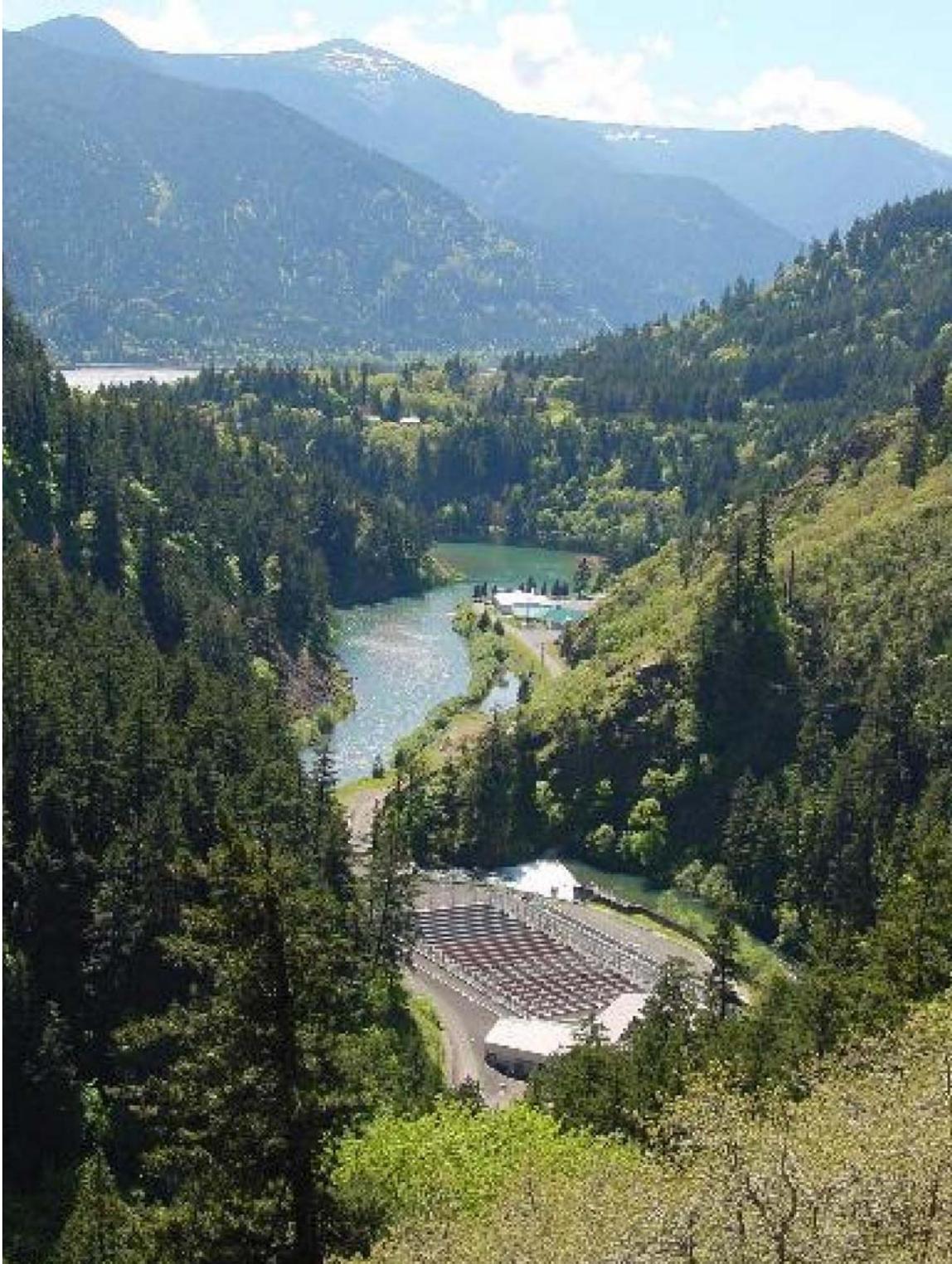


Production of Presmolts from Captive-Reared White River Spring  
Chinook Salmon at Little White Salmon National Fish Hatchery,  
Cook, Washington



## Introduction

### Little White Salmon National Fish Hatchery

The Little White Salmon National Fish Hatchery (NFH) was established in 1898 (although production began in 1896 on an experimental basis) to address the decline of tule fall Chinook, the native salmon stock that returned to the Little White Salmon River.

While the hatchery initially produced the native tule fall Chinook salmon, production was expanded to include chum, Coho, sockeye and spring Chinook salmon in later years. The completion of Bonneville Dam was probably the most significant event of the early years. Not only was the hatchery flooded by the rising Bonneville pool, but the average annual egg take of tule fall Chinook declined by 44%. The natural spawning grounds of this fish were lost as habitat at the mouth of the river was inundated by the Bonneville pool. Led by scientific advances in fish culture, the hatchery program continued to change in an attempt to reverse the decline of the native stock. Today hatchery reform initiatives including an evaluation of natural rearing techniques, incorporation of successful nature's rearing techniques in the design of new raceways, mass marking and coded wire tagging of fish to enhance monitoring and evaluation efforts, and implementation of strict fish health protocols have contributed to a very successful hatchery program.



Little White Salmon NFH at the confluence of the Little White Salmon River and Drano Lake

The hatchery is located in south-central Washington on the Little White Salmon River approximately one mile upstream from the Columbia River. The Little White Salmon River joins the Columbia River at river mile 162. Drano Lake, a natural impoundment at the mouth of the river, is a popular sport and tribal fishing area. The hatchery encompasses 432.59 acres of land including easements. The Annual Report of Lands Under Control of the U.S. Fish & Wildlife Service as of September 30, 2003 shows that 211.39 acres were acquired by other federal agencies, 1.34 by devise or gift, 202.44 acres purchased by the Service, and 17.42 acres by agreement, easement or lease.

The Washington Department of Fish & Wildlife law enforcement office for the Columbia River Gorge is also located on the grounds of Little White Salmon NFH. In addition, five government residences are located on Chinook Drive approximately ½ mile from the hatchery area.

## Willard National Fish Hatchery



Willard NFH middle bank raceways with shade structures

Construction began at Willard NFH in 1952. The Willard facility was authorized by an amendment to the Mitchell Act to mitigate for fisheries lost due to the construction and operation of hydroelectric dams on the Columbia River. The earliest reports available regarding the Willard hatchery indicate that it was planned and constructed as a fall Chinook salmon production facility. The extremely cold water temperatures characteristic of the Willard NFH rearing water supply proved to be too excessive for the rearing of fall Chinook but were adequate for the rearing of Coho and spring Chinook salmon. Located above an

impassable natural waterfall, migrating adult salmon were unable to reach the Willard facility. Adult fish were collected and spawned at Little White Salmon and eggs shipped to Willard to initiate fish production. Co-located with the former Western Fish Nutrition Laboratory, this fish culture station was responsible for making significant early advances in fish nutrition. The laboratory building is now occupied by the U.S. Geological Survey (USGS) Columbia River Research Laboratory, a substation of the Western Fisheries Research Center, Seattle, WA. In 1975, the Little White Salmon NFH and Willard NFH were administratively combined to form the Little White Salmon/Willard NFH Complex (Complex). Administration of the Complex occurs at the Little White Salmon facility. Complex facilities are managed, staffed, and budgeted as a single organization.

Willard NFH is located on the Little White Salmon River approximately 5 miles upstream from the Little White Salmon facility. The hatchery includes 80.10 acres of land purchased by the Service, and an additional 3.70 acres acquired by agreement, easement, or lease. In addition, nine government residences are located adjacent to the hatchery on Coho Loop.

Carson Depot Springs is a separate substation of the Little White Salmon/Willard NFH Complex. Located approximately 9 miles west of Little White Salmon NFH, this facility has a water supply and space for egg incubation. The U.S. Fish and Wildlife Service has an indefinite lease with Burlington Northern Railroad for use of this 55' X 100' land parcel. This area includes a spring water supply and a small building equipped with 48 - 16 tray incubators for egg incubation. Carson Depot Springs historically had been used for incubation of Coho salmon eggs prior to shipment to Willard NFH and for various research activities requiring egg isolation (quarantine to prevent the spread of fish disease for eggs from outside the Little White Salmon River watershed). Rehab of the Little White Salmon NFH well during 1995 produced an adequate supply of groundwater for the early incubation of Willard NFH Coho salmon eggs. The termination of the Willard

NFH Little White Salmon River Coho program in 2004 along with the additional groundwater available at the Little White Salmon facility precluded the need to use



Carson Depot Springs incubation building

Carson Depot Springs in support of Willard operations. Experiments were initiated during 2004 to test the validity of using Carson Depot Springs for the expanded production of upriver bright fall Chinook, a new effort being negotiated by the *U.S. v Oregon* co-managers to reprogram both tule and upriver bright fall Chinook hatchery stocks above Bonneville Dam. The building was remodeled during 2005 in preparation for use during future fall Chinook reprogramming efforts to circumvent the cold water temperatures characteristic of Willard NFH.

## Existing Facilities/Strategies for the Rearing of White River Spring Chinook

### Available Rearing Infrastructure

Both spring Chinook and upriver bright fall Chinook salmon at Little White Salmon National Fish Hatchery are reared in 10-foot x 110-foot x 3.5-foot deep concrete raceways. Constructed in 2001, these raceways are enclosed by 1.5-inch mesh chain link fence and overhead aircraft cable space 6-inches on center to preclude entrance by both mammalian and avian predators. All raceways are equipped with aluminum baffles to maintain a self-cleaning environment and extra metal guides at the tail end to allow installation of double screens to prevent escapement of non-endemic fish into the Little White Salmon River. The entire upper raceway area is designed to facilitate loading of fish onto large distribution trucks for off-site transfer. In addition, conveniently located utility stations can accommodate a variety of fish marking trailers. Both Little White Salmon River and spring water are available at the upper raceways.

Currently, 5 raceways are available that could be potentially used for this program, each raceway containing 3,850 ft<sup>3</sup> of rearing space. As a result, a total of 19,250 ft<sup>3</sup> of raceway space is available for the final rearing of White River spring Chinook.



Little White Salmon National Fish Hatchery upper raceways with predator exclusion system. A total of 5 raceways are available for the final rearing of White River spring Chinook.

In addition, 48 – 15 tray Heath incubators are available at the off-site Carson Depot Springs incubation facility. These incubators, supplied by spring water, can be used to hold freshly fertilized, green eggs from captive broodstock pending ELISA test results. Egg lots can then be segregated based on their incidence of bacterial kidney disease, held to eye-up, and then transferred to Little White Salmon National Fish Hatchery incubators for hatching and rearing to presmolts. The Carson Depot Springs facility was completely remodeled in 2005 and 2006 following installation of new plumbing, insulation, wall and ceiling panels, and water and intrusion alarms.

### Typical Rearing Strategies

Spring Chinook fry are initially transferred from incubation trays to nursery tanks to establish initial feeding with water flows set at 30 gpm. Due to consecutive weekly takes at spawning, tank rearing occurs for only one to two weeks. From tanks, fish are transferred to nine 8 foot x 80 foot lower raceways with water flows ranging from 233 to 466 gpm (flow rates are increased as fish size increases). Fish remain in these raceways until release of the previous brood year from seventeen upper hatchery raceways. Once these raceways are emptied and disinfected, final transfer is made to fifteen 10-foot x 110-foot raceways and two 10-foot x 214-foot upper raceways at water flow rates of 670

gpm and 900 gpm respectively. Fish are held in baffled raceways until release during mid-April of the following year. Fall Chinook are transferred directly from incubation trays to seven remaining un-baffled 10-foot x 110-foot upper raceways. Water used for fall Chinook rearing is a combination of the warmer Bailey spring water which is diverted from the lower hatchery spring box building and river water. After transfer of 1.7 million fall Chinook to the Yakama Nation hatchery located at Prosser, WA, final thinning occurs and raceway baffles are set in place. One month prior to release in late June the Bailey spring water supply is turned off to allow fish an opportunity to acclimate on water derived from the Little White Salmon River.

Fish are fed Bio-Oregon™ (Warrenton, OR) Starter #2, #3, Bio-Moist Grower 1.0mm, 1.3mm, 1.5mm and Bio-Moist Feed 2.5mm and 3.0mm feeds. Fish, initially fed by hand, are fed once an hour, eight times per day and those fed by automatic tank feeders receive feed every half hour. As fish grow and feed size increased, feeding frequency is reduced. At the time of release fish are fed 2 to 3 times a day. Daily feed rations are determined by water temperature and fish size, and are adjusted when feed waste is observed. Once final loadings are achieved, all spring Chinook undergo a prophylactic medicated feed treatment with erythromycin thiocyanate for a minimum of 21 days. The treatment is designed as a preventive measure to reduce the incidence of BKD and is applied at a dosage rate of 100 mg/kg body weight. A second medicated feed treatment is completed during the fall for fish destined for future transfer to the Umatilla River, Oregon as specified in the Umatilla Hatchery and Basin Operation Plan. If deemed necessary by fish pathologists, a second treatment may also be given to the other spring Chinook. The treatments are covered under provisions of section 512 of Federal Food, Drug and Cosmetic Act, INAD 4333.

Raceway cleaning is performed full length for un-baffled raceways while baffled raceway cleaning involves flushing of the lower compartment. All waste from cleaning operations is diverted to the pollution abatement circular clarifier. Fish mortalities are removed and recorded daily and equipment is disinfected between individual fish lots. Water temperatures are monitored daily and any unusual fish behavior or culture incidents are reported to hatchery supervision.

Fish are sampled approximately every two weeks to determine growth and feed rates during early rearing and then once a month after reaching approximately 100 fish per pound. Condition factors (K) are taken once a month and again prior to release. Density at time of release is programmed not to exceed a 0.20 density index for spring Chinook and 0.30 density index for upriver bright fall Chinook.



Little White Salmon National Fish Hatchery upper raceways showing baffled and unbaffled raceways. The baffled raceways are self-cleaning.

### Available Equipment

As mentioned previously, the new hatchery raceways were intentionally designed to facilitate fish loading onto distribution trucks for off-site transfer and release. To assist with this effort, existing hatchery equipment includes an overhead distribution truck fill station with available river, spring and well water supplies; adequate turn around area to accommodate semi tractor-trailer distribution units; removable predator exclusion gate panels and raceway baffles; and two Aqua-Life hydraulically operated fish pumps and dewatering towers capable of transferring both subyearling and yearling sized fish from hatchery raceways to fish distribution tanks.

## Production Potential

### Production Goals

Staff of Little White Salmon National Fish Hatchery have been asked to consider the following preliminary production goals if a decision was made to rear White River spring Chinook at Little White Salmon National Fish Hatchery:

Number: up to 200,000  
Duration: full-term, smolt size, transfer as pre-smolts  
Density: maximum density index of 0.06  
Size: 10-15 fish per pound

Two limitations currently exist based on the preliminary production goals established for the White River spring Chinook program at Little White Salmon National Fish Hatchery. First, the characteristic cold water temperature of the Little White Salmon River, the principal rearing water supply, restricts growth. In the best (warmest) years, full-term yearling spring Chinook smolts have achieved a maximum of 13 fish per pound during the 3<sup>rd</sup> week of April, although 15 fish per pound is goal (and normally attainable). Traditional transfer size of presmolt spring Chinook to the Umatilla River during mid-March is approximately 18 fish per pound (for the most recent transfer, brood year 2003, 17.9 fish per pound on March 15, 2005).

Secondly, the upper rearing density limit of a 0.06 density index restricts the number of fish that can be reared in a raceway. At this density index, the full-term rearing of 200,000 spring Chinook in 5 raceways cannot be achieved. The following table identifies maximum production based on density index and size at transfer.

Table 1. Maximum production potential of White River spring Chinook as limited by density index and size at release (transfer).

		Size at Release/Transfer (fish per pound)			
		15	18	20	22
Density Index	0.06	97,020	111,019	119,612	127,457
	0.10	161,700	185,031	199,353	212,428
	0.12	194,040	222,037	239,224	254,913
	0.15	242,550	277,547	299,030	318,641

The current Umatilla River spring Chinook program at Little White Salmon National Fish Hatchery is similar to the proposed White River program in that production is initiated following the receipt of eggs collected and initially incubated off-station, and fish are reared to a presmolt size prior to transfer back to their river of origin. The following table contains hatchery performance data for brood year 2003 Umatilla River spring Chinook reared at Little White Salmon National Fish Hatchery. The following data is representative of growth rates that might be achieved following the initial feeding of White River spring Chinook. It is important to note that the Umatilla Basin Annual Operations Plan requires two erythromycin feed treatments as prophylaxis for bacterial kidney disease.

Table 2. Brood year 2003 growth and performance for Umatilla River spring Chinook reared at Little White Salmon National Fish Hatchery. Production is initiated following the off-site spawning of adults on the Umatilla River and receipt of eyed eggs at Little White Salmon National Fish Hatchery during mid-late October.

<u>Date</u>	<u>No. Fish</u>	<u>Weight</u>	<u>Mortality</u>	<u>Size (fpp)</u>	<u>Length (in.)</u>	<u>Density Index</u>	
16-Jan-04	219,524	204	0	1,073	1.373	0.35	initial feeding in nursery
30-Jan-04	216,993	241	2,531	899.7	1.456	0.39	
11-Feb-04	216,993	306	0	710.2	1.575	0.06	*thinned to lower
1-Mar-04	216,222	542	927	399.0	1.909	0.09	raceways 51-52
17-Mar-04	216,222	811	0	266.5	2.184	0.11	
31-Mar-04	206,219	914	334	225.7	2.309	0.12	*post mass marking
30-Apr-04	206,131	1,641	88	125.6	2.807	0.19	inventory correction
10-May-04	206,131	1,934	0	106.6	2.965	0.21	
20-May-04	206,131	2,397	0	86.0	3.184	0.04	*thinned to upper
1-Jun-04	205,951	2,528	179	81.5	3.243	0.04	raceways 8-12
30-Jun-04	205,792	3,410	159	60.3	3.584	0.05	
31-Aug-04	205,613	6,297	78	32.7	4.398	0.08	
30-Sep-04	205,585	7,470	28	27.5	4.656	0.09	
29-Oct-04	205,531	8,446	54	24.3	4.850	0.10	
30-Nov-04	205,507	9,012	24	22.8	4.957	0.10	
31-Dec-04	205,491	9,926	16	20.7	5.119	0.11	
31-Jan-05	205,481	10,033	10	20.5	5.137	0.11	
28-Feb-05	205,463	11,280	18	18.2	5.342	0.12	
15-Mar-05	205,463	11,458	0	17.9	5.370	0.12	transfer to Imeques

It is important to note that this is considered a very preliminary scoping document. Additional discussion needs to occur, both within the agency (U.S. Fish & Wildlife Service) and with external partners, to discuss potential policy and fish health ramifications of this program.