Mid-Columbia Coho Reintroduction Project
At
Willard National Fish Hatchery

Coho Salmon Production
Annual Report
February 15, 2005 – February 14, 2006

BPA Project No. 1996-040-00
Contract No. 00017067

Speros Doulos
Dan Magneson
U.S. Fish & Wildlife Service
Little White Salmon/Willard National Fish Hatchery Complex
Cook, Washington

April 2006

Background

As part of the U.S. Fish and Wildlife Service (USFWS) Little White Salmon/Willard National Fish Hatchery Complex, Willard National Fish Hatchery (NFH) has produced fish for reintroduction into the Wenatchee River Basin, WA since 2001. Located near the towns of Cook and Willard, WA five miles upstream from the Columbia River, the hatchery draws water from the Little White Salmon River to meet a production capacity of 2.0 million Coho salmon.

The Little White Salmon/Willard National Fish Hatchery Complex has assisted the Yakama Nation in an effort to reestablish Coho salmon in the Upper Columbia River system using both locally adapted and lower river stocks of fish. The highest priority rearing program involves the use of gametes collected from fish returning to the Wenatchee River system in an attempt to develop a locally adapted stock of fish. The long-term goal of this project is to reestablish Coho salmon with enough numbers to be near carrying capacity and provide harvest opportunities for tribal and non-tribal fishers.

Willard NFH, with funding from the BPA, has increased the number of fish reared for reintroduction into Mid-Columbia tributaries of the Wenatchee River Basin. Coho salmon produced by Willard NFH including egg incubation, nursery rearing and raceway rearing are transferred to Mid-Columbia River sites located in the Wenatchee and Methow River Basins as part of the Yakama Nation Coho reintroduction effort. Specifically, the USFWS provides labor and facilities to produce 650,000 Coho salmon pre-smolts during an 18-month period for transfer, acclimation, and release from sites designated by the Yakama Nation. Production is initiated using eggs derived from adult fish returning to the Wenatchee River, and previously from adult Coho returning to other lower Columbia River facilities following a shortfall in the number adults returning to the Wenatchee River. Incubation and nursery rearing are accomplished using Heath incubators and concrete nursery tanks located in the Willard hatchery building. Final rearing and subsequent transfer occur in outdoor 8’ x 80’ concrete raceways.

Brood Year 2003 – Transfer of Coho Salmon Pre-Smolts to the Methow and Wenatchee River Basins

Final rearing of Brood Year 2003 Coho salmon occurred on March 25, 2005 when a total of 647,455 pre-smolts were transferred to a variety of sites within the Methow and Wenatchee River Basins. Fish health was excellent at the time of transfer and this distribution of fish occurred without incident.

The following table summarizes the transfer of Brood Year 2003 Coho from Willard NFH:

Lower Columbia River Origin Coho Salmon (LCR)							
RWY #	Number	Fish/Lb.	Weight	Length	Density Index	Flow Index	Transport By – Destination - Date
1	37,453	20.04	1,869	5.328	0.23	0.58	By YIN to Winthrop NFH Back Channel on 3/21/05
2	38,600	21.35	1,808	5.216	0.23	0.58	By YIN to Winthrop NFH Raceway C12 on 3/21/05
3	36,657	19.68	1,863	5.360	0.23	0.58	By ODFW to Winthrop NFH Back Channel on 3/10/05
4	36,360	20.03	1,815	5.328	0.22	0.57	By ODFW to Winthrop NFH Back Channel on 3/10/05
LCR	**149,070**		**7,355**				
Wenatchee River Origin Coho Salmon (WEN)							
RWY #	Number	Fish/Lb.	Weight	Length	Density Index	Flow Index	Transport By – Destination - Date
5	27,809	20.86	1,333	5.257	0.17	0.42	By ODFW to Beaver Creek on 3/22/05
6	28,531	20.87	1,367	5.256	0.17	0.43	By ODFW to Leavenworth NFH -LFL #1 on 3/22/05
7	27,336	19.15	1,427	5.409	0.17	0.44	By ODFW to Leavenworth NFH -LFL #3 on 3/23/05
8	29,079	20.04	1,451	5.328	0.18	0.45	By ODFW to Leavenworth NFH -SFL #23 on 3/23/05
9	30,362	19.75	1,537	5.354	0.19	0.48	By ODFW to Leavenworth NFH -LFL #3 on 3/23/05
10	32,908	20.97	1,569	5.248	0.20	0.50	By ODFW to Butcher Creek on 3/17/05
11	35,050	24.70	1,419	4.969	0.19	0.48	By ODFW to Butcher Creek on 3/17/05
12	32,982	22.40	1,472	5.133	0.19	0.48	By ODFW to Coulter Pond on 3/17/05
13	28,444	19.44	1,463	5.382	0.18	0.45	By ODFW to Leavenworth NFH -LFL #2 on 3/24/05
14	33,029	23.56	1,402	5.048	0.18	0.46	By ODFW to Leavenworth NFH -LFL #2 on 3/24/05
15	31,012	20.35	1,524	5.300	0.19	0.48	By ODFW to Leavenworth NFH -LFL #2 on 3/24/05
16	30,099	18.81	1,600	5.441	0.19	0.49	By ODFW to Leavenworth NFH -SFL #8 on 3/24/05
17	30,601	19.38	1,579	5.387	0.19	0.49	By ODFW to Leavenworth NFH -LFL #3 on 3/25/05
18	30,303	20.59	1,472	5.280	0.18	0.46	By ODFW to Leavenworth NFH -LFL #7 on 3/25/05
19	29,045	19.47	1,492	5.379	0.18	0.46	By ODFW to Mahar Pond on 3/16/05
20	41,768	20.69	2,019	5.271	0.25	0.64	By ODFW to Mahar Pond on 3/16/05
WEN	**498,358**		**24,126**				
Total	**647,455**		**31,482**				

Brood Year 2004 - Incubation and Nursery Rearing of Coho Salmon Eggs and Fry

Adult Coho salmon returning to the Wenatchee River Basin are trapped at Dryden Dam, spawned, and the fertilized eggs are then incubated within facilities located at Peshastin and Entiat NFH. After eye-up, eggs are shocked, sorted to remove any unfertile eggs, enumerated and shipped to Willard NFH. For Brood Year 2004, eyed egg shipments from Peshastin totaled 420,000 and while those from Entiat NFH totaled 245,000. The combined total was 665,000.

Picking and enumerating eggs

Upon receipt of eyed eggs from Peshastin and Entiat NFH in December 2004, egg numbers were confirmed with the eggs being measured and transferred into Heath incubation trays at a target level of approximately 5,000 eggs per tray. Dates of hatching and completion of yolk sac absorption (i.e. ready to leave trays and be transferred to nursery tanks to begin feeding) were projected based on total temperature units starting from the time of fertilization through time of receipt and subsequent incubation in the constant 41.7^{o} F temperature of the Willard NFH well water incubation supply. The eyed eggs were incubated under a constant flow of 3 gallons per minute (GPM), increased to 4 GPM at hatching. Eggs were hand-picked to remove unfertile embryos and prevent fungus from adhering to adjacent fertile eggs. For Brood Year 2004, mortality in the incubation trays varied from a low of 1.25% for eggs originating from Peshastin to a high of 2.41% for the eggs originating from Entiat NFH. This translates into the hand-picking of 11,183 unfertile eggs from the remaining 653,817 eggs.

Nursery rearing fry

Initial feeding occurred during February 2005 when a total of 653,817 swim-up fry were placed into nursery tanks. As of March 31, 2005 there were 646,763 Coho fry on-hand (411,150 from Peshastin and 235,613 originating from Entiat NFH). Survival from initial feeding through March 31 was 99.13% and 98.55% respectively. Additional nursery tank space was used to rear these fish at low densities (reducing normal rearing density indices by half at time of release), ultimately improving fish health and quality.

Feeding is performed by automatic feeders set to feed every 1/2 hour over the course of 12 hours; tanks are cleaned every other day (by alternating from cleaning one side of the nursery one day to cleaning the other side the following day).

Overall, the Brood Year 2004 swim-up fry were generally smaller than usual, with most fish in the 1300 – 1400 fish per pound (fish/lb) range instead of the more typical 1200 fish/lb range.

The average fish size for all Coho salmon in the nursery was 554.47 fish/lb on March 31.

Brood Year 2004 - Outdoor Rearing of Coho Salmon in Raceways.

On May 4, 2005, the Coho began transfer from the 40 indoor nursery tanks to 20 – 8-foot X 80-foot outdoor concrete raceways at a rate of 2 tanks per raceway. Nursery tanks 3 -12 and 41- 50 were transferred to raceways 1- 10 on May 4 and tanks 13 - 22 and 31 - 40 were transferred to raceways 11 – 20 on May 5. Fish sizes averaged approximately 275 fish/lb at that time. All 20 outdoor raceways

are covered by a shade cover/structure system that provides an optimal rearing environment necessary for the production of healthy, high-quality juvenile Coho salmon. These shade covers consist of black polypropylene tarps that are attached to a 3-inch X 3-inch steel frame structure. For 2005, the shade structure over raceways 3 and 4 were covered with white tarps to determine whether the area beneath them is cooler in the summer and brighter in the cloudy weather of winter. (See Photograph Section; Figures 28 - 30.) Secondly, testing will show how durable white covers are in comparison to the standard black covers, especially in resisting damage from ultraviolet radiation. The expected useful life of the standard black covers is 5 years. This performance data will be useful during future orders to assure the use of the most durable product available. Again this year flow rates were increased in each raceway from the standard 390 GPM to 600 GPM (as performed in 2004 with the BY03 Coho salmon). This should further contribute to the goal of producing the highest-quality juvenile Coho possible. It is projected that Coho pre-smolts will be transported to acclimation sites within the Methow and Wenatchee River Basins at an approximate size range of 20 - 22 fish/lb during March 2006.

Additional predator exclusion fencing was installed around the perimeter of Willard NFH outdoor raceways during the year using USFWS maintenance funding. The additional fencing is an attempt to address and avert otter and mink predation problems in the future. While predator activity has generally been light to non-existent in recent years, otters were gaining entry to hatchery raceways in the spring and again in late summer. Previous depredation problems resulted in the installation of a 6-foot high, 2-inch mesh chainlink fence around all raceways. This newest project incorporates a 3-foot height of 11-gauge, 1-inch mesh chainlink around the base of the existing fence, welding in extra lengths of pipe to eliminate all gaps created at gates, and utilizing a single strand of aluminum electric fence wire near the top. Electricity is controlled by Intermatic Model SS7 series programmable timers (switching off at 7:00 AM and coming back on again at 4:30 PM) coupled with ground-fault circuit interrupter (GFCI) outlets within a weather-proofed housing. These outlets are in turn connected to Zareba “Red Snap’r” Model RS3 chargers. (See Photograph Section; Figures 40 - 42.)

Feeding, Cleaning, Sampling and Releasing

Work is performed for fish rearing and culture to maintain a high quality rearing environment and optimal fish health. Hatchery staff also assist USFWS, Yakama Nation, and other agency staff during the marking, loading and distribution of fish to designated acclimation/release sites. Fish marking occurred during June 7 – 28, 2005 and was accomplished with a single automated marking trailer. The automated marking trailers feature the latest in fish marking technology and this was the first use of such a trailer at Willard NFH. Automated trailer mark quality appeared excellent. The actual marks employed consisted of coded-wire tags only with no fin clips involved. For raceways 1 - 10, 5 tag codes were used or 1 tag code for each pair of raceways. For raceways 11 - 20, fish in each raceway

were assigned a single unique code. Additionally, raceways 14 -16 were "body-tagged" by a regular marking trailer and contracted employees. This type of tagging consisted of injecting a second, blank wire tag just beneath and off to the side of the adipose fin. Information collected from these body tags will be used at a later date to identify fish that originate from releases above Tumwater Dam. Survival past this dam has been relatively poor, and Coho that ultimately survive and return as adults will be collected and spawned separately to select for fish that better negotiate this dam. These Coho will be differentiated by the presence of the second body tag near the adipose fin using a hand-held "wand" detector. Traditionally, tags are extracted at spawning and subsequently read before mating to determine the origin of the adult fish. The use of this body tag is necessary to establish the parentage before spawning in order to properly pair adult fish. (See Photograph Section; Figures 31 - 34.)

Coho salmon in raceways are hand fed 4 times per day from initial ponding through May 31, 3 times per day June 1 – 30, and then 2 times per day from July 1 through the remainder of raceway rearing. From October 16 until February 14, fish in raceways 5 -8 were fed at a reduced rate (approximately 50% of prescribed level) in hopes of better mimicking the winter growth patterns observed in wild fish. Raceways are cleaned once per week, and sample counts to monitor fish growth are performed at the end of each month and occasionally at mid-month to validate growth and feeding rates.

Direct counts provided by the marking trailer resulted in population numbers lower than previously estimated after deducting mortality that occurred during incubation and early rearing (645,263 on May 31 compared to the post-marking inventory of 591,526 on June 30, 2005). Generally speaking, the populations showed remarkable consistency from one raceway to the next within the groups originating from both the Peshastin and Entiat egg shipments.

During the week of December 12, 2005 Yakama Nation fisheries staff PIT-tagged a total of 20,246 Coho at Willard NFH.

Fish health has been exceptionally good to date, with no outward appearance of potential fish health problems. Mortalities have been quite low. As of December 31 the Coho numbered 591,022 and had attained an average size of 26.00 fish/lb.

Brood Year 2004 – Transfer of Coho Salmon Pre-Smolts to the Wenatchee River Basin

Four raceways of Brood Year 2004 Coho salmon located at Willard NFH were transferred to the Wenatchee River Basin during January 2006. This early transfer group marked with 4 unique tag codes will be allowed to acclimate over-winter prior to a Spring 2006 release.

The following table summarizes Brood Year 2004 Coho salmon transfers to date:

Wenatchee River Origin Coho Salmon (WEN)							
RWY #	Number	Fish/Lb.	Weight	Length	Density Index	Flow Index	Transport By – Destination - Date
17	28,605	26.28	1,088	4.867	0.15	0.37	By YN to Icicle Creek SFL 25 on 1/10/06
18	29,513	28.93	1,020	4.714	0.14	0.36	By YN to Icicle Creek SFL 24 on 1/10/06
19	28,932	26.09	1,109	4.879	0.15	0.38	By YN to Icicle Creek SFL 12 on 1/17/06
20	27,978	27.61	1,013	4.788	0.14	0.35	By YN to Icicle Creek SFL 11 on 1/18/06
Total	**115,028**		**4,230**				

Coho remaining in Willard NFH raceways are designated for transfer to acclimation sites within the Methow and Wenatchee River Basins during mid-March 2006.

The following table includes data for Willard NFH Brood Year Coho salmon as of February 1, 2006:

Wenatchee River Origin Coho Salmon (WEN)						
RWY#	Number	Fish/Lb.	Weight	Length	Density Index	Flow Index
1	31,226	26.73	1,168	4.840	0.16	0.40
2	27,374	26.73	1,024	4.840	0.14	0.35
3	27,977	26.73	1,047	4.840	0.14	0.36
4	28,549	26.73	1,068	4.840	0.14	0.37
5	28,269	26.73	1,058	4.840	0.14	0.36
6	28,050	26.73	1,049	4.840	0.14	0.36
7	28,027	26.73	1,049	4.840	0.14	0.36
8	29,053	26.73	1,087	4.840	0.15	0.37
9	29,215	26.73	1,093	4.840	0.15	0.38
10	29,654	26.73	1,109	4.840	0.15	0.38
11	28,898	26.73	1,081	4.840	0.15	0.37
12	28,777	26.73	1,077	4.840	0.15	0.37
13	29,835	26.73	1,116	4.840	0.15	0.38
14	34,112	26.73	1,276	4.840	0.17	0.44
15	33,419	26.73	1,250	4.840	0.17	0.43
16	33,204	26.73	1,242	4.840	0.17	0.43
Total	**475,639**		**17,795**			

Figure 1 Larry Leighton, Complex Maintenance Worker, providing snow removal service at the quarters area.

Figure 2 Bryan Charlton, Fish Culturist at Willard NFH, removing mortalities from a Heath-style incubation tray. (Note tubing supplying a constant supply of fresh water during this process.)

Figure 3 Pat Cushman, Fish Culturist at Willard NFH, tracking data via computer.

Figure 4 Transferring the swim-up fry from the incubation tray into a 36-quart cooler.

Figure 5 Transporting the swim-up fry to a nursery tank.

Figure 6 Pouring the swim-up fry from the cooler into the nursery tank.

Figure 7 Dan Magneson, Supervisory Fishery Biologist for Willard NFH, weighing a sample of Brood Year 2004 fry from a nursery tank.

Figure 8 Sample counting in the nursery.

Figure 9 Loading the Northstar Louden II feeders in the morning.

Figure 10 Feeders are set to go off every ½ hour over the course of a 12-hour day.

Figure 11 Cleaning nursery tanks.

Figure 12 Weighing a sample of Brood Year 2003 smolts.

Figure 13 Sample-counting Brood Year 2003 smolts.

Figure 14 Fish are held off feed one full day prior to marking and 2 full days prior to distribution by tanker truck.

Figure 15 Crowding the fish up to the intake of the fish pump.

Figure 16 Inlet of fish pump.

Figure 17 Raceway 1 being loaded into a Yakama Nation truck

Figure 18 Operating the fish pump.

Figure 19 Raceway 1 being loaded.

Figure 20 Flushing sediments accumulated over the winter within the Large Screen Chamber settling basin. (2004 Photo.)

Figure 21 Cleaning the raceways with a fire hose following transfer of smolts. (2004 Photo.)

Figure 22 Set up for applying disinfectant to raceways.

Figure 23 Applying a 200 ppm chlorine solution

Figure 24 Transferring the coho from the indoor nursery tanks to outdoor raceways using the “hatchery helper.”

Figure 25 Flexible 3" hose from the “hatchery helper” out to raceway.

Figure 26 Running a foam rubber ball through the hose to chase out stragglers.

Figure 27 Retrieving the foam rubber ball as it exits the hose.

Figure 28 Overview of coho raceways showing the white tarps in place.

Figure 29 Light level beneath the white tarps. (Photo taken at same time as Figure 30.)

Figure 30 Light level beneath black tarps. (Photo taken at same time as Figure 29.)

Figure 31 Automated marking trailer

Figure 32 Forward section within automated marking trailer.

Figure 33 View to rear of automated marking trailer.

Figure 34 Performing the "body-tagging" inside the manually-operated marking trailer.

Figure 35 Burning of accumulated woody debris near the sedimentation pond by USFWS Fire Management staff.

Figure 36 Trimming of trees growing into power lines adjacent to raceway 50.

Figure 37 Skamania County Youth Success Program workers applying a new layer of plastic sheeting atop the Japanese knotweed patch.

Figure 38 Skamania County Youth Success Program workers painting clothesline poles at the quarters area.

Figure 39 Skamania County Youth Success Program workers painting the swingset at the quarters playground area.

Figure 40 Cutting and welding sections of pipe to close gaps in the chainlink fence.

Figure 41 3-foot height of 1" chainlink applied over lower portion of existing 2" chainlink.

Figure 42 Set up for applying and controlling electric fence power at Willard NFH. (Note roof installed to minimize exposure to moisture.)