

2002 proved to be an above average year for sockeye in the Lake Washington system, with approximately 400,000 adult sockeye recorded through the Ballard Locks by WDFW and the Muckleshoot Indian Tribe. Although sockeye are observed in most tributary streams in the Lake Washington system, the majority return to the Cedar River and Bear Creek systems. The Cedar River Sockeye Enhancement Project began in 1991, in an effort to increase the number of sockeye returning to the Cedar River, and to provide biologists a vehicle to study sockeye throughout their life history. The Landsburg Hatchery project is located at river mile 22 in the City of Seattle Cedar River Watershed, and is funded by Seattle Public Utilities. All sockeye that have been released from the project have received otolith chillmarks so they can be distinguished from their naturally produced counterparts throughout their life history. Sockeye produced from the hatchery provide biologists an excellent opportunity to study why the sockeye population in Lake Washington is so cyclical. Many different aspects of the sockeye life history are currently being analyzed with ongoing studies of the Lake Washington system.

Releases of unfed fry produced from the Cedar River Sockeye Enhancement Project have varied from a low of 2,079,100 from the first brood year in 1991 to a high of 17,209,000 for the 2000 brood year. Egg to fry survival rates from 88 to 94% have been experienced during the twelve years of hatchery operations at Landsburg. The egg to fry survival rate for the 2002 brood year was 88%, resulting in the release of 15,957,000 sockeye fry into the Cedar River. This report summarizes the activities of the 2002 collection and spawning season.

Construction of the Cedar River rack was completed on the afternoon of September 10, 2002. The rack was constructed at river mile 6.5, at a site referred to as Cavanaugh Ponds that is owned by the King County Parks Department. The rack was removed on November 12, 2002. The rack is a structure built on a framework of wood horses, with a walkway consisting of 2" X 12" boards. Two 10' X 12' fish collection cages are placed in the current seam used by travelling fish. The rack consists of welded 2' x 7' aluminum panels with picket sections spaced 1" apart. These picket sections can be removed during high flow periods so logs and other large debris can pass over the rack. During normal flow periods small debris is raked and removed from the picket sections so water can flow uninterrupted. It was decided to utilize two 10' x 12' aluminum fish collection cages for the 2002 season because of the anticipated large return of sockeye back to the Cedar River. The collection cages consist of 1" round aluminum bars welded 1" apart. The trap entrances consists of a v-shaped funnel that culminates into a 6" slot. The front section of the cage is equipped with a gate that can be lifted so fish can pass volitionally, and to relieve water pressure during high flow intervals.

Due to concerns about chinook passage through the weir, a new set of fish collection and weir protocols were developed in 1999 by the Cedar River Sockeye Technical Committee. These protocols were implemented again in 2002 to minimize and avoid delays to chinook passage. Adult collection began on September 10, 2002, with the last sockeye collected on November 11, 2002. A total of 16,816 sockeye were trapped during this time frame. Out of these, a total of 5,810 females and 5,413 males were hauled to holding ponds at the Landsburg Hatchery. In addition, 5,593 sockeye, 73 chinook, 37 coho, and 20 trout were captured and passed manually upstream of the rack. These numbers do not include fish that passed volitionally through the rack when picket sections were pulled, or when high water prohibited fishing. The late summer and fall of 2002 was marked with very low rates of precipitation, and river flows were lower than

average for the majority of the season. This made it easier for weir operators to maintain the weir, and very little time fishing time was lost due to high water events, which is atypical. Two hauling trucks, each equipped with an oxygen tank and airstones, were used to transport adults to Landsburg. The fish in the collection cage were dipnetted in small groups, sorted by hand according to species and sex, and counted before loading onto the truck. All spawning at Landsburg is based on a 1:1 spawning ratio, and fish are hauled to the ponds in accordance to this ratio.

As in previous years, a very small percentage of females captured in the trap during the early portion of the run are ripe enough to spawn, and require a significant amount of maturation time in the holding ponds until ripe. Early run females, those that enter the trap prior to November, typically take between five and ten days of holding time before they are ripe enough to spawn. Later run females, those that enter the trap after the first of November, typically are much riper upon entering the trap, and require less maturation time, usually one to four days. Males tend to arrive at the trap riper than females, and require significantly less holding time in the ponds.

Adults are held at Landsburg in a series of four thirteen-foot diameter circular ponds that are gravity fed with pathogen free spring water. For the 2000 brood year, a fourth pond was installed that was fed by pumped water; a diesel generator powered a pump that utilized a previously unused water source. Addition of the fourth pond increased holding potential considerably at the adult holding area. Female sockeye were held in separate ponds from the males. Fish were loaded into the ponds until the dissolved oxygen level reaches a level between 5 and 6 parts per million.

The eggtake procedure begins by working all fish into one half of the pond with screen mesh crowders. The spawning crew is broken down into two groups of people: fish sorters and fish spawners. After the fish are crowded, two people begin sorting fish. Ripe fish were placed into a net pen for later dispatch and green fish were transferred to the empty side of the pond. After sorting, fish were dispatched in groups of 24, placed on a spawning rack, and wiped down with a 100 p.p.m. solution of iodophor. After sitting for 10 minutes, fish were wiped free of iodophor and other organics with a paper towel and spawned manually with a Zak knife. Eggs were collected in 16 oz. disposable plastic containers and milt was collected in 8 oz. disposable plastic containers. After collection gametes were placed into separate ice filled coolers for transportation to the fertilization area. After spawning all fish carcasses were returned to the Cedar River at several different locations.

All egg fertilization and disinfection takes place in an area isolated from both the spawning and incubation areas. Before arriving at the fertilization area, it is critical that all equipment such as coolers, raingear, waders and spawning gear be thoroughly disinfected with a 100 p.p.m. Iodophor solution. Ten containers of eggs are placed on the fertilization table, each of which is placed into a new 32 oz. disposable plastic bowl for the process. Milt from a different male is added to each bowl, followed by a teaspoon of pathogen free water. Each bowl has its own spoon to prevent cross contamination. After gently mixing the milt and water into eggs and letting it set for two minutes, milt from a second male is added to serve as a backup. After sitting for five minutes the eggs are flushed in a 100 p.p.m. iodophor solution to remove excess blood, milt, and other organics. After flushing, the bowls are topped off with fresh iodophor solution, and the eggs are allowed to disinfect and water harden for one hour. This one-hour disinfection period is one of the most important steps taken to insure that no IHNV is transferred

into the incubators. After the one-hour water hardening and disinfection process, the eggs were transferred to the respective incubators.

There is currently potential to incubate 18 million eggs at the Landsburg Hatchery. The incubation system consists of 53 Kitoi box incubators and 20 vertical incubators. A Kitoi box incubator is an upwelling style incubator. It is an aluminum box 4' long, 2' wide, and 2' high with two 1.5" intake lines that upwell water through a plate perforated with 3/32" holes staggered 1/2" apart. Water exits the box via a 2" outlet located at the top of the box. Water flows into the box are kept at 10 g.p.m. Each Kitoi box can incubate up to 300,000 eggs, although optimum loading is 240,000. The incubation trailer contains 20 vertical incubators that are each supplied with 4 g.p.m. Each stack can be loaded with up to 112,000 eggs. Each vertical stack and Kitoi box are compartmentalized and have an independent water supply line, to reduce the risk of disease transmission between egg lots.

For egg eyeing, fertilized eggs were poured directly into incubators with no substrate. Eggs were physically shocked at 700 temperature units, and picked using an electric egg picker. After picking and weighing, eggs were placed in their respective incubators along with substrate. Substrate for the vertical incubators was a three layer sheet of 3/4" plastic mesh, which was placed inside the tray. Kitoi substrate consisted of 2" black half-moon shaped plastic saddles. Kitoi boxes were filled with a 5" layer of saddles, then half the eggs were gently dispersed equally over the substrate. Another 5" layer of saddles was carefully added over the eggs, followed by the remaining eggs. After the eggs were put down, they were left alone until hatching. All incubators received daily formalin treatments until hatchout to reduce the growth of fungus and disease.

The first eggtake for the 2002 brood occurred on September 18, and eggtake continued until December 2, 2002. A total of 5,330 females were spawned with 5,142 males. The 5,330 females produced a total of 18,095,000 eggs, which resulted in a fecundity of 3,395. After shocking, 1,169,000 non-viable eggs were picked, producing a green to eyed egg survival of 94.0%.

Despite rigorous disinfection protocols, 2002 proved to be the first year that IHNV was found in incubators at the Landsburg Hatchery. A total of 7 incubators, 3 verticals and 4 Kitoi boxes, were confirmed to contain the virus. Four of those incubators were destroyed, resulting in the loss of 942,000 sockeye fry. The source of contamination was not confirmed, however 2002 was the first year of adult passage above the aqueduct crossing, and several thousand sockeye were observed spawning within close proximity to the hatchery.

Because of the consistent spring water temperatures at Landsburg hatchery, egg and alevin development occurs consistently and predictably. Sockeye typically hatch-out at 1060 temperature units. At this time, the vertical tray screens and Kitoi outlet screens were brushed frequently to prevent clogging caused by eggs shells. The Kitoi incubators were also gently stirred and plunged to bring up eggshells and organics from the bottom of the incubator. Fish were ponded for release at an average of 1700 temperature units. Trays from the vertical stacks were transferred manually to the acclimation ponds, where they were gently poured over a screen basket to capture egg and fry loss. Kitoi substrate was removed manually with an aluminum scoop. The remaining fry are flushed into a screen bucket and poured manually over a screen collection basket into the release ponds.

The spring of 2002 was the second year of an experimental rearing study for sockeye fry. A series of 4 3'X3'X16' fiberglass rearing raceways were utilized at the adult holding pond site

for short term sockeye rearing. Four groups of fry were reared for periods of between 10 and 14 days to determine the effects of feeding on survival. All fed groups received unique otolith banding patterns and were released with a control group of unfed fry. All reared fish were released at river mile .1.

The optimal release time for a given eggtake was based on temperature units, KD value and visual observation. The KD value is a length to weight equation that is used to gauge fry development and yolk absorption. Historical KD factors from naturally produced fry captured at the fry trap are used as a baseline for hatchery produced fry. When a group of fish was determined ready for release, they were ponded into four 6' diameter acclimation ponds filled with spring water. A trash pump is then used to supply the ponds with water from the Cedar River so fry would imprint to the river water. Acclimation time was a minimum of nine hours at the beginning of the release season, and increased up to twelve hours at the end of the season. All fry releases occurred at one hour after official sunset, because fry trap counts have shown that sockeye fry outmigrate almost exclusively at night. Fry were released at four different locations on the Cedar river; just above the river mouth at river mile .1; behind the Riviera Apartments at river mile 1.9; the railroad trestle at river mile 13.5; and at the Landsburg Hatchery at river mile 22.

All sockeye eggs and fry are marked at Landsburg hatchery using a process called otolith chillmarking. The otolith, or carbonate of the fish, is marked with a series of increments by exposing eggs and fry to scheduled bouts of water chilled to eight degrees Fahrenheit colder than ambient spring water for a period of twelve hours. By scheduling a series of these cold water events, a unique mark can be placed on all fish within a given incubation vessel. Because each incubation vessel receives a unique mark, all fish from a given vessel were released at the same time and location. The purpose for this is to determine differences in survival between fish released in different locations, under varying flow regimes, and at different times of the year. Because otolith marking is permanent, the process allows tracking of fish throughout their entire life history, and also gives biologists the ability to differentiate between naturally produced fish and hatchery fish.

Egg incubation started on September 18, 2002 and ended on April 3, 2003 with the last fry release. Overall egg to fry survival was 88%. Of the 15,957,000 fry released; 3,362,000, or 21% were released at the Railroad trestle at river mile 13.5; 4,450,000 or 28%, were released below the fry trap at river mile .1; 3,270,000, or 21% were released at the Riviera Apartment site at river mile 1.9; and 4,875,000, or 30%, were released directly from the Landsburg Hatchery at river mile 22.

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