

2009-2010 CEDAR RIVER SOCKEYE HATCHERY ANNUAL REPORT

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Introduction:

Since 1991 the Washington Department of Fish and Wildlife (WDFW) has operated the Cedar River Sockeye Hatchery at Landsburg, Washington at river mile (RM) 22 on the Cedar River. The program was started in response to a decline in naturally spawning sockeye salmon in the Cedar River watershed. In addition to the goal of stabilizing declining populations the program was designed to provide an opportunity to evaluate culture methods that are unique to sockeye culture and test their effectiveness.

History

In response to declining sockeye populations in the Cedar River basin the WDFW began a supplementation program in the main tributary of Lake Washington, the Cedar River. In 1991, after a few years of minimal success with an egg box program on the Cedar River, the WDFW began operation of the interim hatchery at Landsburg Dam near Ravensdale, Washington.

For the first two years adult broodstock for the program were captured by gillnet in the lower river at various locations. Due to salmon redd damage, high prespawn mortality, and relative inefficiency of gillnetting for broodstock, WDFW installed a temporary trap and weir at Cavanaugh Ponds Park (RM 6.4). This trap and weir was operated for 15 years but was replaced due to its susceptibility to high water damage, cost and impact of installation and removal requiring heavy equipment, and lack of access to adults who spawned below RM 6.4. In the fall of 2008 a new, floating resistance-board weir and trap was installed at RM 1.8 between Renton's Cedar River Park and Narco Property just upstream of where I-405 crosses the Cedar River.

The interim hatchery itself is situated on Seattle Public Utilities (SPU) property at the bottom of the Cedar River Watershed parcel. It was built in stages over 17 years of operation and consists mostly of temporary structures and facilities and is capable of incubating up to 18,700,000 eggs. In the first year of operation 2,079,100 sockeye fry were released from the hatchery, this is the lowest number of fry released during the program's history. The largest number of fry released was in 2000 when 17,209,000 fry were released. The average from 1991 through 2009 is 8,513,200 fry per year.

Program Goals

The primary goals of the Cedar River Hatchery program are to enhance the Lake Washington sockeye population to levels allowing for sport and tribal fishing opportunities; to afford scientists the opportunity to study and learn about sockeye salmon and their life cycle; and to not negatively impact other species in the Cedar River watershed.

Specifically, to collect, hold, and spawn enough adult sockeye broodstock to achieve a maximum green egg take of 18,700,00 eggs and release a maximum of 17,000,000 fry after a normal egg to fry loss of 9.1%. Additionally, the hatchery serves to ensure stable sockeye fry production in years when floods impact the survival of natural production in the river.

For the 2009-2010 season adults were collected at the floating resistance-board weir, at the new trap location in Renton, Washington (RM 1.8). Adults were then hauled by truck to one of four 16-foot diameter circular holding ponds at the Hatchery site in Landsburg. When the adults were ready to be spawned gametes were collected at the adult pond area, transported to and fertilized in the fertilization room, and then put down in one of either the 40 vertical Heath-type or 55 kitoi incubators. When the eggs were in the eyed stage they were shocked, picked, and put back into their incubators to continue incubation until they swam up and were ready to be ponded. At defined times during incubation chilled water was substituted for ambient temperature water to provide distinguishing thermal marks on the otolith bones of all of the hatchery fish. Once the fry swam up and were ready to be ponded they were moved to one of either seven, 6-foot diameter circular ponds or four, 15-foot by 3-foot rectangular fiberglass raceways. In the 2009-2010 season all of the fry were fed for approximately 14 days and then hauled by truck and released at the mouth of the Cedar River (RM 0.1).

Methods and Results:

Adult sockeye counts through the fish ladder at the Ballard Locks conducted by the WDFW and Muckleshoot Indian Tribe biologists indicated that the 2009 run was small. The total count for the season (6/12/2009-7/31/2010) was only 21,718 (<http://wdfw.wa.gov/fish/sockeye/counts.htm>), less than 1/10 the 350,000 required to have a sport fishing season on Lake Washington.

Trap and Weir Operations:

The weir structure is made up of 3-foot by 20-foot panels of 1-inch diameter schedule 40 PVC pipe spaced with 1-inch spaces between them. Panels are linked together with stringer through overlapping pieces of adjoining panels. The panels are anchored to the river bottom at the upstream edge of the structure by hooking to the substrate cable. The substrate cable runs through eyelets on the substrate rail that is anchored to the river bottom by 38-inch rebar stakes driven into the gravel substrate. The weir panels float up and downstream from the substrate rail lifted by the floatation from the air trapped inside the 1-inch PVC pipes that are capped on both ends and foam in the resistance boards. A 2-foot by 3-foot plywood/Styrofoam hinged resistance board is attached at the downstream end of each panel. Additional floatation during higher flows is achieved by setting the resistance boards to act like flaps on the wings of an airplane, using resistance against the fast moving water to lift the panel. At either side of the weir there are vertical bulkheads that block fish from passing around the end of the submerged portion of the panels. The weir is connected to the riverbank at one end by a customizable, rigid aluminum picket section and at the other (north) end with a custom, rigid aluminum picket section with a 2-foot wide tip gate. The tip gate was designed so that the gate could be opened and closed by someone on the walkway on top of the rock wall on the north bank to allow unimpeded upstream fish passage. The aluminum picket and tip gate structure are propped up against the river current by tripods and are attached to the weir panels by connecting to the bulkheads. There are also two weir panels (north trap door

and south trap door) with 2-foot square trap doors that can be opened or closed to allow for unimpeded upstream fish passage through the weir.

In addition to the new tip gate on the north end of the weir the opening to the trap was modified in 2009. The tunnel opening from the original design was replaced with a 6 foot wide opening immediately downstream of the trap. This was accomplished by constructing and installing two bulkheads to connect the downstream corners of the trap with the adjoining weir panels. The result was that, as fish swam upstream they had completely open access to the downstream end of the trap.

The trap itself is a 6-foot by 12-foot by 6-foot high cage made of aluminum. It consists of individual frame panels that are bolted together, individual pickets that slide into holes drilled in the frame, lids that are bolted to hinges on the top of the walls, and an adjustable vee-trap leading into the cage.

In addition to the weir and trap there is an aluminum debris shield that was installed upstream of the trap to deflect large debris floating down the river, protecting the trap.

On September 10, 2009 WDFW and SPU installed the weir near the Cedar River Park, Renton location just upstream from the I- 405 overpass. Low flows, good weather, and the ease of access provided by the new driveway made for a quick, approximately 3-hour installation.

Trapped sockeye were sorted by sex from the trap into two aluminum live boxes for holding until they were loaded into rubber carrying boots, and loaded into the tanker trucks to be hauled to the adult holding ponds at the Cedar River Hatchery. In general, on days when there were more than 50 of one gender of sockeye to be hauled SPU hauled fish in their tanker truck, and on days where there were fewer fish WDFW would haul in their smaller trucks. SPU and WDFW staff worked together to load and haul the adult fish.

In addition to the 2,907 sockeye trapped and hauled from the weir and trap, 165 males and 62 females were transported to the hatchery from the SPU fish passage facility at the Landsburg Diversion Dam.

WDFW and SPU staff removed the trap and weir by hand from the river on November 5 in under four hours. The substrate rail was left in place in the river.

Table 1, Trap Data

Date	Trap Configuration (Hours Set/Fishing)					Fish Activity At the Weir		
	Trap	South Trap Door	North Trap Door	Deep End Panels	Tip Gate	Sockeye Hauled (Trap)	Sockeye Trapped and Passed Upstream	Chinook Trapped and Passed Upstream
11-Sep	0	24	24	24	0			
12-Sep	0	24	24	24	0			
13-Sep	24	24	24	24	8			
14-Sep	24	24	24	24	16	8		3
15-Sep	24	24	24	24	16	15		1
16-Sep	24	24	24	24	14	17		1
17-Sep	10	10	10	24	7	0	1	4
18-Sep	16	16	16	24	0			
19-Sep	24	24	24	24	0	0	8	2
20-Sep	24	24	24	24	0	10	9	1
21-Sep	24	24	24	24	0	57		2
22-Sep	24	16	16	24	8	111		
23-Sep	24	24	24	24	16	75		2
24-Sep	24	24	24	24	10	50		2
25-Sep	24	24	24	24	0	95		1
26-Sep	24	24	24	24	0	96		
27-Sep	24	24	24	24	0	0		1
28-Sep	24	24	24	24	0	40		
29-Sep	24	24	24	24	8	45		
30-Sep	24	24	24	24	10	94		1
01-Oct	24	24	24	24	8	62		1
02-Oct	24	24	24	24	8	85		2
03-Oct	24	24	24	24	0	137		1
04-Oct	24	24	24	24	8			
05-Oct	24	24	24	24	16	100	44	2
06-Oct	24	24	24	24	8	28	64	1
07-Oct	24	24	24	24	8	90		
08-Oct	24	24	24	24	8	111	1	1
09-Oct	24	24	24	24	8	179	3	
10-Oct	24	24	24	24	0	61	1	
11-Oct	24	24	24	24	8		1	
12-Oct	24	24	24	24	16	175		
13-Oct	24	24	24	24	24	79	1	1
14-Oct	24	24	24	24	24	313	20	
15-Oct	24	24	24	24	8	278	1	1
16-Oct	16	24	24	16	8	55	1	1
17-Oct	14	24	24	14	14	0	40	
18-Oct	8	24	24	0	12	57	20	
19-Oct	24	24	24	16	24	6	7	
20-Oct	24	24	24	24	16	31	35	
21-Oct	24	24	24	24	8	24	34	
22-Oct	24	24	24	24	16	47		
23-Oct	24	24	24	16	16	98		
24-Oct	24	24	24	8	8	24		
25-Oct	24	24	24	16	24			
26-Oct	16	24	24	16	16	10	14	
27-Oct	0	24	24	0	0	0		
28-Oct	12	24	24	12	12			
29-Oct	24	24	24	16	24	55		
30-Oct	24	24	24	16	16	24	5	
31-Oct	24	24	24	18	24			1
01-Nov	24	24	24	18	24	16		
02-Nov	24	24	24	18	24	5		
03-Nov	24	24	24	18	24	21		
04-Nov	10	24	24	10	10	23		
05-Nov								
06-Nov								
07-Nov								
08-Nov								
09-Nov								
10-Nov								
11-Nov								
TOTALS:	1,158	1,290	1,290	1,140	585	2,907	310	33

Spawning Operations:

The 2009-2010 spawning season began on September 24 and ended on November 23. There were a few minor adjustments to the spawning procedures but overall the spawning operations were orchestrated similarly to past years.

On spawn days all sockeye females were crowded in their ponds, checked for ripeness, and then killed if they were ready to be spawned. Gametes were collected in lidded plastic cups, kept in coolers until all the gametes for the day were collected, and then transported to the fertilization room.

Strict disinfection procedures and protocols for spawning IHN infected sockeye were adhered to to limit the risk of vertical transmission of the virus from the parents to the offspring. The first and last egg takes were small and the eggs were incubated in vertical, Heath type incubators, while all of the other egg takes were large enough to be incubated in kitoi incubators.

Once the gametes were collected they were brought into the disinfected fertilization room for fertilization. Eggs were fertilized according to a 1:1 matrix whereby each female's eggs are fertilized by one male with a secondary male's milt used as insurance against the first male's milt being compromised or non-viable. This 1:1 matrix is used to ensure a maximum combination of genotypes and to minimize the overrepresentation of males with dominant sperm.

Fertilized eggs were then rinsed thoroughly and water hardened for one hour in a 1:100 solution of iodaphor and put into their incubation vessel.

1,458 females were spawned during the 2009-2010 season giving an adjusted egg take of 5,162,325 with a fecundity of 3,541 eggs per female.

During the 2009-2010 spawning season the plastic cups used for collecting and transporting gametes were disinfected, washed, and reused in order to reduce waste and save money. Immediately after the gametes were poured into the larger 48-ounce bowls used for fertilizing and water hardening the eight ounce, 16 ounce, and 25 ounce gamete cups were placed in a garbage can filled with iodaphor and water to soak and disinfect for 24 hours. The next day the cups were thoroughly cleaned, rinsed, and dried by hand to ensure that no biological fluid residue, iodaphor, or water remained on the cup before being used again. If a cup was damaged, stained, or scratched it was thrown away. At the request of the WDFW fish health specialist the lids and 48 ounce bowls were not reused because they present higher vulnerability to contamination and would be much more difficult to thoroughly clean.

In addition to taking eggs, otolith, ovarian fluid, kidney and spleen, and fecundity samples were taken by WDFW hatchery and biological staff. There were 649 otolith, 178 ovarian fluid, and 60 kidney/spleen samples taken in addition to fecundity assessment of 200 females.

Incubation and Picking Operations:

The last two spawns only yielded 5 ripe females each and were incubated in the Heath type incubators. All other spawns yielded enough eggs to warrant incubation in kitoi incubators. Eggs were incubated in Heath-type stacks S-18 and S-20 and kitois A-2 through A-23. After one hour of water hardening in a 1:100 solution of iodaphor, eggs are put down in incubators and left alone until they are at the eyed stage. It takes about 45 days for eggs to reach the eyed stage at normal Cedar River Hatchery water temperatures.

Each day during incubation between the second day after fertilization and the eggs hatching eggs were treated with formalin to control fungus growth. This is done by dumping a prescribed amount of formalin into the inflow of each individual incubator and allowing the formalin to flush through the incubator. This method is called the California Flush.

In addition to being treated with formalin every day the eggs and alevins received thermal marks by supplying their incubators with chilled water for prescribed periods of time. To accomplish this ambient spring water is cooled at least 3 degrees Celsius by an array of chillers before going through an incubator. When an incubator is scheduled to be chilled the ambient temperature spring water supply to that incubator is replaced by the chilled water for the number of hours prescribed by the chilling schedule (Appendix 3). When the mark is complete ambient temperature spring water is returned as the water source for the incubator.

When the eggs reached the eyed stage they were siphoned out of their incubators and physically shocked (bumped) to help distinguish healthy eggs from dead ones. 24 hours after they were shocked they were picked by a Gensorter egg picker initially and secondarily by hand. Once the eggs were picked they were put back into their incubators layered with substrate (vexar pillows in the Heath-type trays and 1 inch plastic “saddles” in the kitois).

During the picking operation eggs were sampled to determine size and weighed to establish accurate populations and rates of loss. The rate of loss for the 2009-2010 season was 7.04%.

Table 2, Egg Inventory and Distribution

EGG INVENTORY AND DISTRIBUTION

TAKE DATE	FEMALES	LOT NO.	LIVE EYED EGGS					EGG LOSS	% LOSS	ADJUSTED EGG TAKE	FECUNDITY
			PICK DATE	PICK TUs	NUMBER	LBS/OZ	SAMPLE				
09/24/09	29	A-2	11/06/2009	688	100,000	29.00	3448	6,000	5.66	106,000	3,655
09/29/09	61	A-3	11/12/2009	704	189,000	55.18	3425	22,000	10.43	211,000	3,459
10/02/09	102	A-4	11/16/2009	720	157,000	45.22	3472	20,000	11.30	177,000	3,569
		A-5			166,000	47.80	3473	21,000	11.23	187,000	
10/06/09	107	A-6	11/19/2009	704	180,000	52.55	3425	11,000	5.76	191,000	3,523
		A-7			173,000	49.47	3497	13,000	6.99	186,000	
10/08/09	89	A-8	11/20/2009	688	279,000	81.46	3425	23,000	7.62	302,000	3,393
10/12/09	156	A-9	11/23/2009	672	264,000	73.93	3571	6,000	2.22	270,000	3,532
		A-10			269,000	75.86	3546	12,000	4.27	281,000	
10/15/09	185	A-11	11/30/2009	736	298,000	85.22	3497	24,000	7.45	322,000	3,497
		A-12			278,000	77.85	3571	47,000	14.46	325,000	
10/20/09	240	A-13	12/03/2009	704	264,000	73.39	3597	17,000	6.05	281,000	3,550
		A-14			261,000	74.13	3521	25,000	8.74	286,000	
		A-15			257,000	72.99	3521	28,000	9.82	285,000	
10/22/09	139	A-16	12/07/2009	736	245,000	66.65	3676	12,000	4.67	257,000	3,719
		A-17			243,000	67.07	3623	17,000	6.54	260,000	
10/23/09	71	A-18	12/08/2009	736	239,000	66.93	3571	14,000	5.53	253,000	3,563
10/27/09	108	A-19	12/10/2009	704	185,000	51.62	3584	13,000	6.57	198,000	3,713
		A-20			188,000	51.14	3676	15,000	7.39	203,000	
10/29/09	52	A-21	12/11/2009	688	176,000	46.46	3788	3,000	1.68	179,000	3,442
11/02/09	72	A-22	12/15/2009	688	242,000	65.83	3676	7,000	2.81	249,000	3,458
11/09/09	37	A-23	12/23/2009	704	111,000	30.84	3599	6,000	5.13	117,000	3,162
11/16/09	5	S-20	12/29/2009	688	19,000	5.28	3599	1,000	5.00	20,000	4,000
11/23/09	5	S-19	01/05/2010	688	16,000	3.90	4098	325	1.99	16,325	3,265
TOTAL OR AVERAGE				703.00	4,799,000	1349.78	3,578.29	363,325	7.04%	5,162,325	3,531.40

Ponding, Rearing, and Planting Operations:

When fry were ready to be ponded and fed, usually about 123 days after fertilization at normal Cedar River Hatchery water temperatures, they were visually inspected to ensure readiness and then netted out of the kitois or carried in their Heath-type incubator baskets to one of either the seven 6-foot diameter circular ponds or four 3-foot by 15-foot fiberglass raceways.

Ponded fry were fed hourly during the normal workday, seven days per week, for an average of 14 consecutive days before being planted. Rangen Soft Moist Starter (Ran) and BioOregon BioDiet Starter (Bio) feeds were fed at a rate of between 2-4% body weight per feed day. Further discussion of feed rates and practices can be found in the Discussion portion of this report.

Fish were sampled to determine size when they were ponded and again when they were planted. All fry were hauled and planted by truck at the mouth of the Cedar River (RM .1) in the Cedar Trails Park. Overall survival from the green egg stage to planted fry was 88%.

Table 3, Ponding, Rearing, and Planting Schedule

Incubator	Population	Pond Date	Sample at Ponding (fish/lb)	Plant Date	Sample at Planting (fish/lb)	Food Fed (lbs.)	Days Fed	Conversion
A-2	95,000	25-Jan	2700	8-Feb	1921	20.25	14	1.42
A-3	180,000	29-Jan	2400	10-Feb	1965	25.4	12	1.53
A-4	149,000	2-Feb	2757	16-Feb	2007	24.8	14	(Ran) 1.17
A-5	157,000	2-Feb	2780	16-Feb	2110	23.6	14	(Bio) 1.24
A-6, A-7	333,000	5-Feb	2641	17-Feb	2076	41.9	12	1.22
A-8	250,000	8-Feb	2726	22-Feb	1942	36	14	0.97
A-9,A-10	505,000	8-Feb	2805	18-Feb	2332	43.9	10	1.20
A-11, A-12	547,000	11-Feb	2581	25-Feb	1897	93	14	1.22
A-13,14,15	741,000	19-Feb	2774	4-Mar	1917	143.6	14	1.20
A-16	232,000	22-Feb	2960	10-Mar	2080	36.1	14	(Ran) 1.03
A-17	231,000	22-Feb	2895	10-Mar	2053	35.2	14	(Bio) 1.02
A-18	227,000	23-Feb	2825	9-Mar	1994	47.2	14	1.41
A-19,A-20	354,000	26-Feb	2689	11-Mar	1883	78.5	13	1.39
A-21	167,000	1-Mar	2825	15-Mar	2264	24.1	14	1.65
A-22	230,000	5-Mar	2746	22-Mar	1783	48.75	17	1.08
A-23	112,000	12-Mar	2736	29-Mar	1908	20.2	17	1.14
S-20	18,000	19-Mar	3222	2-Apr	2114	5	14	1.71
S-19	15,000	26-Mar	3500	9-Apr	2386	4	14	2.00
Avg/Total:	4,543,000		2809.00		2035.11	752	14	1.26

Discussion:

Adult Trapping and Weir Management:

Adult trapping and weir management were much more successful in 2009 compared to 2008 on a number of different measures. Most notably, as Table 4 shows, the percentage of the overall sockeye escapement that was trapped and hauled went up almost 300%. Additionally, Table 1 shows that 33 Chinook were trapped and passed upstream which is a marked increase from 2008 when only two Chinook were trapped and passed upstream. Both of these results might be due to a couple of design changes to the weir in 2009 and also to diligent fish observations and corresponding weir management by staff at the weir.

Table 4, Eggs Taken at Landsburg Hatchery/Adult Sockeye through the Ballard Locks

Brood Year	Eggs Taken	Lock Counts (6/12 - 7/31)	Eggs Taken/Fish through Locks
2004	16,682,000	376,659	44.3
2005	7,835,000	74,821	104.7
2006	14,794,000	418,005*	32.3
2007	2,870,300	60,117	47.7
2008	2,971,400	33,629	88.4
2009	5,162,325	21,718	237.7

* Counts in 2006 were continued until 8/31 for a grand total of 458,005.

As discussed in the Methods and Results portion of this report, two major changes to the design of the weir were implemented in 2009. First, the tunnel opening to the vee trap was replaced with a completely open, bulkhead opening to the trap. This allowed fish moving upstream an unencumbered, uncovered approach to the trap rather than a narrow, confined approach. That the number of Chinook trapped and passed upstream was so much higher in 2009 suggests that, among other factors, Chinook were much less reluctant to swim into the trap through the wide-open bulkhead opening than through the narrow tunnel. The result was far fewer Chinook holding below the weir and a more uninterrupted upstream migration, even if it meant Chinook being trapped and passed upstream. The bulkhead opening also allowed for fish movement into the trap even during high water. In 2008 the tunnel opening would effectively shut off during high flows due to the flex of the weir panel in which the tunnel was built.

The second major modification was the design, construction, installation, and use of the tip gate on the north bank of the weir. The tip gate allowed staff the ability to open and close a 2-foot wide gate along the north bank of the river, allowing unimpeded upstream migration when opened. It also allowed for opening and closing the weir without staff getting into the river, and for the targeted, specific benefit of individual fish observed to be moving upstream.

During higher flows and when there were more leaves piling up on the tip gate it became difficult to open the tip gate because of the force of water against the gate. When these conditions were present staff would either have to wade out to the tip gate or open it by pulling up on a rope attached to the bottom, upstream edge of the gate from rock wall rather than pushing down on the handles at the top, downstream edge of the gate. SPU and WDFW are working on solutions to this problem that allow for the continued flexibility of weir management even when high flows and an increase in debris are present.

2009 also saw the first test of the new weir and trap's ability to weather a high flow event. In the third week of October a small storm resulted in increased flows to around 850 cubic feet per second. Staff flattened the resistance boards, opened the tip gate, and

opened the trap to minimize the risk of damage or loss to any equipment or fish. Minor damage included the wing wall being pushed over by some larger debris (which is exactly what it's designed to do), lots of debris piling up inside and around the trap, and the north bank bulkhead getting bent and broken in a few spots. All of this damage was easily fixed when the flows subsided.

Beyond the improvements listed above that directly affect the ability to manage the weir and trap for the goals of the program, some other noteworthy improvements were made to the trap site and facilities.

The completed driveway allowing vehicle access to the river's edge made for vastly easier installation and removal of the trap and weir and, more importantly, for quicker, easier transportation of fish from the trap to the tanks of the hauling trucks. The decreased stress on fish, in addition to the personnel carrying them, was a significant improvement over the previous year.

Second, a walkway was installed between the end of the driveway and the fish trap. This allowed staff to carry fish more quickly and easily from the trap to the trucks. Again, the decrease in stress on the fish and personnel was an improvement.

Third, the standby trailer, tool trailer, and all of the necessary utility hook-ups were completed and operational. With some early season modifications, adjustments, and improvements, the work and living areas were greatly improved from previous years.

The convenience afforded by all of those improvements contributed significantly to a safer, more comfortable, and more effective trapping operation. Table 4 shows that, as a result of the improvements outlined above, favorable river conditions, and diligent weir management the trapping operation was very effective in 2009.

Spawning and Incubation:

Table 5, 2005-2009 Adult Prespaw Mortality

Brood Year	Eggs Taken	Male Morts	Female Morts	Total Mort Rate	Female Mort Rate
2005	7,835,000	407	116	10.68%	2.37%
2006	14,794,000	341	358	7.56%	3.87%
2007	2,870,000	365	92	29.29%	5.90%
2008	2,971,000	241	31	14.65%	1.67%
2009	5,162,325	175	19	6.01%	0.59%

Table 5 shows that the prespaw mortality rate was lower than any other year on record. Adults were sorted carefully, pond loadings were managed conservatively, and fewer

adults meant that additional ponds could be used to decrease the number of times fish were crowded, sorted, or moved. The result was less stress on the fish in the adult holding ponds, fewer ripe fish being missed during a spawn day, and lower adult mortality.

Table 6, 2003-2010 Egg loss

Season	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008	2008-2009	2009-2010
Total Eggs	11,487,100	16,682,000	7,835,000	14,794,000	2,870,300	2,971,400	5,162,325
Loss	17.26%	8.99%	8.27%	8.37%	6.62%	4.75%	7.04%

However, as Table 6 shows, egg loss for the 2009-2010 season was higher than in 2008-2009 or 2007-2008. The slightly higher egg loss could be due to a number of different factors. Some of those factors could include poorer egg quality due to warmer water temperatures in the ship canal, lake, or Cedar River, warmer air temperature on spawn days, longer spawn days, less experienced volunteers and one-time help. Higher egg loss could also be due to any number of problems with milt, the fertilization process, or the incubation process.

In the future additional efforts will be taken to schedule, train, and adequately staff to minimize the risk of egg loss due to variables within our control.

Feeding:

In the fall of 2009 hatchery staff cobbled together three new 6-foot diameter circular rearing ponds from materials found around the interim hatchery, increasing the rearing capacity to allow for all fry to be fed for an average of 14 days before being released.

Because of the success with Rangen’s soft moist starter diet in the 2007-2008 and 2008-2009 seasons the same feed was used for the 2009-2010 season. That feed seems to perform well for sockeye at the Cedar River Hatchery for a number of reasons. Most significantly, perhaps, is that it falls very slowly through the water column giving the less aggressive fry a prolonged opportunity to feed. The rate of conversion of food to growth (Table 3, “Ponding, Rearing, and Planting Schedule”) is not as impressive as some of the other starter feeds available, but some of those other feeds sink to the bottom of the pond faster and are wasted which requires feeding more total feed. Additionally, rates of conversion are difficult to compare during the first couple of weeks of feeding because of the presence of slightly variable amounts of yolk on some of the fish. Much more importantly, the fish eat Rangen’s feed more aggressively and grow uniformly at a favorable rate.

While the Rangen feed seems to work well for sockeye at the Cedar River Hatchery an experiment was performed to see if better results could be achieved with a more expensive, typically better quality feed. BioOregon’s premium, and very popular starter feed was tested against Rangen’s starter feed in two groups where eggs taken on the same days (A-4/A-5 and A-16/A-17) could be compared. Kitois A-4 and A-16 were fed Rangen and kitois A-5 and A-17 were fed BioOregon and were reared in as similar conditions as possible with the exception of the feed. They were fed at similar rates in

similar ponds with similar flows, etc. The results show that conversions were almost identical within each set of fry. In other words, eggs taken on the same day showed similar food to growth conversion regardless of feed type.

Even though BioOregon's feed typically shows a better conversion rate if it's actually eaten by the fish, the conditions at the Cedar River Hatchery described above make it much more difficult to present the feed so that it all gets eaten. Some of the BioOregon feed falls to the bottom of the pond too quickly and isn't eaten, resulting in a lower conversion rate.

The conclusion seems to be that the less expensive Rangen feed provides similar feed to growth conversions and is a better value.

Once a newly ponded group of fish was eating well the rate of feed was maintained at approximately 3-4% body weight each feed day for about 14 days. Hatchery personnel were instructed and shown how to watch the fish's feeding behavior carefully, make sure feed wasn't going to the bottom of the pond, and adjust feed rates according to those factors in addition to the rate of feed. This feeding to satiation ensured that all of the fish in each pond were getting enough feed to achieve their maximum growth.

Lastly, the increase in rearing capacity from the addition of three additional 6-foot circular rearing ponds resulted in approximately 1.1 million more fry being fed for an average of 14 days.

Lake Sammamish Kokanee

In response to dramatically declining Lake Sammamish Kokanee populations an emergency recovery program was implemented by several agencies including WDFW, NOAA Fisheries, and King County. The original plan was to incubate and rear kokanee at Issaquah Hatchery but preliminary testing indicated that their pathogen-free incubation water was causing egg loss. As a result the Cedar River Hatchery was proposed as a facility to support the project until Issaquah Hatchery could resolve their water quality issues. The Cedar River Hatchery was a logical, safe option because of its pathogen-free water, capacity for isolated incubation, thermal marking capacity, and in-basin location.

With assurances that this would only be for one year, that none of the associated costs would be charged to the Cedar River Interim Hatchery budget, and that extensive pathogen screening would be conducted to minimize risk to sockeye, approval was granted by Seattle Public Utilities (SPU) and the Cedar River Anadromous Fish Committee (AFC) to move ahead with the project.

Between November 8 and December 17, 2009 the Cedar River Hatchery received approximately 41,000 Lake Sammamish kokanee eggs spread over six different egg takes. All of these eggs were fertilized, water hardened, incubated, shocked, picked, and thermally marked at the Cedar River Hatchery. On January 12, after shocking, picking, dividing by creek group (30% for Lewis Creek, 30% for Ebright Creek, and 40% to Laughing Jacob's Creek), and thermally marking, take #5 (~14,000 eggs) was disinfected

and shipped to Chamber's Creek as eyed eggs to spread the risk of loss over two stations. Takes #1-4 (~12,000 total) were pooled (combined) and then divided by creek group (30% for Lewis, 30% for Ebright, and 40% to Laughing Jacob's) for hatching and rearing at Cedar River Hatchery. Take #6 (~11,000 eggs) was also shocked, picked, and split into creek groups (30% for Lewis, 30% for Ebright, and 40% to Laughing Jacob's) for hatching and rearing at Cedar River Hatchery. All nine groups (three creek groups each for the Early CRH group, Late CRH group, and Chamber's group) were given distinct thermal marks.

On March 25, 2010 the fry being reared at Chamber's Creek were planted into their respective creeks, and on March 14, 2010 the two sets of creek groups being reared at Cedar River Hatchery were planted into their respective creeks.

Conclusions:

Broodstock Collection:

As a result of the improvements to the weir, trap, and broodstock collection area outlined above, consistently low flows throughout the collection season, a small Chinook return, diligent weir management by onsite staff, and a number of other factors, broodstock collection was very successful in 2009. The design, construction, installation, and use of the tip gate and bulkhead opening to the trap alone resulted in a much more efficient, safe, and effective operation.

That over five million eggs were collected from an adult run that was approximately 30% smaller than 2008 was very encouraging. As Table 4 shows, trapping efficiency was significantly higher than any year on record. If similar efficiencies are consistently achieved the capacity to meet egg take goals will be much more reliable. Many of the factors that led to such high trapping efficiencies in 2009 are completely out of the control of weir operators, but the results are still encouraging.

Egg Loss Improvements and Value:

While mild winter conditions in the Cedar River will likely result in high egg to fry survival of wild fish, the extremely small 2009 adult return still points towards the need for hatchery supplementation. With the probable increase in survival of additional fed fry achieved with the use of the three new 6-foot rearing ponds, the contribution of the hatchery to rebuilding weaker brood classes seems significant.

Appendices: Appendix 1, 2008 Adult Trap and Weir Activities Log

2009 Trap Log

DATE	FLOW TIME	WHAT HAPPENED
10-Sep		Installed weir with SPU crew. Observed sockeye under R.R. hole. A reporter from Renton paper asking questions about new weir to Gary. Crew working on weir observed 1 Chinook pass over weir unrestricted midday. Weir was in the laid down position. Trap not fishing. See saw gate open.
11-Sep	7:00	Observed 12 sockeye under RR bridge. No fish seen in hole above weir.
	8:00	Met Cory, got instructions for today. We finished some work on weir and got tool trailer moved and cleaned up. Waiting for more supplies.
	1:00	Cory and Paul showed up with supplies fro break room. We finished weir work and gravel bagging.
	6:00	Observed RR hole for fish, 20sockeye and 1 Chinook male seen
	7:00	Watched weir till dark no fish movement. Street lights working, no fish seen above weir all day.
12-Sep	6:00	Watched weir for 1hr. No fish movement. 18 sockeye under RR bridge spotted 0 Chinook
	8:00	Clean up and racked area around driveway.
	9:30	cleaned trash off of weir
	12:30	swept driveway to weir
		Tree Down across river about two holes up river from weir. Reported it to Paul and Cory. Slow afternoon. No fish movement and no fish above weir. Fire Chief came by today, and wanted to see about getting a key to the posts in front of river driveway after we leave for emergency reasons. Police came and borrowed key to open gate to patrol dog park.
	2:30	Watched weir last 45mins of daylight. no fish movement.
13-Sep	6:30	Person fishing under RR bridge, informed him river was closed. He left, no problems
	8:00	Closed weir trap to begin fishing. Cleaned weir. Spent time today reading manuals for trailer and observed river
14-Sep	145 6:30	Checked trap, 10 sockeye 2female and 8male. Also 3 Chinook 1 hatchery and 2 wild. Released Chinook upstream unharmed, called Cory to report Chinook situation
	8:00	Met with Cory got instructions for today. Trevor and Andrea finished weir work. Opened see saw gate for Chinook passage. Finished hooking up trailer.
	1:00	Transported 7males and 1female to hatchery. Cleaned up after and locked everything up.
	3:30	Steve Foley came by to check things out. He observed no Chinook in RR hole
	4:00	Closed see saw gate.
	7:00	Checked trap for fish, no fish to report.

15-Sep 150 6:30 Checked trap for fish, 17 sockeye and 1 Male **Chinook**. The Chinook was turned upstream with no problems. However the I watched two sockeye in the trap swim out and move back down river.

8:00 Cleaned weir and called Cory for instruction

9:00 Loaded 15 Sockeye, 8 female and 7male. Also 1 female Pink salmon in trap passed up stream. Opened see saw gate for **Chinook** passage.

11:00 Checked weir, no problems to report. John from SPU came by to take unwanted gear from trap site. Also Mike L. came by for introduction, he will be floating the river Tuesdays to count fish and look for redds.

12:00 Checked RR hole for fish about 9 sockeye observed.

2:00 Rich, Andrea and Trevor worked on tool trailer. Built work table and hanging racks for gear. Also built steps to trailer doors. Annette and Steve came by to check progress of weir.

4:00 See Saw gate closed to fish through the night

8:00 Checked trap and weir, no problems to report.

16-Sep 170 7:00 Checked trap about 15 sockeye and 1 male **Chinook** in the trap. The Chinook was passed up stream.

8:00 Cleaned weir and built the river shed.

9:30 Transported fish 14males and 3females

11:00 Richard spotted 1 male **Chinook** under the foot bridge. See Saw gate opened for fish passage.

1:00 Built fence around the tool trailer and living trailer.

2:00 Observed river for Chinook movement. Nothing to report

4:00 Closed see saw gate to fish the night.

8:00 Checked trap, empty

17-Sep 170 6:30 Checked trap for fish **4 Chinooks** inside. I opened the trap door and let all the fish swim out untouched. I then stayed and watched the weir to see if any swam back onto the weir. No fish seen.

11:00 Opened both doors on weir panels and see saw gate for fish passage.

12:30 Floaters came down river and saw **15 Chinook** in RR hole also about 20 sockeye. Doors remain open for fish passage.

2:30 Pulled 5 poles out of forward end of trap to help **Chinook** passage.

18-Sep 169 7:00 Checked trap and cleaned trash off of weir. Counted fish down below RR hole, **5 Chinook** seen

9:00 All gates remain opened for fish passage. Observed river for fish movement, nothing to report.

11:00 Built a wall with hinged door around trailer sewage tank.

2:00 Observed RR hole with Cory 2 **Chinook** and 10 sockeye seen.

3:30 Observed RR hole 2 **Chinook** and 13 Sockeye seen

4:15 Closed the two doors on panels and reset trap to fish overnight. The see saw gate remained opened

19-Sep 169 6:45 Checked trap 12 sockeye and 1 male **Chinook** in trap. The female sockeye were placed into fish boxes and the males were passed with the Chinook
10:00 Observed RR hole for fish, 1 **Chinook** seen and about 15 sockeye
3:15 Checked RR hole for fish. Also checked trap 1 female **Chinook** in trap, I opened the door and let he swim out on her own
7:00 Cleaned weir, see saw gate left opened for **Chinook** passage.

20-Sep 165 7:15 Checked trap, 9male and 6female Sockeye and 1 male **Chinook**. Chinook and male sockeye passed up, Females put into live box.
11:00 Prep. truck for fish transport.
12:00 Marianne, Paul and myself loaded fish
1:00 Checked RR hole for fish 1 **Chinook** and 2 sockeye observed

21-Sep 164 6:30 Check trap, about 40 sockeye and 2 **Chinook** in trap. The Chinook were passed up with no problems
8:00 Met with Cory cleaned weir. Hauled fish see saw door remains opened for **Chinook** passage.
9:00 Opened the two hatch doors on weir to promote **Chinook** passage.
11:00 Observed area around weir. 8 sockeye in RR hole and 0 Chinook . However 1 **Chinook** under foot bridge, no fish movement during the day.
1:00 Cleaned drive way. Andrea walked down 3 bridges and saw 0 fish and 0 redds. 2 **Chinook** seen in RR hole and 12 sockeye
3:00 observed 20 Sockeye 2 **Chinook** in RR hole, no fish in trap
4:00 Trap is fishing, no fish in trap and see saw gate open

22-Sep 164 6:30 Checked trap 101 sockeye in trap 0 **Chinook**
7:00 Watched for fish movement observed. Observed 1 large **Chinook** swim up and under weir then over to the see saw gate and swim through the gate and up the river to the next hole.
7:30 Checked RR hole observed 9 **Chinook** holding in RR hole and 18 sockeye.
8:00 Crew showed up, checked trap 111 Sockeye and 0 **Chinook**
10:00 Paul and Gary showed up with others for meeting.
11:00 5 Sockeye holding below open sea saw door. Talked to Gary for guidance. 1 dead filleted Sockeye washed up on weir (2nd one this year). I reported to Cory.
1:00 Studied manuals looked for a pluming leak in the trailer.
3:00 Cory called; Mike Lesly floated the down over the weir. He only saw 5 **Chinook** in the RR hole. Cory told me to close hatches on the weir panels and closed the sea saw gate.

23-Sep 227 8:00 Crew arrived, we cleaned trap and loaded fish 44 Females and 31 Male Sockeye. 1 **Chinook** male and 1 **Chinook** female passed up stream. Misc projects till lunch, river rising to 227cfs, water coloring up.
4:30 Cory called to close see saw door and raised sides of weir with the rising water.

24-Sep 7:00 Chinook watch. 0 **Chinook** movement, 6 Sockeye swam up to weir and swam through open sea saw gate.
8:00 Crew showed up and SPU crew and tanker. We loaded 27 male and 23 Females sockeye to Landsburg. I released 2 **Chinook** up river both males and on a Jack.

9:00 Cleaned and worked on weir
 Good viz at RR hole. 25 Sockeye seen and 3 **Chinook**. The Floaters coming down saw
 11:00 only 3 Chinook also. Cory called to close sea saw door.

25-Sep 243 7:00 Chinook watch, 0 **Chinook** seen. 15 Sockeye moved up from tail out and swam under weir. Between 7:00-8:00. Released 1 **Chinook** from trap
 Crew showed up and SPU crew we loaded 44 male and 50 female Sockeye in to SPU tanker and they left for hatchery-Landsburg we cleaned weir and fixed weir. Opened sea
 8:00 saw gate for possible Chinook passage trap fishing.

9:30 Maryanne and Andrea walked down bike trail to senior center and observed 7 male and 1 female sockeye 3 **Chinook**. I observed 2 Sockeye and 1 **Chinook** in the hole above weir.
 Checked RR hole observed 50 Sockeye 5 **Chinook** holding under track. Good increase of
 12:00 fish from yesterdays numbers.
 12:30 Cory stopped by he observed the same 50 Sockeye and 5 Chinook. He left instructions.
 1:30 Gary called he wanted some catch info.
 3:00 Checked trap 5 Sockeye first daytime catch this season.

26-Sep 231 7:00 Watched see saw door for 15min saw 7 male Sockeye swim through door.
 SPU crew showed up with tanker we loaded 50 male Sockeye 46 females. 0 **Chinook** in
 8:00 trap this morning. Trap fishing sea saw gate open for **Chinook** passage
 Gary arrived to watch operation and to give presentation to salmon naturalist group. Clean
 8:30 around trailer and weir.
 River observations 7 sockeye in hole above weir, 0 fish below weir. Increased numbers of
 11:00 sockeye in RR hole from yesterday 70 sockeye counted. 7 **Chinook** in RR hole.

27-Sep 243 7:00 Released 1 **Chinook** from trap upstream unharmed. Trap fishing sea saw door open for **Chinook** passage. Watched weir for fish movement 1 male sockeye swam through sea saw door. 1 **Chinook** Jack swam under weir no other fish movement.
 8:00 Cleaned trap 11 male sockeye 4 female sockeye in trap, transferred to live boxes.
 8:30 Cleaned weir, two male sockeye morts on weir
 9:00 Worked on locking system for live boxes
 10:30 watched weir, 2 sockeye swam into trap and 2 swam up under weir all males
 11:30 Fix minor repair trailer.
 Observed a group of older males fishing the RR hole, this is the second time I have seen them now so I told them that the river is closed. I told them because the increased number
 2:00 of **Chinook** in the RR hole. Shady Guys! I called and told Cory.
 2:30 I checked the hole they had left
 After observing the RR hole through out the day there is a noticeably increase of **Chinook** today compared to previous days. I have decided to leave the see saw gate open for
 4:30 **Chinook** passage as instructed by Cory.

28-Sep 245 9:00 Transported 13 females and 27 males, cleaned weir
 10:30 **Chinook** and Coho morts found on weir wand them for tags all neg.
 11:00 Observed RR hole for fish 30-40 sockeye and about 8 **Chinook**

Walked with Marianne down to snagging spot to look for sockeye to snagging area to look
12:30 for sockeye. From library down to senior center 58 plus sockeye observed 0 **Chinook**
2:30 Checked trap 4 sockeye inside
6:30 Checked weir and trap only 3 sockeye now

29-Sep 250 6:15 Checked weir maybe 30 sockeye in trap, 2 mort Pinks on weir as well as 4 sockeye morts
8:00 Moved 11 female and 34 male sockeye to Hatchery. No **Chinook** in trap
9:00 Observed the see saw gate for **Chinook** movement
Watched 1 male sockeye swim through the see saw, 1 **Chinook** swam through the gate
10:00 also.
11:30 4-5 Sockeye in the trap, no fish seen pass through the gate since last.
2:00 Floaters came by and saw 9 **Chinook** in the RR hole.
5:00 Closed the see saw gate as instructed by Cory.
7:00 Checked trap for **Chinook** only 5 sockeye inside.

30-Sep 252 6:00 Checked trap and weir around 80 sockeye in the trap and 1 **Chinook**. The **Chinook** was
passed up safely with no problems also 2 morts on weir 1 **Chinook** and 1 Sockeye.
8:00 Opened see saw gate for **Chinook** passage.
9:00 Transported fish 58 male and 36 females
10:30 Observed gate and river for Chinook movement
1:00 Watched 3 sockeye pass thought the gate (all males)
Closed see saw gate due to high sockeye activity in the river. I have already witnessed 10
2:00 pulse sockeye move thought the sea saw gate.
2:40 Reopened the gate because 1 **Chinook** was seen under the foot bridge.
5:00 Checked trap for **Chinook**, none found

01-Oct 246 6:15 Checked trap and weir 1 Chinook inside passed up with no problems about 40 sockeye in
trap
9:00 Transported 58 male and 38 female
10:30 Observed see saw gat for fish movement
11:00 Floaters passed by only 5 **Chinook** in RR hole
1:00 Put up wing walls above trap. Fixed shed
3:00 Observed trap and gate for **Chinook** passage nothing to report
3:30 Closed see saw gate
7:30 Checked weir and trap. No fish

02-Oct 260 7:00 Checked trap 2 **Chinook** and about 60 sockeye. Chinook passed up with no problems.
7:15 Opened see saw gate for **Chinook** passage
8:00 Loaded fish 33 females and 52 males
Closed see saw gate after seeing over 20 sockeye swim through the gate while loading.
9:00 Will watched for **Chinooks** with gate is closed.
10:30 Re opened see saw because 4 **Chinook** moved in behind weir
11:30 Checked trap 30 plus fish so I went in and sorted in to live boxes
1:00 checked trap 10 sockeye inside no **Chinook**
3:00 Sorted another 12 females and 20 males into boxes

6:00 Sorted more fish out of trap into boxes

03-Oct 252 7:00 Checked trap 1 **Chinook** handled up stream with no problems
8:30 Loaded fish on SPU truck 137 sockeye on board
10:00 Observed weir and trap for fish movement
2:00 Checked weir and observed RR hole
4:00 Cleaned weir, checked trap 1 sockeye

04-Oct 245 7:00 Checked trap for fish and cleaned weir
9:00 Transfer fish to live boxes 80 plus sockeye and one pink salmon inside.
11:00 Observed river for **Chinook** movement, nothing to report.
2:00 Checked trap about 12 sockeye and checked RR hole
4:00 Checked weir and trap, no change
6:00 Closed see saw gate to fish over night

05-Oct 250 7:00 Checked trap 2 **Chinook** handled up with no problems. About 60 plus sockeye in trap
7:15 Opened sea saw gate for **Chinook** passage, on **Chinook** mort on weir
9:00 Loaded fish 54 females and 46 males sent on SPU truck.
10:30 Cleaned walking area and drive way. Observed 45 sockeye in RR hole and 1 **Chinook**.
2:30 2 Sturgeon in RR hole 1 **Chinook** plus 45 sockeye
4:00 Closed sea saw door as instructed by Cory.

06-Oct 250 7:00 Weir watch 1 sockeye no **Chinook** movement 45mins.
Cleaned trap 28 females loaded and 64 males passed up stream. 1 **Chinook** male passed
8:30 up stream
10:00 Fish checks 26 sockeye, 4 **Chinook** and 2 Sturgeon in RR hole.
Observed 5 **Chinook** and 2 Sturgeon in RR hole. 1 **Chinook** in pipe line hole just above.
1:00 Opened sea saw door for possible **Chinook** passage trap fishing.
1:30 Mike floated by did not get his fish numbers
Patrick from the city of Renton came by. He wanted Paul's number. About fresh water
2:00 hook up. Back flush test?
3:30 5 **Chinook** in RR hole
4:00 Andrea turned off the light facing the weir.
Observed young man standing in back of tool trailer. When I checked it out he was
5:00 standing next to his car parked just inside unlocked dog park gate. No problems seen
8:30 Light check-light facing weir still on
Police showed up at gate he contacted me at trailer and explained about break in
happening at Stone way Co. in the dog park area. Hew was setting up perimeter. I
9:00 explained about the gate being unlocked today.

07-Oct 232 7:00 Weir watch. Decent sockeye movement between 7-7:30 20 sockeye moved up tail out to weir
Cleared trap 58 male sockeye 31 female sockeye 1 pink released. No **Chinook** in trap this
8:00 morning
10:00 Ralph Little called flow rising through tonight
11:00 1 **Chinook** female moved up to weir. Opened see saw door for **Chinook** passage
12:00 3 Sockeye no **Chinook** in trap.

1:30 Checked RR hole 30 Sockeye 3 **Chinook** seen 2 Sturgeon
2:30 Closed see saw door.

08-Oct 300 7:00 Weir watch. 1 **Chinook** below see saw door. Opened see saw door for **Chinook** passage
8:00 Checked trap no **Chinook** in trap
8:20 SPU tanker here- cleared trap 52 male and 59 female sockeye.
9:30 Cleaned up- cleaned weir
Gary arrived to give tour for school children. Put 1 Male and 1 Female Sockeye in live
10:00 boxes for kids
11:00 Checked RR hole 6 **Chinook** seen 20 sockeye
Checked weir watched 12 sockeye males and 1 **Chinook** pass through open sea saw
12:30 door
2:30 1 **Chinook** passed through open see saw door. Decent daytime fish movement
3:00 Sweep driveway
3:30 Checked trap 15 sockeye 1 **Chinook** female released upstream

09-Oct 300 7:15 Weir watch 1 **Chinook** passed through open see saw door and 12 plus sockeye. 30
sockeye holding below weir good morning sockeye movement.
Cleaned trap 71 male and 65 female sockeye hauled to Landsburg. 3 male sockeye
8:15 released up stream. Transfer 17 males and 26 females to live boxes
10:30 2nd haul to Landsburg 17 males and 26 females
Mics project and observations 30 sockeye 7 **Chinook** observed in RR hole. We are
12:30 leaving see saw door open for Chinook passage.
Andrea returned from walk to senior center she observed 300 plus sockeye between RR
3:00 hole and senior center
5:30 Checked trap 12 sockeye 0 **Chinook**

10-Oct 313 7:00 Weir watch poor morning sockeye movement 3 sockeye holding below weir 0 fish passed
through door in 20 mins. No sign of **Chinook**
SPU tanker show up we loaded trap 36 male and 25 female sockeye, 1 male sockeye
8:00 released upstream No **Chinook** in trap.
Observations 0 Sockeye holding below weir 15 Sockeye and 3 **Chinook** in off Pipeline
10:00 hole also 3 **Chinook** in RR hole. No fish moving up river
12:30 Observations 0 Sockeye holding below weir 3 Chinook seen in R.R. Hole midday
5 **Chinook** seen between walk bridge and RR hole. See Saw door open for tonight for
3:30 **Chinook** passage
Checked trap 15 Sockeye in trap no **Chinook**. Cleaned weir, 2 **Chinook** carcasses on
5:30 weir one wild and one hatchery

11-Oct 313 7:15 Weir watch 1 Sockeye moved up from foot bridge. Poor fish movement for this morning 1
Sockeye holding below weir.
Cleaned trap transferred 18 males and 19 Female Sockeye to live boxes. No **Chinook** in
8:00 trap. Released 1 male Sockeye
8:30 Cleaned weir 1 wild Coho and 2 **Chinook** carcasses on weir.
9:00 1 Chinook seen in RR hole and 0 Sockeye holding between foot bridge and weir
11:00 Sweep drive way

1:00 Misc projects and trailer cleanup
3:30 Close see saw door trap fishing
5:00 Trap check-sockeye are moving up to weir 20 Sockeye in trap and 0 **Chinook**.

12-Oct 313 8:00 Loaded SPU truck 88 females and 86 male Sockeye, 1 Pink was passed up
8:30 Opened see saw for **Chinook** passage. Observed RR hole 1 **Chinook** seen
10:00 Checked weir and trap about 5 Sockeye in trap and about 15 holding behind/under weir
11:30 Checked trap about 10 Sockeye now in trap and 3 **Chinook** observed in RR hole
Lots of fish observed moving up about 20 Sockeye in the trap now, no **Chinook** inside and
2:00 gate still open
4:00 Closed see saw door to fish trough the night and morning

13-Oct 313 7:00 Checked trap and cleaned weir. No **Chinook** in trap
8:30 Loaded fish into trucks and one male Sockeye passed up.
9:00 Cleaned weir with Cory, see saw door still closed
10:00 No **Chinook** observed down in RR hole
11:00 Checked trap about 15 Sockeye no **Chinook** in trap. 1 **Chinook** observed in RR hole
1:00 Cleaned weir with Andrea and Marianne, found the weir panel gate open we closed it
Observed river and RR hole 1 **Chinook** observed, The girls walked down passed the
2:30 library they observed up to 300 Sockeye 25% on redds.
3:00 Checked trap 1 male **Chinook** and 2 Pinks were in trap all passed up with no problem.
4:00 Cleaned weir about 20 fish in trap and 15 staging behind the trap.
6:00 Checked weir and trap for **Chinook**, no **Chinook** and 30 plus Sockeye

14-Oct 324 7:00 Cleaned weir checked trap
8:00 Loaded fish 227 Sockeye, 3 Pinks passed up no **Chinook** in trap.
9:30 Went to hatchery to take care of some stuff. Andrea and Rich covered for me
Andrea opened see saw because she observed 3 **Chinook** at weir. She observed all 3
11:00 **Chinook** pass through the see saw gate.
12:00 She then closed the gate
1:00 Sorted fish in to boxes
2:00 We decided to make a second haul up to Hatchery with 36 males and 50 females.
3:30 Checked trap, cleaned weir. Maybe 20 plus Sockeye in trap
6:30 Sorted fish in to boxes

15-Oct 365 7:15 Cleaned weir, 1 Coho mort on weir and one Trout (Rainbow). 100 plus Sockeye in trap
and no **Chinook** seen.
Cory saw 3 **Chinook** move up under weir, then opened the see saw gate and watched all
8:00 3 **Chinook** swim through the gate.
8:30 Loaded fish 1 **Chinook** and 1 Coho passed up with no problems
9:00 Cleaned weir and left gate open for **Chinook** passage
Observed river for **Chinook** movement, 2 **Chinook** passed through the gate and up the
10:00 river.
River observations the fish aren't moving as much now, still have 1 **Chinook** below weir
11:15 and 3 in RR hole the gate remains open.
Checked trap 20 plus Sockeye. Observed RR hole only 1 **Chinook** seen lots of Sockeye
1:00 moving up but no **Chinook**.

2:30 Cleaned weir
 3:00 Checked RR hole 3 **Chinook** seen
 6:00 Checked out trap and weir no problems to report. See saw gate closed

16-Oct 327 7:15 Checked trap 20 plus fish, Observed RR hole only 1 **Chinook** seen lots of sockeye moving thought gate but no **Chinook** moving
 8:00 Transported fish, 1 **Chinook** in trap safely handled up stream 15 Female and 40 Male Sockeye loaded
 9:00 Cleaned weir 2 mort **Chinook** on weir both hatchery males. Called Steve for **Chinook** mort samples
 10:30 Checked RR hole for **Chinook**, none seen. Called Cory he instructed to close gate.
 11:30 Checked trap only 2 Sockeye inside
 2:00 Cleaned weir
 3:00 Laid down weir panel flaps for high flow this weekend. Also pulled trap poles for fish passage

17-Oct 400 7:15 Checked weir, no problems
 8:00 Dropped the resistance boards back down to fish today and Sunday. Also put the trap poles back in
 9:30 Checked trap 12 plus Sockeye, poor viz for river observations
 11:00 Cleaned weir. Checked trap about 30 Sockeye
 2:00 Sorted fish into live boxes 30 Females. 40 males were passed up river
 3:00 Cleaned Weir.
 6:00 Checked weir adjusted resistance boards

18-Oct 400 7:30 Cleaned weir only 20 fish in trap
 9:00 SPU called, flows will come up to about 500cfs today but will drop back down so I may not fish the afternoon
 11:00 Loaded fish 57 females and 2 Jacks, I passed up 20 males. River cfs high
 1:00 Checked weir. No problems to report
 2:00 Tried to drop all the resistance boards on weir and opened the see saw gate.

19-Oct 7:30 Checked trap and weir no problems with weir and about 10 fish. 0 **Chinook** in trap
 8:00 Cleaned and reset up weir. Loaded fish 6 females loaded and 7 males passed up river
 10:00 Water clarity better observed river no **Chinook** seen
 1:00 Cleaned weir checked trap about 20 Sockeye in trap. Marianne walked down below snagging area she saw about 340 Sockeye.
 1:30 Checked RR hole no **Chinook** see and about 40 Sockeye holding
 2:00 Checked trap and weir no change
 3:30 Cleaned weir
 6:15 Checked trap and weir, no problems

20-Oct 7:15 Checked trap about 60 fish no **Chinook**, 2 **Chinook** morts on weir, both wild one male and on female
 8:00 Hauled fish, 31 females and 35 males passed up also 3 pinks
 9:00 Cleaned weir and did my RR hole observations
 11:00 Paul from SPU came by to check on weir

1:00 Cleaned weir. Checked trap 20 Sockeye inside
 2:00 SPU guys came by to work on trap bridge/walkway I helped and then cleaned weir
 2:45 Checked RR hole only saw about 20 sockeye viz wasn't very good. No **Chinook** seen
 Cory called said that floaters saw multiple **Chinook** below weir and instructed to open gate
 4:00 for the night

21-Oct 8:00 Transported fish 24 female Sockeye
 9:00 Closed see saw gate
 Cleaned weir and checked RR hole. Watched redd below foot bridge, didn't see female **Chinook** maybe she has passed away. RR hole very dark hard to see, 20 Sockeye 1 **Chinook** observed 15 Sockeye under weir.
 Paul from SPU called and wanted width of walkway we have been using to get to cage. Dark still in RR hole Still 20plus Sockeye 0 **Chinook** seen but viz was poor. Raining very steady 339 cfs
 11:00
 Shawnee with the city came by with electrical permit- asked for key to electric boxes- she
 1:00 said they would be here tomorrow
 Cleaned part of weir wing and backside. RR hole has lots of sockeye over 40 . Still hard to
 2:00 see- I saw 2 Chinook
 3:00 Marianne being nice to me cleaned weir I helped at the end
 4:30 Look down below

22-Oct 7:30 Cleaned weir, Looked at RR hole saw a couple of Sockeye no **Chinook**
 SPU picked up fish 23 male and 24 female Sockeye. Passed up 1 pink and 1 Trout, no
 8:30 **Chinook**
 9:30 Cleaned up weir put things away locked up stuff for the day
 10:45 Cleaned weir gave tour to pretty girl walking dog
 12:00 Larry and Janis from Seattle Aquarium came by with two classes of kids for tours
 2:00 Renton PUD Came by and signed off on electrical permits
 20/20 came by and filmed a man fishing right above the weir the guy was using just a
 2:00 weight and no hook I asked them and looked at his gear.
 3:00 Racked weir and walked to RR hole about 20 sockeye couldn't see any **Chinook**.
 Hans floated by and marked a Chinook redd 50 feet down from weir. He said it looked like
 3:30 she was spawning right there and wasn't going to go any further
 4:30 Cleaned weir for the night

23-Oct 360 7:30 Cleaned weir with Cory, moved live boxes back in the water.
 8:30 SPU came down and hauled 61 male 37 female Sockeye
 Adjusted V-gate in trap and sand bagged the front of live boxes in hopes of keeping them
 9:30 in place
 10:00 Cleaned weir and gate a lot of leaves
 10:45 Walked down to RR hole saw about 10 Sockeye and nothing else.
 12:00 Larry and Janis came bye with more school kids
 1:30 USGS taking samples from D. Bridge, RR hole and below weir only 20 Sockeye.
 3:00 Cleaned weir a lot of leaves
 Laid down all the resistance board, Kimberly at Landsburg called they were shutting down
 3:45 the diversions and to expect high flows tonight
 4:30 Tied live boxes off to shore for high flows coming tonight.

24-Oct 550 8:00 SPU hauled 15 male and 9 female. Weir under water this morning.
8:30 Cory came by and helped me fix the wing wall which was flattened by heavy flows and leaves last night
9:30 RR hole water high and dirty can't see anything
10:00 Replaced padlocks with new ones from SPU
11:00 Cleaned out trap and fixed wing wall to stacks flow still strong about 450-500cfs
12:00 RR hole too dirty to see
1:00 Cleaned front of trap again and wing wall
2:30 walked to library water still dark hard to see fish
4:00 Cory and Pat fixed weir bulkhead and cleaned weir

25-Oct 8:00 Cleaned weir and trap removed fingers in trap. Weir under water this morning
10:00 Cleaned weir of logs 10-15 Sockeye above weir
11:00 RR hole 10 Sockeye
2:00 Cleaned weir and trap
3:45 Tied off bulkhead on the gate side to keep it up right

26-Oct 850 8:00 Cleaned weir, almost whole thing under water this morning
8:30 Loaded fish 10 females, passed up 14 male Sockeye.
9:00 Dropped resistance boards on weir because of high flows from rain.
Museum Class came by I pulled out 2 male Sockeye to show class and then passed them up river
12:00
1:30 Checked weir. No problems to report
3:00 Pulled picket poll out of trap with John(SPU)
4:30 Towed live boxes out of with trucks. Flows very high
7:00 Checked on weir, water very high but trap stable

27-Oct 700 7:30 Checked weir/trap. Paul was at trap all is secure, flow still high. Won't go in the water till flows go down. Weir is under water 591cfs
Went into trap to try and clean logs out and off of trap. Most logs moved but still need help
12:00 fixing see saw and bulkheads
2:00 Worked on weir

28-Oct 420 7:30 Checked on weir, completely underwater/sunk
8:00 Went out with the others to set trap and weir back up
The Aquarium class came by I pulled out 1 male Sockeye to show kids and passed it up
12:00 after.
1:00 Checked trap about 10 Sockeye in trap
2:00 Walked down to the snagging area and counted about 250 plus Sockeye
3:30 Cleaned weir, about 25 fish in trap
6:00 Checked weir, all clear no problems

29-Oct 430 7:30 Cleaned weir with Cory, Weir was under water
8:30 Loaded fish with SPU 25 males and 11 females. No **Chinook**
10:00 Check weir and trap all clear a few fish in trap about 10
11:00 Checked trap about 20 fish

2:00 Hauled fish 16 males and 3 females
3:00 Cleaned weir
5:30 Checked trap a15 fish, weir ok

30-Oct 420 7:30 Checked trap 20ish fish/ weir under water
8:15 Cleaned weir. Will transport fish this afternoon
10:30 Checked trap maybe 30 fish, cleaned weir.
1:00 Hauled fish with SPU 12 males and 7 females
1:30 Dropped resistance board on weir opened gates for high flows tonight.
A man came to my trailer because his dog was washed down on the see saw and was trapped so I suited up and went out on and safely retrieved the dog
6:00

31-Oct 9:00 Cleaned weir. Closed see saw gate began fishing again.
11:00 Checked trap and weir 7 fish inside trap
1:00 Cleaned weir 10 fish in trap
Seattle Aquarium came by with class I pulled out a Sockeye for them and then returned it to the trap.
2:00
5:00 Cleaned weir with Cory

01-Nov The weir was under water so I cleaned it and set it back up. 1 **Chinook** female hatchery in trap passed up with no problems
7:00
11:00 Cleaned weir
1:00 Loaded fish 7 females and 9 males
3:00 Cleaned weir and only 2 fish in trap
6:00 Checked trap and weir, no problems

02-Nov 7:00 Checked trap and the weir was under water. 5 fish in trap
8:00 Cleaned weir and trap hauled 3 male and 2 female Sockeye
12:00 Cleaned weir 5 fish in trap
2:00 Cleaned weir
3:30 Cleaned weir 10 fish in trap

03-Nov 7:00 Cleaned weir
8:30 Hauled 12 male and 9 female
10:00 Picked up thing we aren't using at trap an preped them for transport to hatchery
10:30 Paul and John came by to look at what it was going to take to remove weir
Andrea and Rigo came down with the truck to pick up unneeded equipment and took it back to hatchery
1:00
1:30 Cleaned weir 2 fish in trap
2:30 Cleaned weir and trap
3:00 Pat walked down river to count fish, 200 Sockeye 1/3 spawned out
4:00 Cleaned weir for the night 4 fish in trap

04-Nov 7:00 Cleaned weir about 20 fish in trap
8:30 Hauled fish 18 males and 5 female
John and James from SPU came down with the flat bed and we pulled out the trap and wing wall.
10:00

05-Nov 7:00 Removed the rest of the weir with SPU done fishing
12:00 Paul buying pizza for lunch

Appendix 2, Trap and Weir Protocols

Operational Guidelines for the Cedar River Weir and Fish Trap at I-405 2009 Field Season

These guidelines are based on the framework that was established for the 1999 field season in response to concerns regarding weir impacts to Chinook salmon. The guidelines are based on nine years of successful implementation during the 1999-2007 brood collection years. It is recognized that the Cedar River Anadromous Fish Committee and the Sockeye Hatchery Adaptive Management Work Group will have the opportunity to recommend changes to these guidelines if conditions change during the season. Such adaptive management will be documented and communicated through the committee chair. Since the implementation of this protocol and the adaptive management approach, the operation of the weir has been successful in avoiding impacts to Chinook salmon. Careful monitoring of fish behavior at the new location, with the new weir will be necessary to be responsive to changing conditions and fish behavior. The number of Chinook salmon passing the weir and entering the trap in relation to the number of sockeye salmon entering the trap will dictate how the trap and weir will be operated.

GOALS:

The weir and fish trap in the Cedar River are maintained and operated to collect sockeye broodstock. However, an additional goal of equal importance is to minimize the risks of adverse effects to upstream migrating adult Chinook salmon. These protocols are intended to satisfy both goals.

Due to ESA issues involving Chinook salmon in the Cedar River, the weir will be operated to avoid adverse impacts to adult Chinook salmon. There are two major impacts that we will seek to avoid: 1) having Chinook spawn within 25 meters above or below the weir such that the eventual removal of the weir could impact those redds, and 2) significantly delaying (defined as more than 24 hours) the upstream migration of Chinook. It is recognized that operating the weir to avoid impacts to Chinook compromises our ability to meet the objective of collecting sockeye broodstock.

Hatchery personnel and biological staff will communicate and work together to monitor Chinook activity in the area adjacent to the weir.

- Because this weir design and location are new this year, monitoring and documenting Chinook responses to this new situation is very important.
- An open weir is defined as the condition that exists when fish have unrestricted access through one or more openings in the weir or trap.
- There will be no restrictions on fishing (closed weir) if there are no Chinook observed downstream of the weir for a 24-hour period, outside of the peak Chinook spawning period, however during the typical peak Chinook spawning period (typically September 25 through October 10) as determined by redd surveys and live counts, the weir will be opened for a 12-hour period following three consecutive days of fishing regardless of Chinook being observed.
- If Chinook are observed holding in the area immediately downstream of the weir, and there is a need to collect sockeye adults, then the weir will be opened to allow Chinook to move upstream. The duration of the opening will be in response to the observed behavior of the Chinook, with the goal of keeping any potential delay of Chinook to less than 24 hours. This may be accomplished by opening the weir at night.
- If field biologists or field technicians see more than 10 Chinook holding between the weir and the Renton Library below the weir, they will discuss the situation with the hatchery staff and jointly determine a course of action (i.e., opening the weir).

- The weir is to be fished only when sockeye adults need to be collected.
- If there are more Chinook in the trap than sockeye trap pickets will be pulled.
- Chinook that enter the trap will be passed upstream as quickly as possible.
- If the number of Chinook in the trap exceeds what can be removed in 30 minutes, trap pickets will be pulled to pass Chinook.

If a Chinook female unavoidably constructs a redd in close proximity to the weir, then the redd is to be immediately marked and a discussion will take place. This discussion will include, but is not limited to, the following types of actions: early weir removal, staged weir removal, and modification of weir operations. Discussion will include at least these people or their designee: Rand Little (SPU), Gary Sprague (SPU), Paul Faulds (SPU), Brodie Antipa (WDFW), Larry Fisher (WDFW), Steve Foley (WDFW) Annette Hoffmann(WDFW), Eric Warner (MIT), and Tom Sibley (NMFS).

PROPOSED SCHEDULE FOR BROODSTOCK COLLECTION.

The following target numbers to be collected are based upon a large run size, assuming an average fecundity of 3,200, and a 1:1 male to female spawning ratio. The prediction for sockeye returns entering Lake Washington is low for 2008. It may not be possible to achieve the eggtake goal of 18.4 million sockeye eggs.

Weekly targets for gamete collection are based upon the average run timing curve, which is identical to the one provided in exhibit A of the Cedar River MOA. It is agreed that between- week adjustments to accommodate actual returns will be appropriate.

Week beginning	Percentage of eggs	Cumulative Number of Eggs	Cumulative Number of Adults	Weekly Adult Goal
Sept. 15	4.9%	901,600	564	564
Sept. 22	12.0%	2,208,000	1,380	817
Sept. 29	21.7%	3,992,800	2,496	1,116
Oct. 6	33.3%	6,127,200	3,830	1,334
Oct. 13	45.2%	8,316,800	5,198	1,369
Oct. 20	56.3%	10,359,200	6,475	1,277
27-Oct	66.4%	12,217,600	7,636	1,162
Nov. 3	75.4%	13,873,600	8,671	1,035
Nov. 10	83.4%	15,345,600	9,591	920
Nov. 17	90.0%	16,560,000	10,350	759
Nov. 24	95.5%	17,572,000	10,983	633
Dec. 1	100.0%	18,400,000	11,500	518

MONITORING

The following monitoring activities associated with the weir are to be conducted by hatchery personnel:

- Observe and enumerate Chinook and sockeye 25 m up and downstream of the weir (when possible) three times daily; it is recognized that at times of high flow or turbidity, accurate observation and enumeration may be compromised. The observation times are as follows: once between 7 AM and 9 AM, once between 11 AM and 1 PM, and once between 3 PM and 5 PM. For sockeye, total estimated numbers are to be recorded.

- Record the number and sex of Chinook that are collected in the fish trap and passed upstream; notice and record any tags or marks observed on the fish. Provide data to the co managers.
- Record the number and sex (where possible) of all other species passed upstream. All Atlantic salmon will be killed and sampled by WDFW staff.
- Count and flag any Chinook redd within 25 m of the weir.
- Chinook carcasses that float onto the weir will be retrieved (placed on the bank) as workload allows.

Appendix 3, Summary of Thermal Mark Patterns

Incubation Vessel	Pop.	Egg Take Date	Release Date	Thermal Codes	River Location	# Fry Released	Thermal Mark Pattern	Symbol
A-2	92,000	9/24/09	2/8/10	EF4	Lower	95,000	wnw nnwwn	
A-3	195,000	9/24/09	2/10/10	EF4	Lower	180,000	wnw nnwwn	
A-4	163,000	10/2/09	2/16/10	EF4	Lower	149,000	wnw nnwwn	
A-5	163,000	10/2/09	2/16/10	EF4	Lower	157,000	wnw nnwwn	
A-6	171,000	10/6/09	2/17/10	EF4	Lower	199,000	wnw nnwwn	
A-7	171,000	10/6/09	2/17/10	EF4	Lower	164,000	wnw nnwwn	
A-8	284,000	10/8/09	2/22/10	EF4	Lower	250,000	wnw nnwwn	
A-9	249,000	10/12/09	2/18/10	MF4	Lower	250,000	wnw wwww	
A-10	249,000	10/12/09	2/18/10	MF4	Lower	255,000	wnw wwww	
A-11	296,000	10/15/09	2/25/10	MF4	Lower	283,000	wnw wwww	
A-12	296,000	10/15/09	2/25/10	MF4	Lower	264,000	wnw wwww	
A-13	256,000	10/20/09	3/8/10	MF4	Lower	250,000	wnw wwww	
A-14	256,000	10/20/09	3/8/10	MF4	Lower	248,000	wnw wwww	
A-15	256,000	10/20/09	3/4/10	MF4	Lower	243,000	wnw wwww	
A-16	220,000	10/22/09	3/9/10	LF4	Lower	232,000	wnw wnwvw	
A-17	224,000	10/22/09	3/10/10	LF4	Lower	231,000	wnw wnwvw	
A-18	227,000	10/23/09	3/9/10	LF4	Lower	227,000	wnw wnwvw	
A-19	172,000	10/27/09	3/16/10	LF4	Lower	177,000	wnw wnwvw	
A-20	173,000	10/27/09	3/16/10	LF4	Lower	177,000	wnw wnwvw	
A-21	166,000	10/29/09	3/15/10	LF4	Lower	167,000	wnw wnwvw	
A-22	230,000	11/2/09	3/22/10	LF4	Lower	230,000	wnw wnwvw	
A-23	118,000	11/13/09	3/29/10	LF4	Lower	112,000	wnw wnwvw	
S-19	16,000	11/13/09	4/12/10	LF4	Lower	18,000	wnw wnwvw	
S-20	16,000	11/19/09	4/5/10	LF4	Lower	15,000	wnw wnwvw	