream for natural spawning. [WDFW Sept. 2008]

3. Adult spawning

a) Spawning protocols

- The number of eggs per female is approximately 6,100. Based on fecundity survival estimates, Lyons Ferry FH typically spawns 13 females to provide 79,300 green eggs for the program. Spawning has occurred from February to early April. Matrix spawning is employed, due to the relatively small founding population for this program. The intent of this protocol is to spawn two males with each female, increasing genetic diversity and helping ensure successful fertilization of eggs. If not enough males are ripe to achieve this goal; a 1:1 spawning matrix is employed. As stated above, a minimum of 3 females spawned is needed to continue with production for that year. [WDFW Sept. 2008]

- All males and females that have been collected for broodstock will be examined weekly during the spawning season to determine ripeness, and all fish will be spawned when ripe. The priority will be to use any males that have not yet contributed in spawning. All males are PIT tagged for identification purposes after they have been spawned to track the number times a particular male may contribute. WDFW July 2005d]

- Mating occurs in a 2x2 factorial cross to ensure the highest likelihood of fertilization. Jack or precocious steelhead (<20" TL) are generally not seen in the population. Likewise, repeat spawners are not known to exist in significant numbers in the population (1-2%). WDFW July 2005d]

- Equal sex ratios in the spawning population were originally identified as a goal for the program. However, problems getting enough ripe males to spawn with females was a

problem. Further, fecundity has generally been greater than originally planned. As such current program goals can be reached by spawning on 13-14 females. As such, additional males will be collected, or live spawned and released at the adult trap to ensure adequate number of males are available. During spawning, a 2x2 factorial spawning occurs (or a 1x2 when only one female is available) to increase the number of crosses. The small number of fish ripe on individual days usually limits spawning options. Males are usually limited to primary status on one half the eggs from two females. Where insufficient males are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution. [WDFW July 2005d]

b) No. of males and females spawned each year over past 10 years (table)

Table. Number of males and females collected, number of fish spawned, pre-spawning loss, and effective population size for the Touchet and Tucannon rivers Endemic Stock programs, 2000-2008 brood years.

Year	Collected		Spawned		Pre-spawn Loss	% Loss	Not Spawned	Effective Breeder Size
	Males	Females	Males	Females				
Tucannon River Stock								
2000	23	23	21	16	9	19.6	0	36
2001	18	18	15	15	6	16.7	0	30
2002	20	15	16	13	6	17.1	0	29
2003 [c]	19	16	18	16	0	0.0	1	27
2004	16	17	15	16	0	0.0	2	31
2005	25	17	25	14	0	0.0	3	36
2006	20	15	16	13	4	11.4	2	29
2007	13	14	12	13	1	3.7	1	25
2008	2	1	1	1	1	33.3	0	2
Average	**17.3**	**15.1**	**15.4**	**13.0**	**3.0**	**9.3**	**1.0**	**27.2**

[c] Five of the 16 spawned females produced non-viable eggs.

[WDFW Dec. 2008]

4. Fertilization

a) Protocols

- Equal sex ratios in the spawning population were originally identified as a goal for the program. However, problems getting enough ripe males to spawn with females was a problem. Further, fecundity has generally been greater than originally planned. As such current program goals can be reached by spawning on 13-14 females. As such, additional males will be collected, or live spawned and released at the adult trap to ensure adequate number of males are available. During spawning, a 2x2 factorial spawning occurs (or a 1x2 when only one female is available) to increase the number of crosses. The small number of fish ripe on individual days usually limits spawning

options. Males are usually limited to primary status on one half the eggs from two females. Where insufficient males are available to meet these criteria, males can be used as primary more than twice. In those circumstances, males will be used no more than four times as primary spawners (egg equivalent = 2 females). After fertilization, eggs are rinsed in a buffered iodine solution (100 ppm) to control viral and bacterial disease, and allowed to water harden for one hour in the same solution. [WDFW July 2005d]

- Matrix spawning is employed, due to the relatively small founding population for this program. The intent of this protocol is to spawn two males with each female, increasing genetic diversity and helping ensure successful fertilization of eggs. If not enough males are ripe to achieve this goal; a 1:1 spawning matrix is employed. As stated above, a minimum of 3 females spawned is needed to continue with production for that year. [WDFW Sept. 2008]

b) Number of eggs collected and fertilized each year over past 10 years (table)

Table. Numbers of males and females spawned, eggs taken, and survival by life state of Touchet River endemic stock summer steelhead spawned at Lyons Ferry FH, 2000 to 2008 brood years.

BY	Spawned		Eggs taken	Eggs retained [a]	Percent retained	Fry	Egg to fry survival	Smolts	Fry to smolt survival
	Female	Male							
2000	12	7	53,139	43,572	82.0	43,296	99.4	36,487	84.3
2001	14	11	67,861	52,116	76.8	52,116	100.0	45,501	87.3
2002	14	19	70,843	*66,460*	93.8	31,715	47.7	31,440	99.1
2003	16	17	82,602	75,059	90.9	70,198	93.5	58,733	83.7
2004	15	10	66,125	59,644	90.2	55,358	92.8	55,706	100.0
2005	18	17	79,540	52,195	63.6	49,870	95.5	52,476	100.0
2006	18	18	88,668	73,633	83.0	61,141	83.0	58,989	96.5
2007	16	17	73,101	69,626	95.2	68,626	98.6	48,298	70.4 [b]
2008	14	12	66,928	57,279	85.6	57,111	99.7		

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).
[b] High fry-smolt loss was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.

[WDFW Jan. 2009]

5. Incubation

- After spawning, fertilized eggs are water hardened in 100-ppm iodophore. They are incubated in down-welling iso-incubation buckets (one fish per bucket). After shocking, they are handpicked and weighed down in hatching baskets suspended over shallow troughs. [WDFW Sept. 2008]

- Fish hatch from baskets and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after all are buttoned up (usually 1-3 days post swimup). Fish are then moved to intermediate inside tanks (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways. [WDFW July 2005d]

6. Ponding

a) Protocols

- After hatch and swim-up, they are introduced to feed, and transferred to intermediate raceways at around 500 fpp in June. They are transferred again to outside raceways at roughly 200 fpp in July. In September, they are size-selected during marking and split into two raceways. By sorting into two size groups, culturists can adjust growth rates to minimize size variance at release. Additionally, a number of non-traditional fish culture techniques are being employed on this stock to ensure release size goals are met. [WDFW Sept. 2008]

- Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000 gpm water enters each raceway through secondary degassing cans. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. [WDFW July 2005d]

b) Number of fry ponded each year, including % hatch each year

Table. Numbers of males and females spawned, eggs taken, and survival by life state of Touchet River endemic stock summer steelhead spawned at Lyons Ferry FH, 2000 to 2008 brood years.

BY	Spawned		Eggs taken	Eggs retained [a]	Percent retained	Fry	Egg to fry survival	Smolts	Fry to smolt survival
	Female	Male							
2000	12	7	53,139	43,572	82.0	43,296	99.4	36,487	84.3
2001	14	11	67,861	52,116	76.8	52,116	100.0	45,501	87.3
2002	14	19	70,843	*66,460*	93.8	31,715	47.7	31,440	99.1
2003	16	17	82,602	75,059	90.9	70,198	93.5	58,733	83.7
2004	15	10	66,125	59,644	90.2	55,358	92.8	55,706	100.0
2005	18	17	79,540	52,195	63.6	49,870	95.5	52,476	100.0
2006	18	18	88,668	73,633	83.0	61,141	83.0	58,989	96.5
2007	16	17	73,101	69,626	95.2	68,626	98.6	48,298	70.4 [b]
2008	14	12	66,928	57,279	85.6	57,111	99.7		

[a] The number of eggs retained includes all losses from green egg to eye up (mortality and eggs destroyed due to IHNV).
[b] High fry-smolt loss was due to stress induced mortality of 20,389 fish caused by overcrowding during the PIT tagging operation.

[WDFW Jan. 2009]

7. Rearing/feeding protocols

Fry/fingerling will be fed an appropriate commercial dry or semi-moist trout/salmon diet. Feeding occurs several times daily as necessary to provide the diet at a range of 0.7 – 1.1% B.W./day. Feed conversion is expected to fall in a range of 1.1 – 1.4 pounds fed to pounds produced. Due to the duration of spawning time for the natural steelhead, a variety of starter diets and feed schedules may be used to achieve a similar size among the fish before they are

moved outside to the rearing raceways. This strategy will reduce length variation (CV) of juveniles within the supplemented population. [WDFW July 2005d]

8. Fish growth profiles

Table. Fish per pound by month for BY05 and BY06 Tucannon steelhead.

Month	BY06	BY06
January	6.8	Na
February	Na	Na
March	Na	Na
April	Na	2,000
May	507	1,000
June	190	184
July	60	180
August	32	80
September	22	35
October	18	
November	12	
December	8	

[USFWS May 2009]

9. Fish health protocols and issues

- A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Hatchery Specialists under the direction of the Fish Health Specialist provide treatment for disease. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [WDFW July 2005d]

- Currently, IHN in Chinook salmon is not a concern at Lyons Ferry FH. The strains of IHN found in the Columbia River Basin have been problematic for sockeye, steelhead and rainbow trout, but not for Chinook salmon. Therefore, standard hatchery practices of egg disinfection and use of pathogen-free rearing water during early rearing have been sufficient fish health measures. . [WDFW Sept. 2008]

- The fish health specialist will respond to all fish disease outbreaks at the request of the fish hatchery staff. [WDFW Sept. 2008]

10. Chemotherapeutant use

Monthly fish health inspections occur at Lyons Ferry FH. Because of very low numbers of adults held in broodstock raceways, raceway cleaning is unnecessary. Treatments for fungal infections are applied as chemical flushes through the raceways. [WDFW July 2005d]

11. Tagging and marking of juveniles

On August 28th, 2008, 2,344 (BY08) Tucannon River summer steelhead juveniles at 197 fpp were planted as unmarked fry in the upper Tucannon. The program goal is 50,000 smolts released. The BY08 production was low because high stream flows and a very low return resulted in only a few fish trapped, with only one pair spawned. WDFW decided it would be better to release these fish into the upper Tucannon in September as parr/fingerlings. Further, discussions amongst the managers have proposed that should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River. Less than 8,000 fish production would not allow enough fish for evaluations to occur.

At this time, there is no direct research associated with the Tucannon River endemic stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc..). As indicated above, PIT tags along with a CWT's, will give us juvenile migration and SAR data. Other research/monitoring activities are centered on the adult trap (passage issues, location of trap), and getting age composition data from the wild fish.

[WDFW Sept. 2008]

12. Fish Release

a) Protocols

On August 28th, 2008, 2,344 (BY08) Tucannon River summer steelhead juveniles at 197 fpp were planted as unmarked fry in the upper Tucannon. The program goal is 50,000 smolts released. The BY08 production was low because high stream flows and a very low return resulted in only a few fish trapped, with only one pair spawned. WDFW decided it would be better to release these fish into the upper Tucannon in September as parr/fingerlings. Further, discussions amongst the managers have proposed that should low production numbers (i.e. less than 8,000 fish at smolt release, ~3 females at trapping) occur in the future, the fish will not be reared full term, but released as parr/fingerlings in the upper Tucannon River. Less than 8,000 fish production would not allow enough fish for evaluations to occur. [WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Tucannon River	
2001	60,000
2002	58,600
2003	43,700
2004	43,000
2005	58,000
2006	65,200
2007	62,900
2008	53,070

[WDFW Dec. 2008]

D. Program benefits and performance

Since the 2001 release year, WDFW has also produced smolts from two endemic stock programs. The co-managers agreed to an interim smolt production goal of 50,000 smolts annually for each stock as the program went through a 5-year evaluation stage. Current size and date of release is programmed for 4.5 fish/lb in mid-April. Limited, but an increasing amount of information on the success of this program is currently available. Since these fish are not marked for harvest, our evaluations have centered on adult trapping and adult PIT tag recoveries. Survivals have been estimated from the total release number. However, we believe that many of the fish never migrate because of death immediately following release, residualism, or they were too small at release to leave the river and did not survive until the following spring.

Estimated survivals derived from captures at adult traps have been less than desired. With the exception of the Asotin Creek adult trap, the lower trap on the Tucannon River, and Touchet Adult trap in Dayton are not efficient even under moderate flows, hence the numbers collected to date from these location are likely underestimated. Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern.

[WDFW Dec. 2008]

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Table. Estimated smolt-to-adult survival rate of hatchery endemic summer steelhead smolts from the Touchet and Tucannon rivers, and one groups of Lyons Ferry stock steelhead based on adult PIT tag detections at Columbia and Snake River dams.

Smolt Migration Year	Release Location	Number of PIT Tags	Bonneville Dam or above	Percent Survival	McNary Dam or above	Percent Survival
Tucannon River						
2001	Curl Lake	497	0	0.00	0	0.00
2004	Camp Wooten	9,969	59	0.59	45	0.45
2005	Camp Wooten	9,968	83	0.83	70	0.70
2006	Camp Wooten	8,953	111	1.24	73	0.82
			Average (all)	**0.63**		**0.49**
			Average ('04-'06)	**0.89**		**0.66**

[WDFW Dec. 2008]

b) Return timing and age-class structure of adults

Table. The number of adult Tucannon River endemic stock PIT tagged fish detected from the 2004-2005 release years.

Site	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
Bonneville	5	42	73	10	2							132
McNary	2	16	17	53	13	4				3		108
Ice Harbor	2	8	16	47	15	2					1	91
Lower Granite [a]	1	2	5	38	15	5					1	67
Tucannon			2	8	4	5	5	1	2	5	3	35
Walla						*1*	3					
Walla [b]												4
Upper Columbia [b]			2	*1*								1

[a] Of the 67 fish detected at Lower Granite Dam, 11 eventually made it back downstream to enter the Tucannon River and presumably spawn.

[WDFW Dec. 2008]

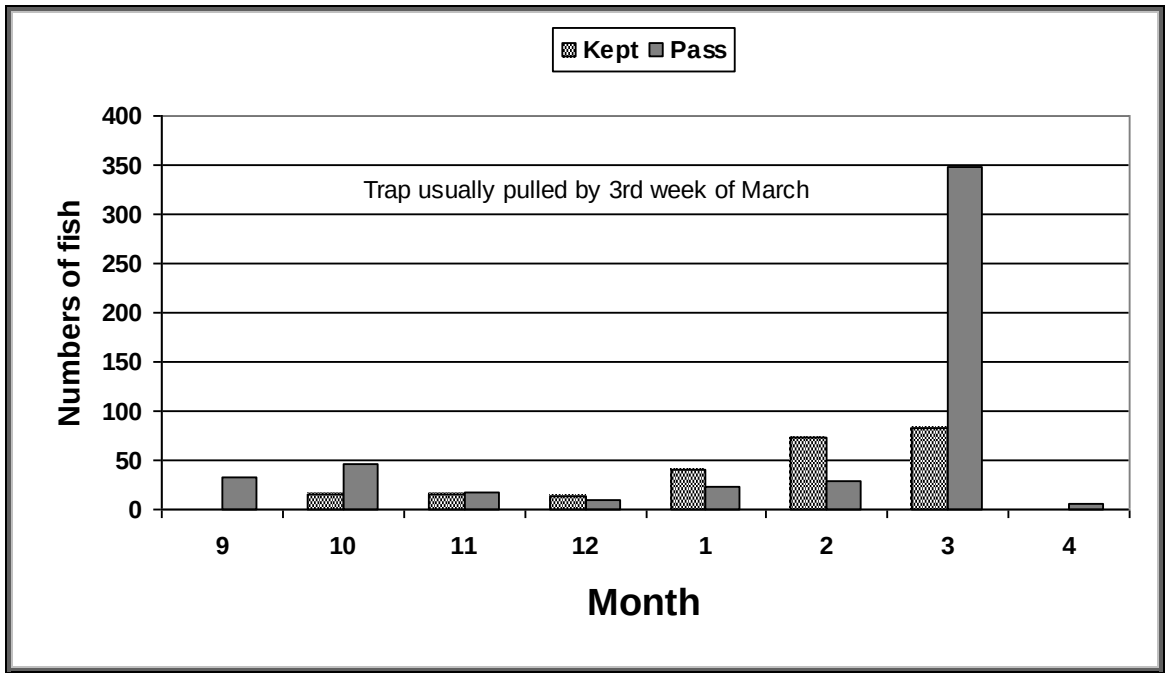

Figure. Timing of Tucannon River endemic steelhead collected for broodstock or passed upstream at the Lower Tucannon River Adult Trap, 2001-2007.

[WDFW Dec. 2008]

c) Smolt-to-adult return rates

Table. Estimated smolt-to-adult survival rate of hatchery endemic summer steelhead smolts from the Touchet and Tucannon rivers, and one groups of Lyons Ferry stock steelhead based on adult PIT tag detections at Columbia and Snake River dams. [pers. comm. Joe Bumgarner, WDFW, 2009]

Smolt Migration Year	Release Location	Number of PIT Tags	Bonneville Dam or above	Percent Survival	McNary Dam or above	Percent Survival
Tucannon River						
2001	Curl Lake	497	0	0.00	0	0.00
2004	C.Wooten	9,969	59	0.59	45	0.45
2005	C.Wooten	9,968	83	0.83	70	0.70
2006	C.Wooten	8,953	111	1.24	73	0.82
			Average (all)	**0.63**		**0.49**
			Average ('04-'06)	**0.89**		**0.66**

d) Stock productivity (e.g. recruits per spawner)

Limited information is available at this time, so our estimates should be used with caution. Based on the PIT tag information, we think the recruit: spawner ratio is about 10-12:1, which is much lower than we observe for Lyons Ferry or Wallowa stock program produced at Lyons Ferry Hatchery, but about twice the performance of the Touchet endemic stock fish.

2. Contributions to harvest and utilization (e.g. food banks)

Tucannon River steelhead are not adipose fin clipped for harvest.

3. Contributions to conservation

Development of a hatchery stock based on the endemic stock from the Tucannon River for mitigation production will not necessarily increase natural productivity, but can serve several purposes. 1) Hatchery production can attempt to maintain or increase the numbers of naturally reproducing Tucannon River steelhead in under-utilized spawning and rearing habitat. The intent of efforts within this ESU is to reduce the short-term extinction risk to the existing wild population and to increase the likelihood of their recovery to a healthy status. These objectives may be accomplished through the establishment of a supplemented population using an endemic brood stock. 2) Minimize the potential for genetic introgression and depression that may occur with continued use of the existing hatchery stock. In the early 1990's genetic allozyme data indicated little introgression between the native stock and the Lyons Ferry FH stock had occurred. However, more recent microsatilite DNA data indicates some introgression between the two stocks has occurred (Bumgarner et al 2003). Given that information, interbreeding between hatchery and natural fish may be reducing productivity and fitness within the natural population. 3) Speed the recovery of Tucannon River steelhead

once natural productivity has reached or exceeded replacement as a result of habitat improvements within the basin. 4) Provide mitigation production under LSRCP while complying with NMFS's Reasonable and Prudent actions as listed in their Biological Opinion. Washington Department of Fish and Wildlife desires to maintain healthy, abundant populations of steelhead within the Snake River, but also wants to provide abundant fishery opportunities as provided for under the LSRCP mitigation program. 5) Potentially reduce straying within the Snake basin. Hatchery fish from the Lyons Ferry FH program have been shown to stray into other Columbia basin steelhead rivers. While this program will consist of hatchery fish, the chance for straying may be reduced because the new hatchery stock will be developed from the endemic population. Mitigation goals will be fully integrated as conservation and recovery goals are achieved. [WDFW July 2005d]

4. Other benefits

None identified here.

E. Research, monitoring, and evaluation programs

At this time, there is no direct research associated with the Tucannon River endemic stock summer steelhead at the hatchery (i.e. time or size at release studies, growth studies, etc..). As indicated above, PIT tags along with a CWT's, will give us juvenile migration and SAR data. Other research/monitoring activities are centered on the adult trap (passage issues, location of trap), and getting age composition data from the wild fish. [WDFW Sept. 2008]

F. Program conflicts

1. Biological conflicts (e.g. propagated stock maladapted to hatchery water source)

- Since the 2001 release year, WDFW has also produced smolts from two endemic stock programs. The co-managers agreed to an interim smolt production goal of 50,000 smolts annually for each stock as the program went through a 5-year evaluation stage. Current size and date of release is programmed for 4.5 fish/lb in mid-April. Limited, but an increasing amount of information on the success of this program is currently available. Since these fish are not marked for harvest, our evaluations have centered on adult trapping and adult PIT tag recoveries. Survivals have been estimated from the total release number. However, we believe that many of the fish never migrate because of death immediately following release, residualism, or they were too small at release to leave the river and did not survive until the following spring.

- Estimated survivals derived from captures at adult traps have been less than desired. With the exception of the Asotin Creek adult trap, the lower trap on the Tucannon River, and Touchet Adult trap in Dayton are not efficient even under moderate flows, hence the numbers collected to date from these location are likely underestimated. Touchet and Tucannon summer steelhead have been documented in the area above Lower Granite Dam

for years. However, the recent documentation of them entering and spawning in Asotin Creek, or other tributaries above Lower Granite Dam may be of concern.

- The PIT tag detections from the endemic stock groups are however showing some disturbing migration patterns. Tucannon River endemics are passing above Lower Granite Dam at a high proportion as to what crosses Ice Harbor Dam (~50%), with only a few being detected coming back down to enter the Tucannon River. This same pattern of bypassing the Tucannon River is also being observed in the Lyons Ferry stock fish released into the Tucannon, and Tucannon River natural origin steelhead. Adult trapping on Asotin Creek since 2005 has documented many of the Tucannon River endemic stock fish during the spawning season (e.g.16 fish in 2007).

Table. Disposition of PIT tagged Tucannon Endemic stock, Tucannon natural stock, and Lyons Ferry hatchery stock summer steelhead that crossed Ice Harbor Dam.

								Percent of those that passed Ice Harbor Dam		
Release Year	Pass Ice	Pass Granite	Enter Tucannon	Unknown Location	Back to Tucannon From Granite	% back to Tucannon from LGR	Total into Tucannon	% into Tucannon	% above Granite	% Unknown
Tucannon Endemic Hatchery Stock Summer Steelhead										
2004	48	30	11	7	5	16.7	16	33.3	52.1	14.6
2005	55	35	17	3	8	22.9	25	45.5	49.1	5.5
2006	105	70	16	19	14	20.0	30	28.6	53.3	18.1
Totals	**208**	**135**	**44**	**29**	**27**	**20.0**	**71**	**34.1**	**51.9**	**13.9**
Tucannon Natural Stock Summer Steelhead										
2004	18	11	6	1	2	18.2	8	44.4	50.0	5.6
2005	20	12	7	1	3	25.0	10	50.0	45.0	5.0
2006	19	9	4	6	0	0.0	4	21.1	47.4	31.6
Totals	**57**	**32**	**17**	**8**	**5**	**15.6**	**22**	**38.6**	**47.4**	**14.0**
Lyons Ferry Hatchery Stock Summer Steelhead (Released into the lower Tucannon River)										
2006	318	224	53	41	43	19.2	96	30.2	56.9	12.9

- Recent estimated smolt-to-adult survivals derived from PIT tags have been more encouraging compared to the adult trap data. In the Touchet River, survival may be approaching 0.5%, while in the Tucannon River mean survival in the last three returns is around 1%.

- Problems/concerns encountered with the endemic stock program have been 1) not achieving the planned release number or size of 4.5 fish/lb, 2) difficulties in operating the trap for broodstock collection during high spring flows, 3) extended spawn timing of wild broodstock (February – May) making randomized spawning crosses and hatchery rearing difficult, 4) the juvenile progeny (especially from the Touchet stock) are "spooky" and conventional feeding approaches have not worked well, 5) low numbers of founding broodstock prevents future collection of their progeny for the endemic broodstock, and 6) detection of IHN virus in the broodstock (Touchet) that have created problems with broodstock collection.

- Great strides have been made in getting the endemic progeny to meet, or at least get closer to, program size goals. Both endemic stocks are now graded early in the rearing cycle in an attempt to prevent the bi-modal length distribution that was observed during the first few years. In addition, alternative feeding techniques (e.g. hiding from the fish while feeding so they aren't as easily frightened), and in-raceway cover structures (aqua-mats), have been utilized to make the rearing more successful. Even with all of these improvements, we still generally have two sub-groups of fish (large and small) at time of release. These two groups have then been released at different times in an attempt to reach the final program fish size goal. Over the last few years, we have proportioned out PIT tags in each of the large and small sized fish released. Adult returns from fish released in 2005 and 2006 indicate that the smaller sized fish and/or those that are released at a later date but close to program releases size goals do not perform as well as large fish released earlier. Both endemic stock groups generally have higher K-factors as compared to the Lyons Ferry FH stock fish (Tables 7 and 8). So fish size, overall fish condition, release date, or some combination of factors is limiting the survival and/or migratory ability of the smaller fish, and perhaps even the larger sized fish in some years.

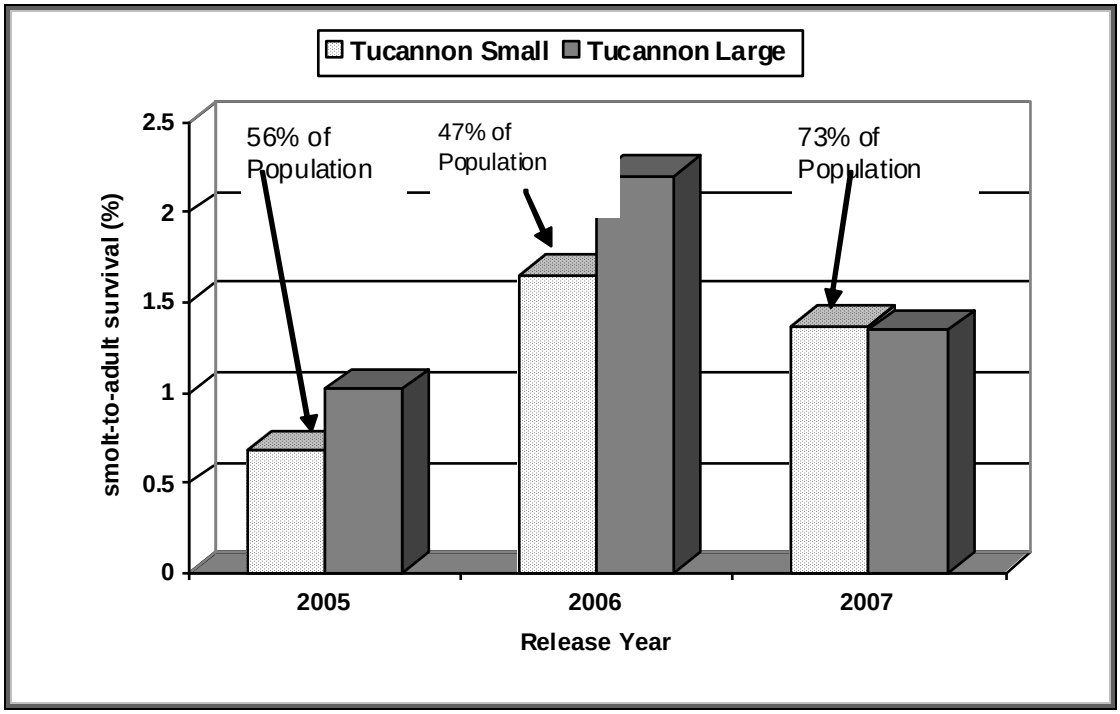

Figure. Smolt-to-adult survival estimated from PIT tags in large or small fish size (and % of release group) from the Tucannon River hatchery endemic stock releases from 2005-2007.

- Production levels continue to vary, but for varying reasons. In the Touchet, production has fluctuated due to difficulties in trapping broodstock or because of IHNV detected in the spawned females. Progeny from these females have been released back into the Touchet River as eggs or fry to reduce the risk of a possible outbreak in the hatchery. While the strategy is not consistent with the FMEP, this is has been the preferred alternative agreed to by WDFW hatchery, evaluation, and fish management staff, co-manager (Umatilla Tribe) and NOAA Fisheries personnel. Production in the Tucannon stock has been more stable, with large fluctuation occurring from high egg mortality in fish that were over-ripe, generally from the first part of the spawning season.

- Natural origin broodstock collections, and their resultant spawn timing, for each endemic stock has been skewed towards the beginning for each stock. This strategy has been done for two reasons: 1) for each stock this allowed for additional rearing time to get the fish to program size within one-year, 2) in the Tucannon River this was done because the adult trap can easily be disabled by high spring flows in the Tucannon River. In the long-term, this strategy may have to be reconsidered, or a two-year smolt program might have to be considered if additional rearing time is considered best for the stock (this applies mainly to the Touchet River program).

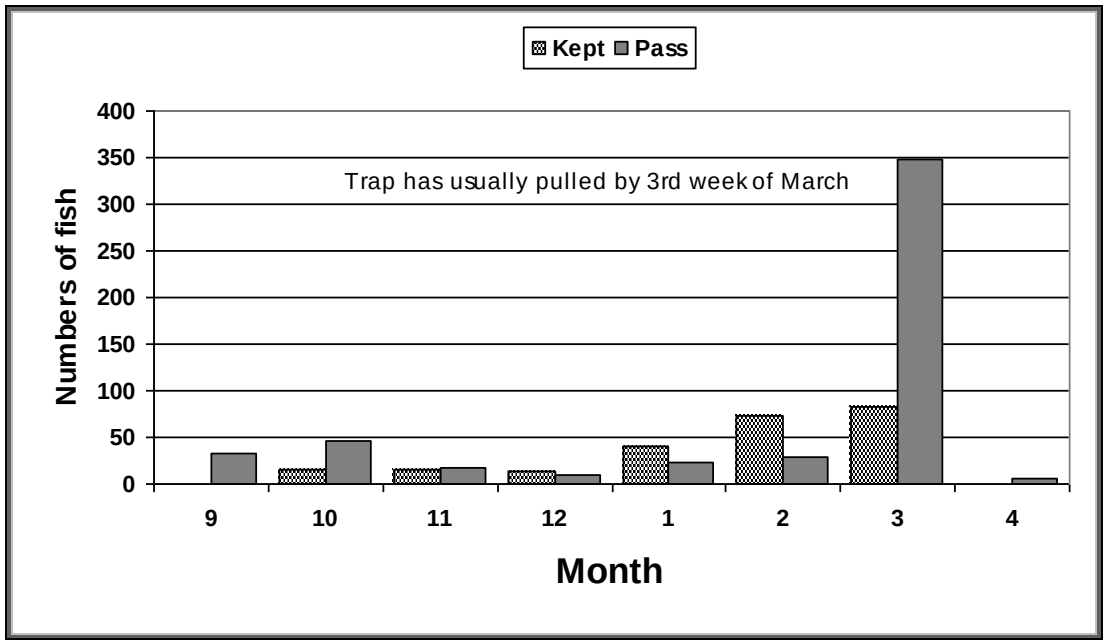

Figure. Timing of Tucannon River endemic steelhead collected for broodstock or passed upstream at the Lower Tucannon River Adult Trap, 2001-2007.

[WDFW Dec. 2008]

2. Harvest conflicts (e.g. mixed stock fishery on hatchery and wild fish limits harvest opportunities on hatchery fish)

The Tucannon endemic stock fish are not currently marked for harvest

3. Conservation conflicts and risks

a) Genetic conflicts associated with straying and natural spawning of hatchery fish (Stray rates, proportion of hatchery-origin fish on natural spawning grounds, etc. Provide tables or figures where appropriate)

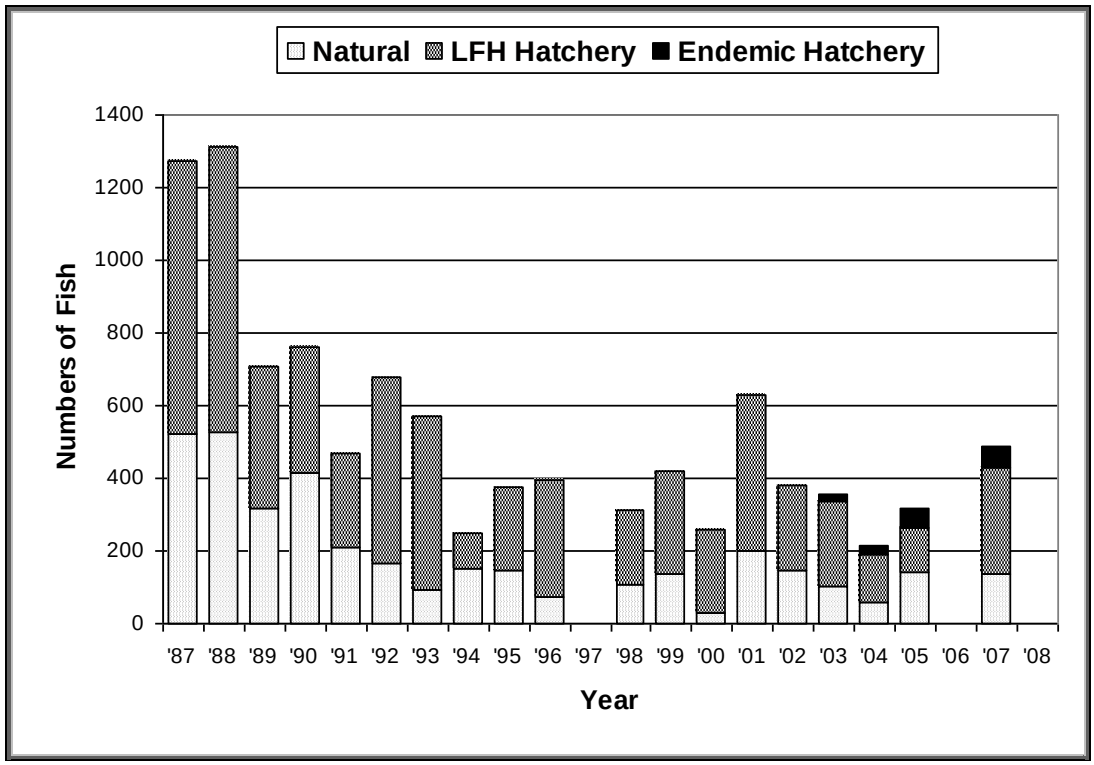

Figure. Estimated number of natural and hatchery origin fish spawning in index areas of the Tucannon River, 1987-2008. Flood conditions or high stream flows precluded spawning survey estimate of redds in some years, which are the basis for escapement estimates. Note: The percent of hatchery fish on the spawning grounds is related to the index spawning areas surveyed and hatchery fish release locations which have been moved to downstream locations in more recent years. Releases of hatchery steelhead occurred in the upper 1/3 of the basin through the mid-1990's, about ½ way up the basin from the mid-1990's to mid 2000's, and have been below the index spawning areas for the last four years.

[WDFW Dec. 2008]

b) Ecological conflicts (e.g. competition between hatchery fish and wild fish, predation,)

- Rearing progeny of IHN virus positive females may pose fish health risks to other fish reared on station at Lyons Ferry FH; however, the risk is considered low due to egg disinfection and isolated rearing.

- Tucannon steelhead are held in the same adult holding pond as Touchet steelhead, posing a fish health risk to both stocks. Of special concern is the transmission of the IHN virus.

- Hatchery-origin steelhead that residualize may pose ecological risks to other species including bull trout.

- The collection and barging of steelhead smolts at mainstem Snake River and Columbia River dams poses a stress (crowding and handling) and overall fish health risk to other populations of salmon and steelhead that are co-collected for barging.

4. Other conflicts between the hatchery program, or fish produced by the program, and other non-hatchery issues

None identified.

IIG. Spokane Rainbow Trout

A. General information

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. When originally proposed, the trout program was to produce 233,000 trout at 2.5 fpp for a total of about 93,000 pounds. These "catchable-sized" trout were to compensate for the loss of 67,500 angler-days of fishing. During the hatchery siting phase of the program, The Washington Department of Wildlife and Corps agreed that at least 29 stream segments (100-200 feet in length) would be improved with one or more instream structures in lieu of producing 7,000 pounds of hatchery trout (equivalent to two raceways at Lyons Ferry). From 1983 to 1986, 91 structures were built in the Tucannon River, South Fork Asotin Creek, North Fork Asotin Creek, and Asotin Creek. The remaining 86,000 pounds of trout production was incorporated into rearing facilities at Lyons Ferry and Tucannon FH's.

Lyons Ferry (Phase I) was designed to rear 45,000 pounds of trout for release into Washington and Idaho waters. At the time of the hatchery design, WDFW and IDFG estimated that about 6,200 pounds of the total production would be reared for release into Idaho to offset their trout angler losses, with the remainder (38,800 lbs) to go into Washington streams and lakes.

Tucannon FH, located on the Tucannon River, was designed to rear 41,000 pounds for the compensation program. Tucannon FH was an existing resident trout hatchery operated by WDW that was rebuilt for the LSRCP program and completed in 1984.

[USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase I) was constructed in 1983 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 86,000 pounds of rainbow trout (2.5 fpp) for release. [USFWS May 1990]

2. Goals of program

The goal of this program is to compensate for the loss of 67,500 angler-days of fishing (Washington and Idaho) to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]

3. Objectives of program

- The production objectives are 237,500 yearling and 160,000 sub-yearling Spokane rainbows. This requires 500,000 eyed Spokane rainbow trout eggs for the Washington. A small State funded program at Tucannon FH utilizes Spokane stock rainbow reared to1½ lbs each, to provide a unique fishing opportunity in local lakes. [WDFW Sept. 2008]

- The goal of this program is to compensate for the loss of 67,500 angler-days of fishing in Washington and Idaho. [USFWS May 1990]

4. Type of program (Integrated or Segregated)

Segregated: Mitigation – To produce and stock rainbow trout that will provide 67,500 anglers days of recreation. [WDFW July 2002]

5. Alignment of program with ESU-wide plans

LFC and the resulting production of rainbow trout is part of the compensation provided to Washington under the LSRCP Program. According to the Artificial Production Review (APR-1999), the Council stated "Management objectives such as harvest opportunities, or for in-kind, in-place mitigation, or for protection of specific natural populations are all equally important." As such, managers will have to identify their legal mandates, and do their best to provide fish for harvest, while protecting naturally spawning populations. WDFW believes they have taken such actions with the current rainbow trout program outlined in this HGMP, and believe it to be consistent with the Policy Recommendations in the APR. Since all rainbow trout are currently stocked into non-anadromous water, interaction with listed species is negligible. [WDFW July 2002]

6. Habitat description and status where fish are released.

Watersheds currently targeted by the rainbow trout program include landlocked or screened lakes that have no access for anadromous salmon or steelhead. These waters are primarily located in the Walla Walla, Snake, and Tucannon rivers, and Asotin Creek Watersheds. [WDFW July 2002]

7. Size of program and production goals (No. of spawners and smolt release goals)

Eggs for the trout program are received from WDFW's Spokane FH.

Table 12. 2008 Kamloops rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Idaho Rivers	50,000	15	0+	ADLV or ADRV	None	Transfer to and planted by IDFG October 2008

Table 13. 2008 Spokane rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/Elastomer	Pit Tags	Transfer/release Date
Idaho Reservoirs	160,000	60 – 80	0+	None	None	Transfer to and planted by IDFG in April/May 2009
SE Washington Lakes	236,725 500	2.5 – 4 1	1+ 1+	None None	None None	Planted in February through July 2009
SE Washington Lakes	4,000 200	1.5 lbs ea 3.0 / fpp	1+	None	None	Planted in February through May 2009

[WDFW Sept. 2008]

C. Description of program and operations

1. Broodstock goal and source

Eggs for the trout program are received from IDFG's Hayspur FH and WDFW's Spokane FH. [WDFW Sept. 2008]

2. Adult collection procedures and holding

Not Applicable

3. Adult spawning

a) Spawning protocols

Not Applicable

b) No. of males and females spawned each year over past 10 years (table)

Not Applicable

4. Fertilization

a) Protocols

Not Applicable

b) Number of eggs collected and fertilized each year over past 10 years (table)

Not Applicable

5. Incubation

Eyed eggs received from Spokane Hatchery hatch from baskets at Lyons Ferry FH or Tucannon FH and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after most are buttoned up (usually 1-3 days post swim up). [WDFW July 2002]

6. Ponding

a) Protocols

After button up fish are then moved to intermediate inside tanks at Lyons Ferry FH (usually at about 800 fish/lb). Fish rear in intermediate tanks until July or when fish reach 100/lb, at which time they are transferred to outside raceways.

Raceways are supplied with oxygenated water from the hatchery's central degassing building. Approximately 1,000-gpm (23 minute exchange rate) of water enters each north side raceway through secondary degassing cans. The north side of the hatchery have historically been used to raise steelhead. The south side raceways will likely be included for steelhead rearing in the future due to program changes. South side raceways receive about 650 gpm (33.5 minute exchange rate) and enters the raceway through a manifold. Oxygen levels range between 10-12 ppm entering, to 8-10 ppm leaving the raceway, depending on ambient air temperature and number of fish in the raceway. Similar data are expected in the 2.1 acre rearing ponds (17.5 hour water exchange rate), but dissolved oxygen may be different upon exit due to lower densities, slower exchange rate, and greater amounts of algae in lake compared to raceways. Flow index (FLI) is monitored monthly at all facilities and rarely exceeds 80% of the allowable loading. Raceways are cleaned three times a week by brushing to remove accumulated uneaten feed and fecal material. Feeding is by hand presentation. [WDFW July 2002]

b) Number of fry ponded each year, including % hatch each year

Table 2. History of eyed-egg to outplant survival for the Spokane Stock rainbow trout at Lyons Ferry FH from 1986-2000 Brood Years.

Brood Year	Eggs Received	Fry Produced	Egg-to-fry Survival	Fry Planted	Catachables Planted	% Fry-to-outplant Survival
1986	464,500	377,393	81.2	100,289	136,045	62.6
1987	501,500	446,694	89.1	147,993	266,360	92.8
1988	530,700	426,153	80.3	207,186	226,690	100.0
1989	758,090	652,535	86.1	272,164	264,974	82.3
1990	618,000	596,670	96.5	257,780	218,917	79.9

1991	696,220	637,285	91.5	269,387	271,052	84.8
1992	603,200	648,731	90.9	242,366	286,604	96.4
1993	615,600	600,308	97.5	276,602	263,521	89.9
1994	690,200	660,944	95.7	319,125	216,837	81.1
1995	685,610	656,301	95.7	209,905	291,028	76.3
1996	677,420	626,030	92.4	266,626	248,254	82.4
1997	570,000	568,362	99.7	189,961	393,776	100.0
1998	545,000	543,801	99.8	160,900	239,767	73.7
1999	545,000	515,070	94.5	189,788	191,065	73.9
2000	545,000	475,348	87.2	205,091	243,803	70.0
Note: The precision of the hatchery methods at times measure survival between life stages as >100%; 100% is reported as a maximum in these situations.						

[WDFW July 2002]

7. Rearing/feeding protocols

Fry/fingerling will be fed an appropriate commercial dry or moist steelhead/salmon diet. Fry feeding starts at ~8 times daily and is reduced as the fish increase in size. Range of feeding varies between 0.5 – 2.8% B.W./day. Feed conversion is expected to fall in a range of 1.1:1 (dry feed)– 1.4:1 (moist feed) pounds fed to pounds produced. Feeding frequency, percent BWD and feed size are adjusted as fish increase in size in accordance with good fish husbandry and program goals. [WDFW July 2002]

8. Fish growth profiles

Table 3. Growth and size of Spokane Stock rainbow trout at Lyons Ferry FH for the 1998-2000 Brood Years.

	1998 Brood Year			**1999 Brood Year**			**2000 Brood Year**	
Month/Year	**FPP**	**G/fish**	Month/Year	**FPP**	**G/fish**	**Month/Year**	**FPP**	**G/fish**
1/99	2,100	**0.2**	1/00	1,700	**0.3**	1/01	**2,500**	**0.2**
2/99	1,180	**0.4**	2/00	600.0	**0.8**	2/01	**1,194**	**0.4**
3/99	314.2	**1.4**	3/00	189.2	**2.4**	3/01	**214.0**	**2.1**
4/99	98.0	**4.6**	4/00	60.6	**7.5**	4/01	**89.0**	**5.1**
5/99	50.7	**8.9**	5/00	42.8	**10.6**	5/01	**48.0**	**9.5**
6/99	24.8	18.2	**6/00**	23.0	19.7	**6/01**	27.0	16.8
7/99	16.7	27.2	**7/00**	13.5	33.6	**7/01**	16.5	27.5
8/99	10.5	43.2	**8/00**	9.3	48.8	**8/01**	10.9	41.6
9/99	8.3	54.7	**9/00**	7.1	63.9	**9/01**	7.7	58.9
10/99	6.2	73.2	**10/00**	5.3	85.6	**10/01**	6.0	75.6
11/99	5.1	88.9	**11/00**	3.9	116.3	**11/01**	4.8	94.5
12/99	4.4	103.1	**12/00**	3.1	146.3	**12/01**	3.8	119.4
1/00	3.5	129.6	**1/01**	2.6	174.5	**½**	3.1	146.3

2/00	3.1	146.3	**2/01**	2.3	197.2	**2/02**	3.3	137.5
3/00	2.3	197.2	**3/01**	2.9	156.4	**3/02**	2.7	168.0

[WDFW July 2002]

9. Fish health protocols and issues

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [WDFW July 2002]

10. Chemotherapeutant use

Eyed eggs, fry, and larger juveniles are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates. [WDFW July 2002]

11. Tagging and marking of juveniles

No Spokane stock rainbow trout are tagged or fin clipped at Lyons Ferry FH. [WDFW Sept. 2008]

12. Fish Release

a) Protocols

About 99,000 Spokane stock rainbow trout catchables (@ 2.5 fpp) and 500 jumbos (@ 1 fpp) are planted by Lyons Ferry FH drivers into various lakes in southeast Washington. Planting begins in February and is completed in March.

At the Tucannon FH, approximately 137,400 Spokane stock rainbow trout are planted into various lakes in southeast Washington as catchables. Planting typically begins in April, and is completed sometime in July. The jumbo trout (usually around 4,100) are planted in February through May each year, supplementing catchable plants.

[WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Table 12. 2008 Kamloops rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Idaho Rivers	50,000	15	0+	ADLV or ADRV	None	Transfer to and planted by IDFG October 2008

Table 13. 2008 Spokane rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/Elastomer	Pit Tags	Transfer/release Date
Idaho Reservoirs	160,000	60 – 80	0+	None	None	Transfer to and planted by IDFG in April/May 2009
SE Washington Lakes	236,725 500	2.5 – 4 1	1+ 1+	None None	None None	Planted in February through July 2009
SE Washington Lakes	4,000 200	1.5 lbs ea 3.0 / fpp	1+	None	None	Planted in February through May 2009

[WDFW Sept. 2008]

Appendix A, Table 2. Rainbow trout plants from Lyons Ferry Complex, 2003. Represents both LSRCP and State funded programs.

County	Location	Number of Plants	LSRCP lbs of fish planted	LSRCP # of fish planted	State lbs of fish planted	State # of fish planted
Adams	Sprague Lake	1	782	2,502		
	Total		*782*	*2,502*		
Asotin	Golf course Pond	10	6,029	18,064	690	400
	Headgate Pond	1	435	2,001		
	Silcott Pond	2	1,235	4,002		
	West Evans Pond	9	6,136	19,195	702	400
	Total	*22*	*13,835*	*43,262*	*1,392*	*800*
Columbia	Beaver Lake	3	417	1,511		
	Big Four Lake	2	645	2,000	447	300
	Blue Lake	12	5,387	17,459	556	301
	Curl Lake	8	2,612	11,596	355	172
	Dam Pond	2	679	2,003		
	Dayton Jv. Pond	6	982	3,189	150	75
	Deer Lake	3	832	3,031		
	Donnie Lake	1	99	436		
	Orchard Pond	2	668	2,004		
	Rainbow Lake	10	4,583	15,977	585	300
	Spring Lake	7	2,290	8,022	556	300
	Watson Lake	8	3,918	13,120	585	300
	Total	*64*	*23,112*	*80,348*	*3,234*	*1,748*
Franklin	Dalton Lake	6	6,678	20,068	612	300
	Marmes Pond	3	690	2,004		
	Total	*9*	*7,368*	*22,072*	*612*	*300*
Garfield	Baker's Pond	2	493	1,503		
	Casey Pond	1	115	506		
	Total	*3*	*608*	*2,009*		
Walla Walla	Bennington Lake	6	6,714	19,562		
	Fishhook Pk. Pond	3	1,580	5,045	118	60
	Jerrerson Park Pond	2	455	2,002	213	100
	Lions Park Pond	5	1,340	4,026	213	100
	Quarry Pond	6	6,350	19,992	612	300
	Total	*22*	*16,439*	*50,627*	*1,156*	*560*
Whitman	Garfield Pond	1	465	2,000		
	Gilcrest Pond	1	435	2,001		
	Pampa Pond	3	1,423	5,003	408	200
	Riparia Pond	1	693	2,010		
	Union Flat Creek	1	455	1,502		
	Total	*7*	*3,471*	*12,516*	*408*	*200*
Total Rainbows		**128**	**65,615**	**213,336**	**6,802**	**3,608**

[WDFW Dec. 2003, WDFW Dec. 2004, WDFW Feb. 2006, WDFW Jan. 2009, WDFW June 2007, WDFW Oct. 2002]

D. Program benefits and performance

LSRCP funded fish production in Washington began in 1983, with the construction of trout and steelhead rearing facilities at the Lyons Ferry FH. Construction of salmon facilities and steelhead acclimation sites followed, and was completed in 1985. Major upgrades at Tucannon FH also occurred at that time, and operation of that facility has been funded by LSRCP every since. Production at all facilities has been directed toward meeting established program goals of providing 67,500 angler days of fishing opportunity from 80,000 pounds of rainbow trout production, currently planted at 3 fish per pound (fpp). In addition to these LSRCP production goals, Washington Department of Fish and Wildlife (WDFW) funds a jumbo-sized (1.5 pounds each) rainbow trout program at Tucannon FH. [WDFW Sept. 2008]

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Not Applicable.

b) Return timing and age-class structure of adults

Not Applicable

c) Smolt-to-adult return rates

Not Applicable

d) Stock productivity (e.g. recruits per spawner)

Not Applicable

2. Contributions to harvest and utilization (e.g. food banks)

- WDFW desired to evaluate the amount of angler use and the success of the LSRCP and jumbo trout releases in these lakes in 2003. Because of a very limited budget and conflicts for staff time with spring Chinook salmon fishery monitoring we were unable to monitor more than four of the eight lakes. The four lakes (Spring, Blue, Rainbow, and Deer lakes) were selected because they were near each other, which increased efficiency of our monitoring efforts. The uppermost lakes of Watson, Beaver, Big Four and Curl were not sampled as part of this fishery monitoring effort. This is the first time we have surveyed the Tucannon Lakes fisheries since 1985 when all the lakes were monitored during spring and early summer. We terminated the 2003 creel surveys shortly after the July 4th weekend because our past experience indicated that angler effort declined significantly after that time. [WDFW Nov. 2008]

- This study provided valuable information regarding the trout fisheries in the Tucannon Lakes in 2003. The angler effort on four of the Tucannon Lakes was estimated to be 38,116 angler hours and 19,749 angler days (with a completed angler day of 1.93 hrs). This partial fishing season estimate of angler days on only four of the Tucannon Lakes exceeded 29% of the LSRCP mitigation goal of 67,500 angler days for all of southeast Washington. An estimated 27,436 rainbow trout were harvested during the first 4.5 months of the fishing season (March 1 to mid-July). Approximately 58-78% of hatchery trout were removed from the lakes by anglers, excluding hooking mortalities for released fish. Jumbo trout were apparently retained in the fishery at a higher rate than catchable-sized trout. Most anglers (79-82%) used bait when fishing the Tucannon Lakes. Anglers were generally satisfied with the numbers and quality of trout they caught, but satisfaction levels decreased temporarily in April as the size of hatchery trout available decreased. Anglers in March were mostly from relatively nearby areas of southeast Washington, but later in the season a portion of anglers were from very distant areas. The Tricities area comprised the largest percentage (>50%) of anglers using the Tucannon Lakes, but some anglers were from distant states. [WDFW Nov. 2008]

- The fishery monitoring results summarized in this report provide a valuable "snapshot" in time regarding the Tucannon Lakes fisheries and the level of achievement of WDFW fishery management goals for southeast Washington and LSRCP mitigation goals for replacing angler days lost to the Snake River dams and reservoirs. Other southeast Washington resident trout fisheries should be monitored in the future to provide additional insight regarding their fisheries and the level of contribution to achieving LSRCP and WDFW fishery management goals. [WDFW Nov. 2008]

- Note: In 2003, Spring, Blue, Rainbow, and Deer lakes were only 4 of 31 locations (12.9%) that LSRCP trout were planted for fisheries in S.W. Washington totaling 44,489 trout released out of 213,336 released into all 31 locations (20.9%). [pers. comm. Joe Krakker, USFWS, 2009]

3. Contributions to conservation

Not Applicable

4. Other benefits

In 2003, total angling effort at four of the eight Tucannon Lakes was estimated to be 38,116.5 hrs and 19,749.5 angling days. By applying the average daily angler expenditures for all types of fishing in the state of Washington in 2001 ($319/day from USFWS 2003) to our estimated

angling days that would result in an estimated total economic expenditures of $6.3 million for the partial fishing season at four of the Tucannon Lakes in 2003. This value seems exceptionally high even without adjusting for inflation from 2001 to 2003, and provided a cost/benefit ratio of 1/71.5, which is 5-11 times greater than estimated in 1987. An economic study in Idaho estimated that an angling day in that state in 2003 was worth $115.38 per angler. By applying that average value to our estimate of angling days on the four Tucannon

Lakes provides an economic value of $2.279 million. This value seems more reasonable and provided a cost/benefit of 1/25.8, which is 2-4 times greater than estimated in 1985.

[WDFW Nov. 2008]

E. Research, monitoring, and evaluation programs

- WDFW Fish Management staff from the Dayton office began conducting angler counts and interviews initially at Spring, Blue and Rainbow lakes. In mid-March, Deer Lake was added to the creel surveys because it was small and very close to Rainbow Lake, and thus it could be included in the surveys with minimal effort. Initially, one weekend day and one weekday were selected each week for monitoring the fisheries at these four lakes. Weekday monitoring was increased to one or two days per week during May through mid-July, except May 1-15 when staff shortages and schedule conflicts prevented us from sampling on weekdays. Weekends during the first two weeks of May were sampled. We applied the averages from the nearest weekday creel surveys and angler counts on either side of the missing creel survey sampling period to estimate the angler effort, catch and harvest for all weekdays during May 1-15, and for use in the total estimates for the sampled season. The last weekday surveyed during the season was Tuesday, July 8, and the last weekend sampled was Saturday, July 12.

- This is the first time we have surveyed the Tucannon Lakes fisheries since 1985 when all the lakes were monitored during spring and early summer.

- The fishery monitoring results summarized in this report provide a valuable "snapshot" in time regarding the Tucannon Lakes fisheries and the level of achievement of WDFW fishery management goals for southeast Washington and LSRCP mitigation goals for replacing angler days lost to the Snake River dams and reservoirs. Other southeast Washington resident trout fisheries should be monitored in the future to provide additional insight regarding their fisheries and the level of contribution to achieving LSRCP and WDFW fishery management goals. We recommend that Bennington Lake, the largest lake in southeast Washington stocked with hatchery trout, should be the next site for detailed fishery monitoring in the near future.

[WDFW Nov. 2008]

F. Program conflicts

- In the late 1990s, WDFW ceased all stocking of catchable trout in southeast Washington streams and rivers to minimize any adverse effects on salmon, steelhead and bull trout that are listed as threatened under the Endangered Species Act (ESA). [WDFW Nov. 2008]

IIH. Kamloops Rainbow Trout

A. General information

WDFW manages two hatcheries to produce resident trout for the LSRCP Program. When originally proposed, the trout program was to produce 233,000 trout at 2.5 fpp for a total of about 93,000 pounds. These "catchable-sized" trout were to compensate for the loss of 67,500 angler-days of fishing. During the hatchery siting phase of the program, The Washington Department of Wildlife and Corps agreed that at least 29 stream segments (100-200 feet in length) would be improved with one or more instream structures in lieu of producing 7,000 pounds of hatchery trout (equivalent to two raceways at Lyons Ferry). From 1983 to 1986, 91 structures were built in the Tucannon River, South Fork Asotin Creek, North Fork Asotin Creek, and Asotin Creek. The remaining 86,000 pounds of trout production was incorporated into rearing facilities at Lyons Ferry and Tucannon FH's.

Lyons Ferry (Phase I) was designed to rear 45,000 pounds of trout for release into Washington and Idaho waters. At the time of the hatchery design, WDFW and IDFG estimated that about 6,200 pounds of the total production would be reared for release into Idaho to offset their trout angler losses, with the remainder (38,800 lbs) to go into Washington streams and lakes.

Tucannon FH, located on the Tucannon River, was designed to rear 41,000 pounds for the compensation program. Tucannon FH was an existing resident trout hatchery operated by WDW that was rebuilt for the LSRCP program and completed in 1984.

[USFWS May 1990]

B. Stock/Habitat/Harvest Program Goals and Purpose

1. Purpose and justification of program

Lyons Ferry FH (Phase I) was constructed in 1983 under the LSRCP Program, as authorized by the Water Resources Development Act of 1976, Public Law 94-587, to offset losses caused by the four Lower Snake River dam and navigation locks projects. Lyons Ferry FH was designed to rear 86,000 pounds of rainbow trout (2.5 fpp) for release. [USFWS May 1990]

2. Goals of program

The goal of this program is to compensate for the loss of 67,500 angler-days of fishing (Washington and Idaho) to mitigate for survival reductions resulting from construction and operation of the four lower Snake River dams. [USFWS May 1990]

3. Objectives of program

- The production objectives are 50,000 fingerling Kamloops (triploid) rainbows. This requires 70,000 triploid eyed Kamloops stock eggs (provided by IDFG from Hayspur FH) to meet part of the LSRCP mitigation requirement within Idaho. IDFG prefer to use Kamloops stock because of the survival advantage they exhibit over the Spokane stock (Spokane FH) when released into the Clearwater and Salmon Rivers. [WDFW Sept. 2008]

- The goal of this program is to compensate for the loss of 67,500 angler-days of fishing. [USFWS May 1990]

4. Type of program (Integrated or Segregated)

Segregated: Mitigation - The mitigation goal for this program is to produce approximately 50,000 fingerling rainbow trout (approximately 3,333 pounds or 1,512 kg) for planting in the lower 100 miles (161 km) of the Salmon River and the lower 70 miles (113 km) of the Clearwater River in Idaho. [IDFG Sept. 2002]

5. Alignment of program with ESU-wide plans

This program conforms with the plans and policies of the Lower Snake River Compensation Program administered by the U.S. Fish and Wildlife Service and conforms to Section 10(a)(1b) permit language for this activity. This program has had ESA authorization since the 1992 Chinook salmon listing. [IDFG Sept. 2002]

6. Habitat description and status where fish are released.

Hatchery production for harvest mitigation is influenced but not linked to habitat protection strategies in the Salmon and Clearwater subbasins and other areas. The LSRCP rainbow trout program is operated consistent with existing Biological Opinions. [IDFG Sept. 2002]

7. Size of program and production goals (No. of spawners and smolt release goals)

- Eggs for the trout program are received from IDFG's Hayspur FH. [WDFW Sept. 2008]

Table 12. 2008 Kamloops rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Idaho Rivers	50,000	15	0+	ADLV or ADRV	None	Transfer to and planted by IDFG October 2008

Table 13. 2008 Spokane rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/Elastomer	Pit Tags	Transfer/release Date
Idaho Reservoirs	160,000	60 – 80	0+	None	None	Transfer to and planted by IDFG in April/May 2009
SE Washington Lakes	236,725 500	2.5 – 4 1	1+ 1+	None None	None None	Planted in February through July 2009
SE Washington Lakes	4,000 200	1.5 lbs ea 3.0 / fpp	1+	None	None	Planted in February through May 2009

[WDFW Sept. 2008]

C. Description of program and operations

1. Broodstock goal and source

Eggs for the trout program are received from IDFG's Hayspur FH [WDFW Sept. 2008]

2. Adult collection procedures and holding

Not Applicable

3. Adult spawning

a) Spawning protocols

Not Applicable

b) No. of males and females spawned each year over past 10 years (table)

Not Applicable

4. Fertilization

a) Protocols

Not Applicable

b) Number of eggs collected and fertilized each year over past 10 years (table)

Not Applicable

5. Incubation

- 65,000 Kamloops eyed eggs for Idaho's fingerling program are Kamloops stock, from IDFG's Hayspur Hatchery. These eggs are shipped to the Tucannon FH in January each year. [WDFW Sept. 2008]

- Eyed eggs received from Spokane Hatchery hatch from baskets at Lyons Ferry FH or Tucannon FH and drop into troughs where they remain for 4-8 weeks after feeding commences. Fish are fed after most are buttoned up (usually 1-3 days post swim up). [WDFW July 2002]

6. Ponding

a) Protocols

After initial rearing in troughs, they are transferred to outside circular tanks for intermediate rearing. In July at 75 fpp, they are transferred to Lyons Ferry FH for marking and final rearing. [WDFW Sept. 2008]

b) Number of fry ponded each year, including % hatch each year

See next page.

Kamloops Rainbow Rearing Summary (past nine brood years at the Tucannon and Lyons Ferry Hatcheries)

		Jan-00	Feb-00	Mar-00	Apr-00	May-00	Jun-00	Jul-00	Aug-00	Sep-00	Oct-00	
1999 Brood Year		**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number		70,458	56,949	56,097	58,111	56,224	55,084	47,058	50,661	50,540	**50,500**	**AD/RV**
Size (fpp)			1,710	667	280	170	87	69				
Pounds			33	84	208	331	633	682	#DIV/0!	#DIV/0!	**#DIV/0!**	

		Jan-01	Feb-01	Mar-01	Apr-01	May-01	Jun-01	Jul-01	Aug-01	Sep-01	Oct-01	
2000 Brood Year		**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Transfer To IDF&G**		**External Mark**
Number		70,000	53,277	49,666	43,784	43,720	43,695	41,817	41,448	**36,600**		**AD/LV**
Size (fpp)			1,500	907	303	215	131	97	49	**42.0**		
Pounds			36	55	145	203	334	431	855	**871**	**#DIV/0!**	

			Feb-02	Mar-02	Apr-02	May-02	Jun-02	Jul-02	Aug-02	Sep-02	Oct-02	
2001 Brood Year			**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Transfer To IDF&G**	**External Mark**
Number			79,000	58,154	56,541	56,148	56,000	54,883	54,808	45,136	**41,682**	**AD/RV**
Size (fpp)				1,588	1,107	550	288	205	104		**44.3**	
Pounds				37	51	102	194	268	527	#DIV/0!	**941**	

		Feb-03	Mar-03	Apr-03	May-03	Jun-03	Jul-03	Aug-03	Sep-03	Oct-03	

2002 Brood Year			**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number			82,884	59,060	57,496	53,614	53,478	48,078	47,484	47,324	**47,296**	**AD/LV**
Size (fpp)				1,871	725	280	113	75			**18.0**	
Pounds				32	79	191	473	641	#DIV/0!	#DIV/0!	**2,628**	

	Dec-03	Jan-04	Feb-04	Mar-04	Apr-04	May-04	Jun-04	Jul-04	Aug-04	Sep-04	Oct-04	
2003 Brood Year	**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Rearing**	**Marking / Rearing**	**Transfer To IDF&G**		**External Mark**
Number	82,000	73,834	69,727	69,497	70,134	69,135	60,395	59,491	60,165	**60,147**		**AD/RV**
Size (fpp)			909	471	280	196	107			**15.2**		
Pounds			77	148	250	353	564	#DIV/0!	#DIV/0!	**3,957**	**#DIV/0!**	

	Dec-04	Jan-05	Feb-05	Mar-05	Apr-05	May-05	Jun-05	Jul-05	Aug-05	Sep-05	Oct-05	
2004 Brood Year	**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number	75,000	71,248	65,200	65,021	64,173	54,069	53,986	55,531	53,233	53,083	**53,079**	**AD/LV**
Size (fpp)			1,139	577	389	200	94	78	27	15	**14.8**	
Pounds			57	113	165	270	574	711	1,972	3,539	**3,586**	

		Jan-06	Feb-06	Mar-06	Apr-06	May-06	Jun-06	Jul-06	Aug-06	Sep-06	Oct-06	
2005 Brood Year		**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number		70,000	64,414	64,035	62,507	54,921	53,593	47,597	47,485	46,901	**46,894**	**AD/RV**
Size (fpp)			1,667	830	344	168	92	73	44	25	**23.7**	

Pounds			39	77	182	327	583	656	1,079	1,876	**1,979**	

		Jan-07	Feb-07	Mar-07	Apr-07	May-07	Jun-07	Jul-07	Aug-07	Sep-07	Oct-07	
2006 Brood Year		**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number		65,000	59,119	58,907	53,268	53,229	53,187	53,808	53,700	54,343	**54,324**	**AD/LV**
Size (fpp)			1,433	717	297	162	83	81	39	20	**13.2**	
Pounds			41	82	179	329	641	668	1,377	2,717	**4,115**	

		Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	
2007 Brood Year		**Eyed eggs received at Tucannon**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Rearing**	**Transfer to Lyons Ferry**	**Marking / Rearing**	**Rearing**	**Transfer To IDF&G**	**External Mark**
Number		67,589	60,549	60,034	56,626	56,561	56,186	55,165	54,370	54,105	**53,570**	**AD/RV**
Size (fpp)			1,188	776	404	186	90	78	31	20	**14.5**	
Pounds			51	77	140	304	624	705	1,754	2,705	**3,694**	

[pers. comm. Doug Maxey, WDFW, 2009]

7. Rearing/feeding protocols

See above

8. Fish growth profiles

See above

9. Fish health protocols and issues

A WDFW fish health specialist monitors fish health as least monthly. More frequent care is provided as needed if disease is noted. Treatment for disease is provided by Hatchery Specialists under the direction of the Fish Health Specialist. Sanitation consists of raceway cleaning three times each week by brushing, and disinfecting equipment between raceways and/or between species on the hatchery site. [WDFW July 2002]

10. Chemotherapeutant use

Eyed eggs, fry, and larger juveniles are examined daily by hatchery personnel. Prophylactic treatment of eggs for the control of fungus is prescribed by a WDFW fish health specialist, and may include treatment with formalin or other accepted fungicides. Non-viable eggs and sac-fry are removed by bulb-syringe and the loss documented. Fry and larger juveniles are monitored throughout rearing, with necessary treatments based on mortality rates. [WDFW July 2002]

11. Tagging and marking of juveniles

Lyons Ferry FH receives approximately 52,000 Kamloops stock rainbow trout from Tucannon FH in July each year. They are reared in raceways until August or September, when they are adipose fin clipped and either a right or left ventricle fin clipped (alternating years). [WDFW Sept. 2008]

12. Fish Release

a) Protocols

- In October, IDFG transports and plants the entire population (usually around 50,000 fish) in Idaho Rivers (lower Salmon River and lower Clearwater River), at 15 fpp
- IDFG receives 160,000 Spokane stock rainbow trout fry and transports these fish to designated Idaho waters (inland lakes and ponds) in April or May, at around 60-80 fpp. [WDFW Sept. 2008]

b) Number of fish released each year (subyearlings?; yearlings?; other?)

Table 12. 2008 Kamloops rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/ Elastomer	PIT Tags	Transfer/Release Date
Idaho Rivers	50,000	15	0+	ADLV or ADRV	None	Transfer to and planted by IDFG October 2008

Table 13. 2008 Spokane rainbow trout tagging, transfers and releases.

Site	Number	Size (fpp)	Age	Mark/CWT/Elastomer	Pit Tags	Transfer/release Date
Idaho Reservoirs	160,000	60 – 80	0+	None	None	Transfer to and planted by IDFG in April/May 2009
SE Washington Lakes	236,725 500	2.5 – 4 1	1+ 1+	None None	None None	Planted in February through July 2009
SE Washington Lakes	4,000 200	1.5 lbs ea 3.0 / fpp	1+	None	None	Planted in February through May 2009

[WDFW Sept. 2008]

D. Program benefits and performance

1. Adult returns

a) Numbers of adult returns (need data for the past 10-20 years)

Not Applicable

b) Return timing and age-class structure of adults

Not Applicable

c) Smolt-to-adult return rates

Not Applicable

d) Stock productivity (e.g. recruits per spawner)

Not Applicable

2. Contributions to harvest and utilization (e.g. food banks)

Sport fishery information specific to this activity is not available. Annually, the lower Salmon and Clearwater rivers are sampled to determine presence/absence of program fish and to determine the relative proportion of program fish in the sample. Creel information collected during a 1991 survey on the lower Clearwater River indicated that anglers fished an estimated 203.75 hours to catch an estimated 44 rainbow trout for a catch rate of 0.216 fish per hour. Of the 34 rainbow trout kept, nine originated from the fall fingerling plant program.

The number of fish released from this program and subsequently sampled during summer surveys designed to examine presence/absence and to determine the relative proportion of program fish in the sample is presented in the following table.

Release Year	# of Fish Released to Clearwater R.	# of Fish Released to Salmon R.	Sample Year	# of Program Fish Caught in Clearwater R.	# of Program Fish Caught in Salmon R.
1989	28,290	34,890	1991	3	not sampled
1990	36,490	35,033	1992	not sampled	1
1991	48,200	0	1993	not sampled	0
1992	57,280	0	1994	0	not sampled
1993	28,000	29,400	1995	1	not sampled
1994	30,536	30,536	1996	not sampled	4
1995	25,945	25,945	1997	0	0
1996	0	0	1998	0	0
1997	0	0	1999	not sampled	not sampled
1998	23,450	23,450	2000	0	14
1999	27,000	26,990	2001	not sampled	0
2000	25,245	25,245	2002	n/a	n/a

Stomach contents from 23 rainbow trout associated with this program have been examined to date. No fish or bony fish parts have been identified.

[IDFG Sept. 2002]

3. Other benefits

None identified.

E. Research, monitoring, and evaluation programs

Annual hook-and-line monitoring is conducted in the lower Clearwater and Salmon rivers to determine the relative contribution of program fish to the creel and to collect stomachs for subsequent diet analysis. Sampling generally occurs during the month of August. [IDFG Sept. 2002]

F. Program conflicts

In the late 1990s, WDFW ceased all stocking of catchable trout in southeast Washington streams and rivers to minimize any adverse effects on salmon, steelhead and bull trout that are listed as threatened under the Endangered Species Act (ESA). [WDFW Nov. 2008]

III. References

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www.fws.gov/pacific/Fisheries/Hatcheryreview/

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