2013-2014 CEDAR RIVER SOCKEYE HATCHERY ANNUAL REPORT

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Introduction

Beginning in 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.

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 an interim hatchery at the Landsburg Drinking Water Diversion Dam near Ravensdale, Washington. After almost 20 years in the interim hatchery, operations were moved to a newly-constructed, permanent facility during the 2011-2012 season. The permanent facility is located just below the Landsburg dam on the north side of the Cedar River.

The Cedar River Hatchery was designed to incubate, rear, and release up to 34 million fry and provides the flexibility to adjust operations in accordance with the implementation of the Cedar River Sockeye Hatchery Adaptive Management Plan (AMP). The AMP addresses key concerns about the impacts and capability of the Cedar River sockeye program by utilizing experts in pertinent fields like fish health and hatchery reform to guide hatchery operations. Systems are designed to limit stress on the fish, produce hatchery fish more similar to their wild cohorts, and reduce the risk of pathogen transfer between fish and eggs.

WDFW collects broodstock at a floating resistance-board weir and trap near the Renton Community Center (RM 1.8). As available and necessary, broodstock are also collected at the fish ladder at the Landsburg dam.

Program Goals

The overall 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 avoid negatively impacting naturally produced sockeye or other species in the Cedar River watershed.

Specific goals are to collect, hold, and spawn enough adult sockeye broodstock (24,000) to achieve a maximum green egg take of 37,700,00 eggs and release a maximum of 34,000,000 fry after a normal egg to fry loss of approximately 10%. Additionally, the hatchery serves to ensure stable sockeye fry production in years when floods impact the survival of natural production in the river. In order to maintain the genetic integrity of naturally produced fry, hatchery fry plants are not to exceed 50% of the total fry production of the river for any given year.

Facility Description

The Cedar River Hatchery has a 14,000 square foot hatchery building housing 138 kitoi incubators, 47 fiberglass starter troughs, staff offices, chemical storage, lab, shop, parts, mechanical, and maintenance rooms. Also on site are 4 concrete adult raceways with electric crowders, a covered outside spawning area, an inside fertilization/disinfection building, a 3-bay garage and a large carport housing a trailer for standby personnel at the trap. The hatcheries pump intake assemblies supply surface spring water for all incubation and rearing and are located across the river from the facility. Before the spring water reaches incubation, it is sent through heat exchangers that attempt to mimic the water temperatures that naturally produced fry are exposed to. This more closely aligns hatchery fry outmigration with that of the natural fry. Rearing troughs are equipped with main drains and a 3" fry transfer line for fry releases. There are two 3 bedroom, 2 bath residences onsite for hatchery standby personnel.

Methods and Results

To achieve program goals, WDFW and SPU hired 9 temporary Fish Hatchery Technicians this season. Two of them were 2.5 month positions that performed standby obligations at the trap. The remaining positions consisted of a 7 month, four 3 months, and two additional 2.5 months.

Cedar River sockeye adults were collected at the floating resistance-board weir and trap located in Renton, Washington (RM 1.8). Adults were then hauled by truck to the adult raceways at the hatchery. When adults were ready to be spawned, gametes were collected at the adult pond area. The eggs were then fertilized, rinsed, and water-hardened in the fertilization room adjacent to the adult raceways. From there, eggs were transported to the incubation room and put down in incubators.

At strategic times during incubation, chilled spring water was substituted for ambient temperature spring water to provide distinguishing thermal marks on the otoliths of all hatchery fish. Tempered spring water (spring water conditioned to mimic river water temperature) was also used to slow development of eggs and fry. Once the fry swam up and were ready to be ponded, they were allowed to volitionally migrate to one of the 47, 19-foot by 3-foot rearing troughs. This volitional migration was allowed to progress over 9 days before the remainder of the fry were manually removed from the incubator and placed into the trough. Fry were fed for a minimum of 4 days and a maximum of 15 days prior to release. The release location and number of fry released at each location was predetermined by the Cedar River Hatchery Adaptive Management Work Group (AMWG). The AMWG is an advisory body that helps guide the hatchery program. The three release locations agreed upon were on-site at the Hatchery, just below Landsburg Dam (Upper – RM 22), the train trestle (Middle – RM 13.5), and at the Riviera Apartments (Lower – RM 2.1).

Adult sockeye counts through the fish ladder at the Ballard Locks conducted by the WDFW and Muckleshoot Indian Tribe indicated that the 2013 run exceeded pre-season estimates. While the preseason estimate was 98,000, the total count during the normal counting period (6/12/2013 - 10/2/2013) was 179,203. Locks data can be viewed here (http://wdfw.wa.gov/fish/sockeye/counts.htm).

Trap and Weir Operations

On September 5, 2013 WDFW and SPU installed the resistance board weir at Renton in approximately six hours. Low flows, good weather, and the ease of access to the river promoted this quick install. The trap was placed approximately 24 feet from the edge of the driveway on the south bank of the river. A 6'x8' extension was added to the upstream side of the existing trap to increase trapping capacity and attraction. Plywood panels and a gravel-bag wing wall were used to improve attraction flow to the trap and tip-gate channel. An aluminum panel was also used to increase attraction flow to the trap. Technicians also painted the aluminum "V" entrance to the trap black and provided shade cover over the entrance channel to the trap in an effort to improve recruitment of Chinook and coho.

Although 179,203 sockeye were estimated to have returned to Lake Washington, of those, WDFW estimates that 147,056 reached the Cedar River.

Trapped sockeye were sorted by sex from the trap into three aluminum live boxes for in stream holding until they were placed into rubber carrying boots, and loaded into the tanker trucks to be hauled to the adult holding ponds at the Cedar River Hatchery.

Hatchery technicians monitored fish activity during daylight hours at the trap, weir, and stretches of river above and below the weir regularly and passed any Chinook, coho, or other non-target species upstream or out of the trap as soon as possible. During weir operations, 10 Chinook, 3 coho and 2 trout were passed upstream through the trap (Table 1). A total of 3 Chinook mortalities resulted from being caught in and trapped under some of the weir panels. Causes were identified and immediately repaired. All other Chinook and coho traveled unimpeded through the tip gate (Appendix: 1).

After trap installation, initial trapping efforts were highly productive, yielding some of the heaviest trapping days on record. Adults were hauled to the hatchery in as many as 5 loads (1000 fish) per day (Appendix: 1). The early pulse of fish arriving during ideal trapping conditions, translated to high, early capture efficiencies. However, by September 28th, despite remarkable efforts by WDFW and SPU-hired, professional divers to maintain the weir, an early storm event triggered a decision to remove portions of the trap. The weir was unable to trap for 11.5 days before flows subsided enough to resume trapping. On October 9th, SPU voluntarily reduced the Cedar River flows and in conjunction with subsiding natural flows, hatchery staff were able to reinstall the trap and begin fishing again (Figure 1). After that storm event, sockeye all but refused to recruit to the trap for the remainder of the season. After several high water events requiring the assistance of professional divers, the weir was removed on November 12th. The trap and trap extension were removed intact by crane and all remaining parts were removed by hand. The substrate rail and substrate cable were left in place. Overall trap efficiency for the season averaged 4.33%.

In addition to the 5,020 sockeye trapped and hauled from the weir, 1,354 sockeye were transported to the hatchery from the fish ladder at the Landsburg dam.

Table 1: 2013 – 2014 Cedar River Trap Summary

Fishing Activities

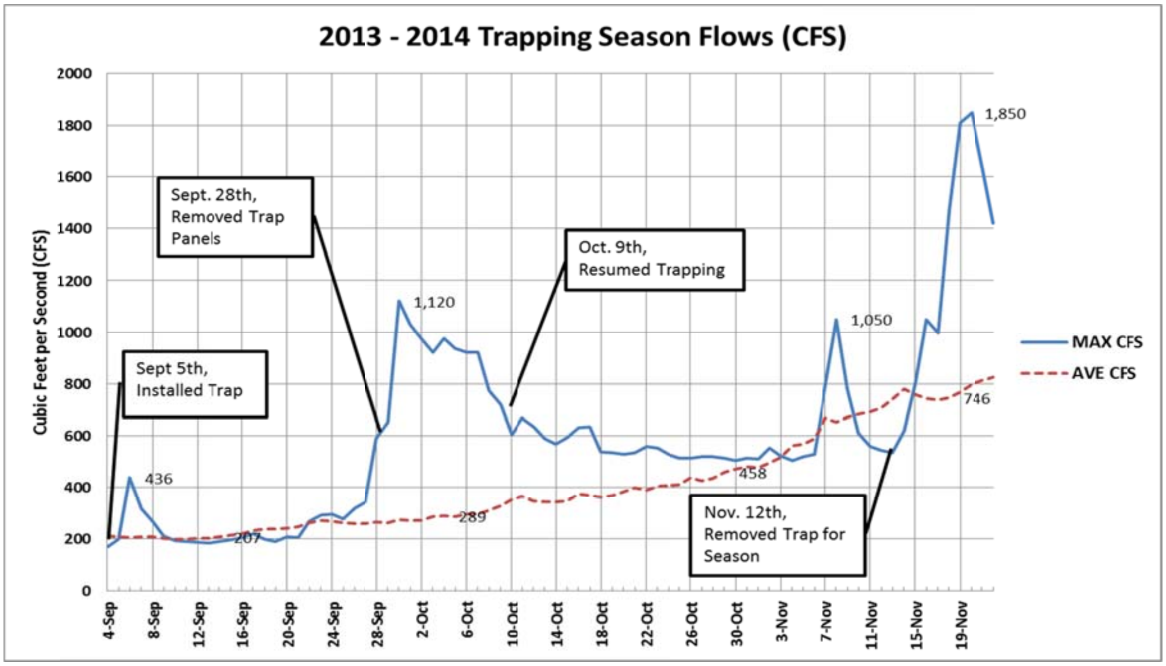
	Sockeye		**Chinook**		**Coho**	**Trout**
	Male	**Female**	**Male**	**Female**	**Unsexed**	**Unsexed**
Hauled to Hatchery*	2,732	2,288	0	0	0	0
Passed upstream	81	55	5	5	3	2
Viewed thru Tip Gate	N/A	N/A	68		N/A	0

* Does not include adults received from Landsburg

Trap Configurations (Last 3 season comparison)

	2011		2012		**2013**	
	Hours	**%**	**Hours**	**%**	**Hours**	**%**
From Install to Initial Removal	1368	100.0%	1224	100.0%	1625	100.0%
Trap Fishing	1362	99.6%	1224	100.0%	1158	71.3%
Tip Gate Open	508	37.3%	499.5	40.8%	416	25.6%
Deep End Panels Fishing	1279	93.9%	1132	92.5%	1141	70.2%

Figure 1: Trapping Season Flows in Cubic Feet Per Second



Spawning Operations

The 2013-2014 spawning season began on September 16 and ended on November 27. Broodstock were delivered via tanker truck to one of four 6 foot wide, 65 foot long adult raceways through an aluminum flume adjacent to the raceways. Males were held in two ponds and females were held in two ponds. All efforts were made to sort through the earliest arrivals whenever possible. Maximum loadings of 1,000 males and 800 females per raceway with 550-600 gpm of river water were found to be suitable.

Prespawn mortality reached 30% this season despite preventative measures that proved successful the year before. Preventative measures included, increasing pond flows, additional spawn days, lighter loadings, covering male ponds and salt block treatments. Heavy September rains coaxed a significant portion of the run into the river earlier than normal. Adults that may have remained in the lake longer, otherwise found themselves holding in the hatchery ponds several weeks prior to their spawn date. Increased holding times and the resulting handling stress may have attributed to the bulk of mortalities but to date, no conclusive cause has been identified. Pathology reports indicated that samples after Oct. 16th revealed a high prevalence of IHN but but did not find a correlation to mortality. Additionally, heavy amounts of fungus and poor gill conditions were identified but again, no direct correlation to mortality was found. (Thomas, 2014).

On spawn days, fish were crowded in their ponds, females were checked for ripeness, and ripe fish were killed using a pneumatic fish stunner and green females were either sent to another pond or passed behind the crowder. Killed spawners were placed on an electric conveyor that lifted them from the lower pond level up to a perforated collection table on the spawning deck. Females were dipped in a solution of 1:100 iodaphor and placed on a table for 10 minutes in an effort to disinfect their exterior. Males were not disinfected, as sperm contact with iodaphor results in mortality, but were wiped down with paper towels. Gametes were collected in stainless steel bowls, combined with approximately one tablespoon of spring water. They were then stirred to aid fertilization, and passed through the roll-up window into the fertilization room. After allowing 5 minutes for fertilization, fertilized eggs were rinsed and immersed in a solution of 1:100 iodaphor for one hour to ensure sufficient IHNV disinfection. After the hour, eggs were combined into a disinfected bucket and transported to the hatchery. Used stainless steel bowls were washed and thermally disinfected with hot water in a commercial dish washer and set to air dry. Fertilized, disinfected eggs were taken up to the hatchery and laid into kitois for incubation. Eggs were then supplied with regulated pathogen free spring water for the entire duration of their incubation and rearing.

Since the program's inception in 1991, the largest egg take was last season (2012) at just over 20 million. The 22 year average is 9.87 million. This year, 2,299 spawned females produced a final egg take of 7,800,307 with an average fecundity of 3,362 (Appendix: 2). The 22 year average fecundity is 3287.

This season marks the first year that hatchery staff collected biological data and removed otoliths without the aid of Biological Technicians. After each spawn day, hatchery staff worked to obtain a total of 919 otoliths (19.9%) from both male and female spawned carcasses. Of those otoliths, 237 (26%) were of hatchery origin and 682 (74%) were of natural origin. Ovarian fluid, kidney and spleen, samples were also taken. A detail of the results can be found in the 2013-2014 fish health report (Thomas, 2013-2014)

Incubation and Picking Operations

Previous seasons' operations have revealed that the exceptional quality and temperature of the spring water permit minimal chemical treatment of eggs. From the day after entering the hatchery until hatch, eggs were treated with formalin 3 days/week for 15 minutes at 1:600 ppm to control fungus growth. The minimal treatment regime once again proved successful and fungus was rarely found.

Last season, a formalin emitter had plugged and dislodged from its supply tubing, killing over 181,000 eggs with unregulated flow. In response, emitters were raised up and out of the kitois to allow visual monitoring. Drip chambers were then added inline just below each emitter. This enabled staff to determine if the flow rate was accurate and whether or not an emitter was plugged or had become dislodged from the tubing without exposing the formalin to the air or having to physically remove the emitter from inside the kitoi. The new system worked flawlessly and the improved visibility enabled staff to identify and address emitter malfunctions as they occurred.

When the eggs reached the eyed stage they were siphoned out of their incubators and physically shocked (bumped) to help distinguish healthy eggs from the dead. 24 hours after shocking, they were picked by a Jensorter egg picker and once again by hand. After picking, the eggs were put back into their original incubator between 3, approximately 2" thick layers of plastic saddle substrate. During the picking operation, eggs were sampled to determine size and weighed to establish accurate populations, fecundity and rates of loss.

Egg loss remained low this year at 4.3%. In order to estimate the proper amount of eggs per incubator, a fecundity estimate is used at the time of spawning each year. Recent years' fecundities have been higher than the average 3287 and therefore, 3400 was used as this season's estimate. After picking, the newly calculated fecundity of 3362 revealed a slight decrease of 16,293 eggs actually taken (Appendix: 2).

In an effort to increase rearing quality, release flexibility, marking efficiency, and exposure to TSW, the AMWG decided to omit the otolith mark that denotes location of release. Brood year 2013 fry will only carry marks identifying their brood year and timing of release (Appendix: 3). The Hatchery Manager and SPU otolith consultant Michael Wunderlich then worked to streamline the thermal marking process by reducing the number of marking events and consequently, human error associated with frequent valve changes.

The otoliths of eggs and alevins received thermal marks by delivering chilled water to their incubators for prescribed periods of time. To accomplish this, ambient spring water was cooled at least 4 degrees Celsius by a chiller and heat exchangers in the headworks before delivery to the incubators. When an incubator was scheduled to be chilled, the ambient temperature spring water supply to that incubator was replaced by the chilled water for the number of hours prescribed by the chilling schedule. When the mark was complete, chilled water was discontinued and ambient temperature spring water was returned to the incubator.

During periods of incubation when thermal marks were not being applied, and average river water temperatures were colder than the 48 degree ambient spring water, tempered spring water was used to slow down egg and fry development. One of the goals of the Cedar River Hatchery Adaptive Management Plan is to sync the development and release timing of hatchery fry with that of naturally produced fry. This goal is reflected in the design and operation of the tempered spring water system which uses the colder river water to cool down spring water.

Thermal mark periods occur shortly after shocking and picking the eggs and again, shortly after hatching. To enhance the visibility of each marking period, 3 to 5 days of static temperature water (ambient spring water) is applied before and after the marking period. Throughout the season, the varying water supplies for each incubator were recorded to establish accurate Temperature Units (T.U.'s). The reduction of marks per kitoi and total mark days resulted in a significant increase in exposure to TSW. Although the rearing strategy was shortened from 2 weeks to 1, the amount of time spent within the hatchery actually lengthened (Table 2). This resulted in later release dates (Table 8).

Table 2, Incubation Water Exposure Summary

	Cumulative Days on Source			Cumuluative Temperature Units			
Season	**TSW**	**ASW**	**CSW**	**Shock**	**Hatch**	**Pond**	**Release**
2012 - 2013	111	36	7	629	1114	1808	2047
2013 - 2014	48	92	12	640	1150	2050	2114
Difference	-63	56	5	11	36	242	67

Rearing and Release Operations

When a substantial amount of fry (a few thousand) began to swim up from the substrate, the outlet screen was removed from the kitoi to allow volitional migration through the incubator drain hose and into the adjacent fiberglass rearing trough.

With the hatchery only utilizing approximately 28% of its capacity and the omission of the location mark, there was ample space and flexibility to allow fry to mature at their own rate. More consistent rearing durations and release dates were also achieved.

One to three days after screen removal, fish were introduced to light passes of feed hourly during their 9 days of outmigration. Fish were then fed hourly during the 8 hour workday, seven days per week with a ration of 3% body weight for approximately 7 days.

EWOS starter feed was introduced this year to compare it's qualities with that of Rangen, our typical starter. Feed conversions were consistent with previous years among both feed brands. Growth rates seemed to dramatically increase by the 6th to 8th day of full-ration feeding for either feed brand. There were no significant performance differences identified between the two brands. EWOS is a heavier feed with a faster sink rate and has much less fines. The cleaner feed resulted in less suspended fines within the trough which improved fry rearing conditions. As no detrimental effects from using EWOS were found, EWOS will be the new standard for the program from this point forward.

Outmigrating fry were sampled to determine their baseline size at ponding and averaged 2,692 fish per pound (fpp). Fry were sampled once more the day of their release and averaged 2,382 fpp. Average growth was 310 ffp or 11.5% and the average coefficient variant (CV) was 4.6 at release with a K factor of 0.6. Mortality incurred between picking and releasing or "rearing mortality" was exceptionally low at <1.0% (Appendix: 4).

Upon release, fry were sent through a 4" PVC fry transfer line to either the planting truck or directly into the Cedar River on-site. Hauled fish were released either in the middle or lower locations (Appendix: 3). The numbers of fry, locations, and schedule for releases were developed by WDFW with input from the AMWG and TWG. 18.9% of the fry were released at the hatchery/upper site, 41.3% were released at the Trestle/middle site, and 39.8% were released at the Riviera/mouth (Table 3). This strategy was employed to simulate wide spatial distribution of redds throughout the river. Season mortality was 5.6%, resulting in a planted fry total of 7,380,948 (Appendix: 3).

Table 3, 2013 Fry Releases by Timing and Location

	Upper	Middle	Lower	Totals
Early	388,154	964,034	779,282	2,131,470
Middle	852,391	1,484,514	1,557,471	3,894,376
Late	153,248	596,188	603,950	1,353,386
Totals	1,393,793	3,044,736	2,940,703	7,379,232
Percent	18.89%	41.26%	39.85%	

Analyses of the release strategies for different locations and timing are achieved through fry trap operations (Kiyohara, 2014) and otolith data. All releases above the mouth were at least 3 days apart from each other in order to differentiate each release from one another as they entered the fry trap downstream.

Fortunately, abundant spring water this season provided ample supply to the pump assemblies and there were no issues with available space or water this season. Concerns regarding sufficient water supply for years of larger egg takes (> 20 million) have spurred intensive investigation that is currently underway.

For the third consecutive season, hatchery fry releases were interrogated at the fry trap to determine in-river survival (Table 4). Several groups of fry were marked with Calcein, a green dye, to determine capture efficiency and delayed migration rates as well.

Table 4, Number of Releases Interrogated for In-River Survival

	Release Location		
Release Timing	**Lower**	**Middle**	**Upper**
Early	1	2	1
Middle	0	1	3
Late	0	2	3

Calcein is a bright green dye that produces a distinct, iridescent mark on the calcium in fin rays and bones. The mark is not visible under normal light, but shows up clearly when illuminated with a bright blue light and viewed through a special lens.

Because Calcein dye is not yet approved for use on animals, an Investigational New Animal Drug (INAD) permit from the Aquatic Animal Drug Approval Partnership Program, administered by the U.S. Fish and Wildlife Service, was required. The INAD process included a thorough application process, adherence to certain study protocols, strict monitoring of drug inventory and disposal, and thorough reporting on the results of use of the dye.

Fry to be marked were crowded to one end of their ponds and kept separate from marked fry by intermediate trough screens. Approximately 6,000 fry at a time were dip-netted from the unmarked section of the trough, placed in a 4 gallon bath of 2% saline solution for 6 minutes, placed in a 4 gallon bath of 0.5% calcein solution for 6 minutes, and then dumped into the marked portion of the trough. On days when fry were marked, they were not fed to minimize stress. The saline solution was exchanged regularly to further minimize stress on the fish.

Calcein dye was used to mark one group of approximately 244,000 fry from a middle river release group. These fry were captured at the fry trap in the lower river on the nights of release and the two following to assess survival, delayed migration rates, and a new study technique.

In addition to the above Calcein study, 6 groups of 5,000 to 3500 were marked and released on separate nights to evaluate collection efficiency of the lower river fry trap. Other studies including wild fry marked with Bismarck Brown were also conducted.

This season, a new counter/sorter was tested. See the Cedar River's Juvenile Salmon Production Evaluation (Kiyohara, 2014) for additional methods, results and conclusions regarding the trapping studies.

Disease

When fry were planted, 36 fish from each rearing vessel were collected and sent to the WDFW fish health lab for virology. This season, no regulated viral pathogens were detected and the program was fortunate to avoid an IHN outbreak. Pathology noticed some increased size variation (Thomas, 2013-2014). This may or may not be due to the shorter rearing time and periods from which the samples were taken. Hatchery staff noticed that fish growth did not seem to increase measurably before the 8th day or so. Given that the fry were only fed for a maximum of 16 days and a minimum of 4, size variation could be expected.

Discussion and Conclusions

This is the third season of operation for the new Cedar River Hatchery and although there were not many adults collected, many lessons were learned. New trapping configurations for next season should prove to be more resilient, attractive to fish, and efficient to clean. A more streamlined marking process improves readability with cleaner marks, enables consistency within the program, provides shorter marking windows that increase river water exposure and reduces the opportunity for human error with limited valve changes. Omitting the release location mark enables the hatchery manager to pond and plant fry as they become ready rather than according to a schedule. Adult mortality was high and its cause continues to baffle managers. However, a study to investigate holding time via PIT tags and increased mortality diagnostics are planned for next season. SPU and WDFW continue to investigate the need for greater adult holding capacity and increased availability of spring water. A new adult/fry hauling truck is currently being constructed and will greatly improve flexibility in hauling for next season.

Adult Trapping and Weir Management

Achieving adequate lift on the resistance board weir in swifter currents continued to be a challenge. Inflatable pontoons were attached immediately behind the resistance boards to achieve greater lift in higher flows.

Although the inflatable pontoons did improve floatation, they were prone to leaking air and the sleeves filled with water. This caused the pontoons to present more drag than floatation in flows greater than 500cfs. On October 23rd the pontoons were removed and replaced with 55g poly drums held in place with ratchet straps. Improved floatation was immediately recognized however, flows surpassing 600cfs still managed to push them down. A complete redesign of the weir bulkheads and additional floatation for the resistance boards should improve the weirs ability to withstand slightly higher flows and/or debris loads for next season, 2014.

A 6' x 8' addition was attached to the upstream end of the trap, almost doubling the existing traps capacity. The extension not only provided greater holding capacity but it allowed technicians to separate adults without handling and improved recruitment when the trap would have otherwise appeared full. The additional space proved to be easier for technicians to work in and the integrated "upstream doors" enabled more friendly and efficient removal of Chinook.

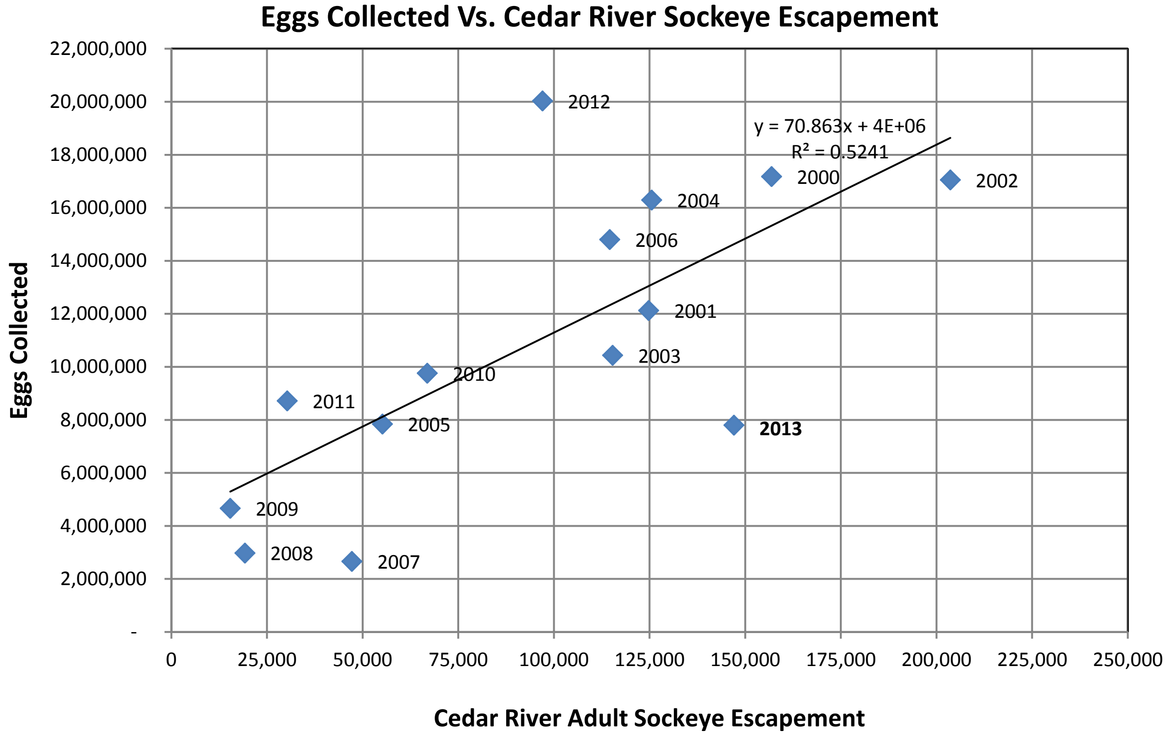
Problems in recruitment highlighted this year's challenges as the bulk of sockeye swam over and around the weir at every opportunity. Encouraging sockeye to use the trap channel was difficult when flows frequently submerged the weir. Bulkheads were mistakenly pinned to the river bottom this year and prohibited sockeye from nosing along the weir and into the trap channel. Floating bulkheads next season will eliminate that obstacle. Panels placed just upstream of the trap channel were used to funnel additional attraction to the trap and did improve recruitment. These will be implemented again next season. Additionally, a sandbag wing-wall was constructed to divert water and encourage chinook to use the tip-gate channel. Although the effectiveness of the wing-wall was inconclusive, a diversion panel will replace the wing-wall next season. A shade was added to the trap channel to improve attraction as well. Many of the efforts to improve attraction were moderately successful but they were implemented too late in the season to contribute significantly.

Another significant recurring issue this season was the impingement of sockeye and Chinook under the base of the weir. Due to the added obstacles of the stationary bulkheads, both sockeye and Chinook spent an increased amount of time searching the weir for pathways upstream. During their efforts, adults were exposed to a combination of fluctuating flows and improper sandbag positioning that allowed the tails to become wedged between the pickets. Next season, sand bags will be placed properly, and the picket sections will have additional spacers toward the bottom to improve rigidity and minimize gaps.

Although robust, this year's Chinook run was quite compacted. Unfortunately, the heavy migration of Chinook correlated with an equally large push of early sockeye. In order to pass the Chinook upstream in accordance with our protocols (Appendix: 6), extensive tip-gate openings were required thus allowing large numbers of sockeye to pass. WDFW missed an opportunity to collect these sockeye during a period of optimal trapping/flow conditions.

Chart 1 illustrates the consistent improvement in adult collection efficiency since 2000. However, due to factors described above, this season (2013) is a noticeable outlier. Collection efficiency refers to the percentage of adults collected vs. what is assumed to have recruited to the Cedar River.

Chart 1, Eggs Taken vs. Cedar River Escapement (Consider moving to back of doc)



Next season (2014 -2015), the hatchery will benefit from an additional fry and adult hauling truck. The new truck will be a Ford F550 flatbed with two 350g tanks capable of hauling 70 adults each and 250,000 fry each. The additional vehicle will enable staff to capitalize on strong return days by increasing the number of adults collected. In addition, days when few adults arrive, the new , smaller truck will be much easier for new staff to drive.

Spawning and Incubation

In an attempt to replicate last season's low holding mortality (7.2%), staff spawned 3 days per week, male adult ponds were covered, pond flows were maintained at 550-600gpm and pond loadings were managed conservatively (<800 adults) for most of the season. Despite these efforts, prespawn mortality climbed to 30.0% (Table 5). Several factors may have contributed to the high levels but no conclusive causes have been identified. One likely theory is that the earlier arrival of adults translated into increased holding time resulting in additional handling and holding stress.

Similar to previous seasons, male prespawn mortality was significantly higher than the females (Table 5). This facility is challenged in that it lacks the holding capacity to sort and distinguish early from later arriving males which contributes to increased handling and holding time. The Cedar River Technical Work Group (TWG) has proposed a study investigating holding duration via the use of PIT tags. By inserting PIT tags at the time of collection and reading them at the time of spawn, managers can easily quantify holding duration.

Tests conducted by fish health specialists and hatchery technicians throughout the season found a high prevalence of IHN, fungus, and poor gill conditions. (Thomas, 2013-2014).

Table 5, 2005-2013 Adult Prespawn Mortality

Brood Year	Eggs Taken	Male Mortality	Female Mortality	Total Mortality Rate	Female Mortality Rate
2005	7,835,000	407	116	10.68%	2.37%
2006	14,794,000	341	358	7.56%	3.87%
2007	2,496,000	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%
2010	9,560,190	454	86	9.04%	1.44%
2011	9,015,000	1067	703	26.45%	10.51%
2012	20,030,477	661	211	7.2%	3.6%
2013	**7,800,307**	**1403**	**507**	**30.0%**	**17.9%**

Egg loss for the 2012-2013 season was low at 4.3% (Table 6). Lower egg loss could be attributed to shorter adult holding time, slightly lighter incubator loadings, careful handling of eggs and meticulous management of incubator water flows.

Table 6, 2003-2013 Egg loss

Brood Year	Total Eggs Taken	Loss
2003	11,487,100	17.26%
2004	16,682,000	8.99%
2005	7,513,600	8.27%
2006	13,465,000	8.37%
2007	2,870,300	6.62%
2008	2,971,400	4.75%
2009	5,162,395	7.04%
2010	9,560,190	5.29%
2011	9,015,000	6.06%
2012	20,030,447	5.3%
2013	**7,800,307**	**4.3%**

Rearing and Releases

As stated above, one of the goals of the AMP is to synchronize the release timing of hatchery fry with the outmigration of naturally produced sockeye in the river. This has been measured by calculating the median migration dates, the date at which half of the fry have migrated. In order to better align the hatchery fry migration with their naturally produced counterparts, their median release date must shift forward. Table 7 illustrates a successful shift of the median release date thus far. This shift can be attributed to the delayed development resulting from the use of cooler tempered spring water. Additionally, the decision to eliminate the location mark and shorten the required ASW periods before and after a chill event significantly increased the exposure to TSW (Table 2). Having the capacity to feed all production and an increase from 8 to 24 hour chill events could also have contributed to slower growth.

Table 7, Median Fry Plant Dates

Year	Median Plant Date
2004-2005	22-Feb
2005-2006	23-Feb
2006-2007	16-Feb
2007-2008	06-Mar
2008-2009	06-Mar
2009-2010	04-Mar
2010-2011	18-Feb
2011-2012	08-Mar
2012-2013	11-Mar
Average	**28- Feb**
2013-2014	**12-Mar**

Appendices

Appendix 1, 2013 -2014 Trapping Data

Trap Configuration (Hours Set/Fishing)				Fish Activity At the Weir													
Date	Trap Fishing	Tip Gate open	Deep End Panels Fishing	Sockeye Hauled (Trap) F	Sockeye Hauled (Trap) M	SO PASSED F	SO PASSED M	Unmarked CK PASSED F	Unmarked CK PASSED M	Ad-Clipped CK PASSED F	Ad-Clipped CK PASSED M	CO PASSED F	CO PASSED M	PK PASSED F	PK PASSED M	TROUT PASSED	CK VIEWED THRU TIP
5-Sep	8	3.5	24	0	0	0	0	0	0			0	0	0	0	0	0
6-Sep	24	10.0	24	0	0												
7-Sep	24	9.0	24	0	0												
8-Sep	24	9.0	24	0	0												
9-Sep	24	12.8	24	91	44	0	0	0	0	0	0	0	0	0	0	1	0
10-Sep	24	11.5	24	54	30	0	0	0	0	0	0	0	0	0	0	0	1
11-Sep	24	13.0	24	0	0	0	0	1	0	0	0	0	0	0	0	0	0
12-Sep	24	13.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13-Sep	24	13.0	24	41	24	0	0	0	0	0	0	0	0	0	0	0	0
14-Sep	24	10.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15-Sep	24	0.0	24	39	30	0	0	0	0	0	0	0	0	0	0	0	0
16-Sep	24	8.0	24	0	0	0	5	1	3	1	1	0	0	0	0	0	0
17-Sep	24	2.0	24	20	32	3	2	0	0	0	0	0	0	0	0	0	3
18-Sep	24	0.0	24	100	100	2	2	1	0	0	0	0	0	0	0	0	0
19-Sep	24	14.5	24	0	0	0	2	0	0	0	0	0	0	0	0	0	35
20-Sep	24	11.0	24	41	100	0	0	1	0	0	0	0	0	0	0	0	3
21-Sep	24	8.0		0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Sep	24	2.0		38	65	0	0	1	1	0	0	0	0	0	0	0	0
23-Sep	24	0.0	20	400	400	0	0	0	0	0	0	0	0	0	0	0	0
24-Sep	24	15	20	500	500	0	0	0	0	0	0	0	0	0	0	0	25
25-Sep	24	0.5	24	200	200	0	0	0	0	0	0	0	0	0	0	0	1
26-Sep	24	0.0	24	200	200	0	0	0	0	0	0	0	0	0	0	0	0
27-Sep	14	0.0	14	300	300	50	50	0	0	0	0	0	0	0	0	0	0
28-Sep	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Sep	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Sep	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8-Oct	0	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Oct	11	0.0	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Oct	24	0.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Oct	24	0.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Oct	24	0.0	20	2	95	0	0	0	0	0	0	0	0	0	0	0	0
13-Oct	24	0.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14-Oct	24	0.0	24	0	0	0		0	0	0	0	0	0	0	0	0	0
15-Oct	24	0.0	24	3	62	0	0	0	0	0	0	0	0	0	0	0	0
16-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19-Oct	24	0.0	24	0	0	0		0	0	0	0	0	0	0	0	0	0
20-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21-Oct	24	0.0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22-Oct	24	0.0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23-Oct	24	0.0	18	1	67	0	0	0	0	0	0	0	0	0	0	0	0
24-Oct	24	0.0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25-Oct	24	0.0	24			0	0	0	0	0	0	0	1	0	0	0	0
26-Oct	24	0.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27-Oct	24	0.0	20	3	85	0	0	0	0	0	0	0	0	0	0	0	0
28-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29-Oct	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30-Oct	24	15	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31-Oct	24	15	24	1	38	0	0	1	0	0	0	0	0	0	0	0	0
1-Nov	24	15	24	52	18	0	0	0	0	0	0	1	1	0	0	0	0
2-Nov	24	0.0	0	18	15	0	0	0	1	0	0	0	0		0	1	0
3-Nov	24	0.0	0	0	0	0	0	0	0	0	0	0	0		0	0	0
4-Nov	24	0.0	24	39	52	0	0	0	0	0	0	0	0	0	0	0	0
5-Nov	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6-Nov	24	0.0	24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7-Nov	24	0.0	0	100	100	0	0	0	0	0	0	0	0	0	0	0	0
8-Nov	0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9-Nov	12	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10-Nov	24	0.0	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11-Nov	24	0.0	20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12-Nov	9	0.0	20	108	100	0	20	0	0	0	0	0	0	0	0	0	0
TOTALS:	1,302	421	1,141	2,351	2,657	55	81	6	5	1	1	1	2	0	0	2	68
TOTALS:				5,008				13									

Appendix 2, 2013 – 2014 Egg Summary

Take Date	Take #	# Females	Green Eggs	Live Eggs	Dead Eggs	% Loss	Adj Total	Over Short(-)	New Fecundity
9/16/13	**1**	86	292,400	288,923	12,450	4.1%	**301,373**	8,973	3504
9/23/13	**2**	172	584,800	581,294	30,663	5.0%	**611,957**	27,157	3558
9/25/13	**3**	78	265,200	255,700	18,648	6.8%	**274,348**	9,148	3517
9/30/13	**4**	231	785,400	771,779	39,522	4.9%	**811,301**	25,901	3512
10/1/13	**5**	77	261,800	255,305	13,490	5.0%	**268,795**	6,995	3491
10/2/13	**6**	156	530,400	531,245	21,690	3.9%	**552,935**	22,535	3544
10/7/13	**7**	326	1,108,400	1,098,799	50,726	4.4%	**1,149,525**	41,125	3526
10/11/13	**8**	165	561,000	541,676	33,293	5.8%	**574,969**	13,969	3485
10/14/13	**9**	156	530,400	522,793	18,333	3.4%	**541,126**	10,726	3469
10/16/13	**10**	84	285,600	276,476	12,259	4.2%	**288,735**	3,135	3437
10/18/13	**11**	171	581,400	508,734	22,282	4.2%	**531,016**	-50,384	3105
10/21/13	**12**	154	523,600	453,990	13,171	2.8%	**467,161**	-56,439	3034
10/21/13	**12**	34	115,600	101,682	3,304	3.1%	**104,986**	-10,614	3088
10/23/13	**13**	32	108,800	92,542	4,860	5.0%	**97,402**	-11,398	3044
10/28/13	**14**	35	119,000	95,332	11,038	10.4%	**106,370**	-12,630	3039
11/1/13	**15**	8	27,200	23,558	331	1.4%	**23,889**	-3,311	2986
11/4/13	**16**	42	142,800	129,054	6,603	4.9%	**135,657**	-7,143	3230
11/8/13	**17**	67	227,800	208,208	10,830	4.9%	**219,038**	-8,762	3269
11/12/13	**18**	96	326,400	306,510	10,962	3.5%	**317,472**	-8,928	3307
11/15/13	**19**	55	187,000	168,626	6,109	3.5%	**174,735**	-12,265	3177
11/20/13	**20**	62	210,800	202,848	4,801	2.3%	**207,649**	-3,151	3349
11/27/13	**21**	12	40,800	38,696	1,172	2.9%	**39,868**	-932	3322
TOTALS / AVERAGES:		**2,299**	**7,816,600**	**7,453,770**	**346,537**	**4.3%**	**7,800,307**	**-16,293**	**3,362**

Appendix 3, 2014 Release Summary

Take Date	Take #	KITOI #	Release #	Release FPP	Release Lbs	Release Length	Release Date	Release Timing	Release Location	Mark Code
9/16/13	1	1	144,367	2241	64.4	30.2	2/12/14	Early	Lower	3H3
9/16/13	1	2	141,667	2241	63.2	30.2	2/12/14	Early	Lower	3H3
9/23/13	2	7	225,316	2192	102.8	30.9	2/18/14	Early	Middle	3H3
9/23/13	2	8	215,154	2302	93.5	31.4	2/18/14	Early	Middle	3H3
9/23/13	2	14	135,011	2242	60.2	31.2	2/18/14	Early	Upper	3H3
9/25/13	3	20	253,143	2208	114.6	31.2	2/18/14	Early	Upper	3H3
9/30/13	4	25	254,785	2226	114.5	31.1	2/26/14	Early	Lower	3H3
9/30/13	4	26	238,463	2192	108.8	31.4	2/26/14	Early	Lower	3H3
9/30/13	4	31	270,813	2570	105.4	29.8	2/21/14	Early	Middle	3H3
10/1/13	4 & 5	32	252,752	2398	105.4	30.5	2/21/14	Early	Middle	3H3
10/2/13	6	37	273,843	2367	115.7	30.7	2/27/14	Middle	Upper	4H4*
10/2/13	6	38	252,090	2340	107.7	30.6	2/27/14	Middle	Upper	4H4*
10/7/13	7	43	269,528	2766	97.4	29.1	3/6/14	Middle	Middle	3H4
10/7/13	7	44	244,108	2575	94.8	29.8	3/6/14	Middle	Middle	3H4
10/7/13	7	49	272,889	2314	117.9	30.8	3/6/14	Middle	Middle	3H4
10/7/13	7	50	248,540	2293	108.4	30.9	3/6/14	Middle	Middle	4H4*
10/7/13	7	56	52,747	1992	26.5	32.4	3/11/14	Middle	upper	4H4*
10/11/13	8	61	293,748	2293	128.1	30.9	3/12/14	Middle	Lower	4H4*
10/11/13	8	62	242,511	2398	101.1	30.5	3/12/14	Middle	Lower	3H4
10/14/13	9	69	263,888	2489	106.0	29.4	3/12/14	Middle	Lower	3H4
10/14/13	9	70	253,677	2670	95.0	30.1	3/12/14	Middle	Lower	3H4
10/16/13	10	76	273,711	2537	107.9	29.9	3/18/14	Middle	Upper	3H4
10/18/13	11	81	220,461	2028	108.7	32.2	3/26/14	Middle	Lower	3H4
10/18/13	11	82	232,292	2310	100.6	30.9	3/26/14	Middle	Lower	3H4
10/18/13	11	88	50,894	2153	23.6	31.6	3/26/14	Middle	Lower	3H4
10/21/13	12	93	235,331	2676	87.9	29.4	3/21/14	Middle	Middle	3H4
10/21/13	12	94	214,119	2600	82.4	29.7	3/21/14	Middle	Middle	3H4
10/21/13	12	100	100,665	2516	40.0	30.0	3/21/14	Late	Middle	3H2-2
10/23/13	13	106	91,617	2878	31.8	28.7	3/25/14	Late	Upper	3H2-2
10/28/13	14	112	94,379	2330	40.5	30.8	4/2/14	Late	Lower	3H2-2
11/1/13	15	118	23,322	2633	8.9	29.5	4/4/14	Late	Upper	3H2-2
11/4/13	16	124	127,763	2442	52.3	30.3	4/8/14	Late	Middle	3H2-2
11/8/13	17	130	206,126	1,928	106.9	32.8	4/16/14	Late	Lower	3H2-2
11/12/13	18	135	155,029	2,591	59.8	29.7	4/16/14	Late	Lower	3H2-2
11/12/13	18	136	148,416	2,507	59.2	30.0	4/16/14	Late	Lower	3H2-2
11/15/13	19	4	166,940	2478	67.4	30.1	4/22/14	Late	Middle	3H2-2
11/20/13	20	10	200,820	2162	92.9	31.5	4/29/14	Late	Middle	3H2-2
11/27/13	21	16	38,309	2422	15.8	30.4	5/1/14	Late	Upper	3H2-2
TOTALS / AVERAGES:			**7,379,232**	**2,382**	**3,118.1**	**30.5**	**3/12/14**	* = Variant Mark		

Appendix 4, 2013-2014 Rearing Summary

Take Date	Take #	Hatch Date	Swim-out Date	Ponding Date	Ponded FPP	Mortality Est. %	Mortality #	Days Fed	Lbs Fed
9/16/13	**1**	25-Nov	27-Jan	5-Feb	2543	1.0%	2,889	7	18.2
9/23/13	**2**	2-Dec	29-Jan	7-Feb	2507	1.0%	5,813	11	42.2
9/25/13	**3**	7-Dec	29-Jan	7-Feb	2524	1.0%	2,557	11	18.8
9/30/13	**4**	14-Dec	8-Feb	17-Feb	2494	1.0%	7,718	9	60.9
10/1/13	**5**	14-Dec	8-Feb	17-Feb	2584	1.0%	2,553	4	12.1
10/2/13	**6**	16-Dec	10-Feb	19-Feb	2606	1.0%	5,312	8	46.9
10/7/13	**7**	22-Dec	15-Feb	24-Feb	2589	1.0%	10,988	10	103.3
10/11/13	**8**	27-Dec	19-Feb	28-Feb	2645	1.0%	5,417	12	60.1
10/14/13	**9**	31-Dec	24-Feb	5-Mar	2814	1.0%	5,228	7	36.8
10/16/13	**10**	2-Jan	1-Mar	10-Mar	2921	1.0%	2,765	8	16.4
10/18/13	**11**	3-Jan	3-Mar	12-Mar	2701	1.0%	5,087	14	89.5
10/21/13	**12**	8-Jan	5-Mar	14-Mar	2692	1.0%	5,557	7	44.4
10/23/13	**13**	12-Jan	9-Mar	18-Mar	2955	1.0%	925	7	8.5
10/28/13	**14**	18-Jan	13-Mar	22-Mar	2879	1.0%	953	11	13
11/1/13	**15**	25-Jan	21-Mar	30-Mar	2754	1.0%	236	5	2.35
11/4/13	**16**	28-Jan	23-Mar	1-Apr	2819	1.0%	1,291	7	11
11/8/13	**17**	31-Jan	26-Mar	4-Apr	2886	1.0%	2,082	12	32.1
11/12/13	**18**	5-Feb	3-Apr	12-Apr	3100	1.0%	3,065	4	25.66
11/15/13	**19**	13-Feb	7-Apr	16-Apr	2830	1.0%	1,686	6	15.8
11/20/13	**20**	16-Feb	8-Apr	17-Apr	2880	1.0%	2,028	12	29.2
11/27/13	**21**	24-Feb	15-Apr	24-Apr	2725	1.0%	387	7	6.98
				TOTALS / AVERAGES:	**2,692**	**1.0%**	**74,538**	**8.9**	**18.3**

Appendix 5, 2013-2014 Operations Plan

General Production Schedule	May	Actual
Broodstock collection	Sep. 6 - Nov. 15	Sep. 4 – Nov. 12
Spawning	Sep. 17 - Nov. 30	Sep. 16 – Nov. 27
Egg picking	Nov. 12 - Jan. 10	Oct. 10 – Jan. 16
Ponding, rearing, release	Jan. 28 - Apr. 19	Feb. 5 – May 1

Adult Return	May	July 31st	Actual
Preseason Forecast	98,000		
Locks Estimate			(N/A)
Live Counts		177,349	179,203

Broodstock Collection Goal	May	July	Actual
Number of Adults	9,700-12,200	10,588-14,118	6374*

Broodstock Collection Schedule**	May	July	Actual Cedar Weir ***	Actual Landsburg ***
Sept. 9	522	692	132	0
Sept. 16	798	1,002	218	297
Sept. 23	1,094	1,369	1296	111
Sept. 30	1,300	1,638	2400	229
Oct. 7	1,336	1,680	0	246
Oct. 14	1,250	1,567	97	267
Oct. 21	1,136	1,426	72	116
Oct. 28	1,010	1,271	237	36
Nov. 4	906	1,129	247	30
Nov. 11	744	932	200	22
Nov. 18	618	776	208	0
Nov. 25	506	635	0	0
TOTALS	11,250	14,118	6461**	1910**

Egg Take Goal	May	July	Actual
Number of Eggs	16,000,000-20,000,000	18,000,000-24,000,000	7,816,600

Rearing Plan	May	July	Actual
Duration	2-weeks	2-weeks	7 days

Release Strategy	Location	May	July	Actual
Group A	Hatchery	33%	33%	18.9%
Group B	Trestle	33%	33%	41.3%
Group C	Riviera	34%	34%	39.8%

*Includes 1910 from Landsburg **Dates refer to week ending dates ***Actual collected and does not include adjustment of -87 fish at end of year.

Appendix 6, Trap and Weir Protocols

2013 Field Season Operational Guidelines for the Cedar River Weir and Fish Trap

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 years of successful implementation during the 1999-2012 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 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 potential impacts that we will seek to avoid: 1) having Chinook spawn within 25 meters of 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 limits 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.

- Monitoring and documenting Chinook responses to the weir 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 within 25 meters 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 (no openings in the weir for passing fish) regardless of Chinook being observed.
- If Chinook are observed holding within 25 meters downstream of the weir, 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 (trigger) and the Renton Library below the weir, they will discuss the situation with the hatchery manager 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.
- Chinook that enter the trap will be passed upstream as quickly as possible.

If a Chinook female unavoidably constructs a redd within 25 meters of 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: no action, early weir removal, staged weir removal, and modification of weir operations. Discussion will include at least these people or their designee: Paul Faulds and Michele Koehler (SPU), Hatchery Manager, Larry Fisher, Aaron Bosworth (WDFW), Eric Warner (MIT), Randy McIntosh (NMFS) and Hans Berge (KC).

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 2013 preseason forecast for sockeye returns entering Lake Washington is 97,000. Weekly targets for gamete collection are based upon the average run timing curve. 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. 9	4.90%	1,847,300	1,155	1,155
Sept. 16	12.00%	4,524,000	2,828	1,673
Sept. 23	21.70%	8,180,900	5,113	2,286
Sept. 30	33.30%	12,554,100	7,846	2,733
Oct. 7	45.20%	17,040,400	10,650	2,804
Oct. 14	56.30%	21,225,100	13,266	2,615
Oct. 21	66.40%	25,032,800	15,646	2,380
Oct. 28	75.40%	28,425,800	17,766	2,121
Nov. 4	83.40%	31,441,800	19,651	1,885
Nov. 11	90.00%	33,930,000	21,206	1,555
Nov. 18	95.50%	36,003,500	22,502	1,296
Nov. 25	100.00%	37,700,000	23,563	1,060

MONITORING

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

- Observe and enumerate Chinook and sockeye from the library to the weir 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 and include it in the Hatchery Annual Report.
- 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. Carcass sampling will be coordinated with WDFW float crews.
- Request routine updates on redd surveys and live counts to validate monitoring results.

Field biologists and hatchery staff will communicate and discuss activities that are observed at the weir as they occur. All biologists and technicians will identify themselves and their respective agencies while making weir observations. Field biologists and hatchery staff will communicate and share information and observations via email. Responsible persons for coordinating this are Hatchery Manager and Aaron Bosworth. The email group this information includes Paul Faulds and Michele Koehler, Eric Warner, and the Cedar River Adaptive Management Work Group.

References

Thomas, J. 2013-2014. Monitoring Sockeye Salmon Health in the Cedar River and Lake Washington. Washington Department of Fish and Wildlife, Olympia, Washington

Kiyohara, K. 2014. Evaluation of Juvenile Salmon Production in 2013 from the Cedar River and Bear Creek, FPA 13-02. Washington Department of Fish and Wildlife, Olympia, Washington.