Lake Washington Sockeye Smolt Collection: 2012 Annual Report

Kelly Kiyohara

Wild Salmon Production Evaluation Unit
Science Division, Fish Program
Washington Department of Fish and Wildlife
Olympia, Washington 98501-1091

October 2012

Supported by
Seattle City Public Utilities

Introduction

A major portion of the Lake Washington sockeye population is produced in the Cedar River. Sockeye were introduced into the Cedar River basin from the Baker River (Skagit basin) between 1917 and 1945 and were naturalized in the system by the 1960's (Kolb 1971). Today, sockeye production from the Cedar River includes both natural and hatchery-origin portions. Hatchery-origin sockeye are reared at Washington Department of Fish and Wildlife's (WDFW) Cedar River Sockeye Hatchery. Brood stock for this program is collected from sockeye returns to the Cedar River. The purpose of this hatchery program is to mitigate for loss of sockeye salmon spawning habitat above Landsburg Dam, which was built in 1901, blocking anadromous fish migrations, in order to provide a majority of Seattle's water supply. A fish passage facility at Landsburg Dam began operation in 2003 and allows coho and Chinook salmon, but not sockeye, access to spawning and rearing habitat above Landsburg Dam.

The Cedar River sockeye population has been well monitored at both the adult and emergent fry stages of their life cycle. Adults return to the river to spawn in September, and the numbers of adult spawners have been monitored by local, state, and tribal entities since 1967. Between January and May of each year, natural-origin sockeye emerge from the gravel and migrate downstream to Lake Washington. Production and survival of sockeye fry has been monitored by WDFW since the 1992 outmigration (1991 brood year). Production of natural-origin sockeye fry is estimated by expanding catch in an inclined-plane trap positioned near the river mouth (Seiler and Kishomoto 1996; Kiyohara and Zimmerman 2012).

Beginning in 1992, hatchery sockeye fry have been released into the Cedar River. Hatchery-origin sockeye have been released as both fed and un-fed fry over the natural outmigration period. Hatchery releases are classified into three release categories: (early, middle, and late) and have occurred at different locations in the watershed. The purpose of these multiple release strategies has been to evaluate which rearing and release strategy maximizes survival while minimizing impacts to natural-origin sockeye. Survival of natural and hatchery-origin sockeye is studied at two subsequent points of their life history – smolts leaving the lake and adult spawners returning to the river. The proportions of natural and hatchery-origin sockeye at the fry, smolt, and adult life stages, provide a measure of relative survival through the lake and marine environment and test the assumption that hatchery and natural-origin sockeye experience similar conditions during their predominantly one year of rearing in Lake Washington and one to four years of rearing in the ocean.

Natural and hatchery-origin sockeye in Lake Washington have no external marks that identify their origin. The small body size of released hatchery sockeye fry prohibits marking tools such as adipose clips and coded-wire tags typically used as external marks for other hatchery releases in Washington State. Therefore, Lake Washington hatchery sockeye fry receive a thermally-induced otolith mark (Volk et al 1990). This mark is detected if the fish is lethally sampled and the otolith is removed and processed. Thermal marking is applied in different

patterns in order to specify release date, location, and other characteristics of the fry (e.g., feeding period).

In 2004, WDFW began collection of sockeye smolts from Lake Union and Lake Washington. Collections occur in the month of May, which represents the sockeye outmigration period. Otoliths were retrieved from up to 1,000 sockeye smolts with the goal of better understanding relative survival between lake entry and lake emigration of natural-and hatchery-origin sockeye, as well as among the different hatchery release strategies (Schroder et al 2009). Fish were also examined for viral pathogens at the WDFW Pathology Lab for indicators of potential epidemics present in the smolt population.

This report describes the 2012 collection of sockeye smolts in lakes Union and Washington as they began their migration to the sea. Results of the otolith analysis will be presented in a separate report prepared by WDFW's Otolith Lab.

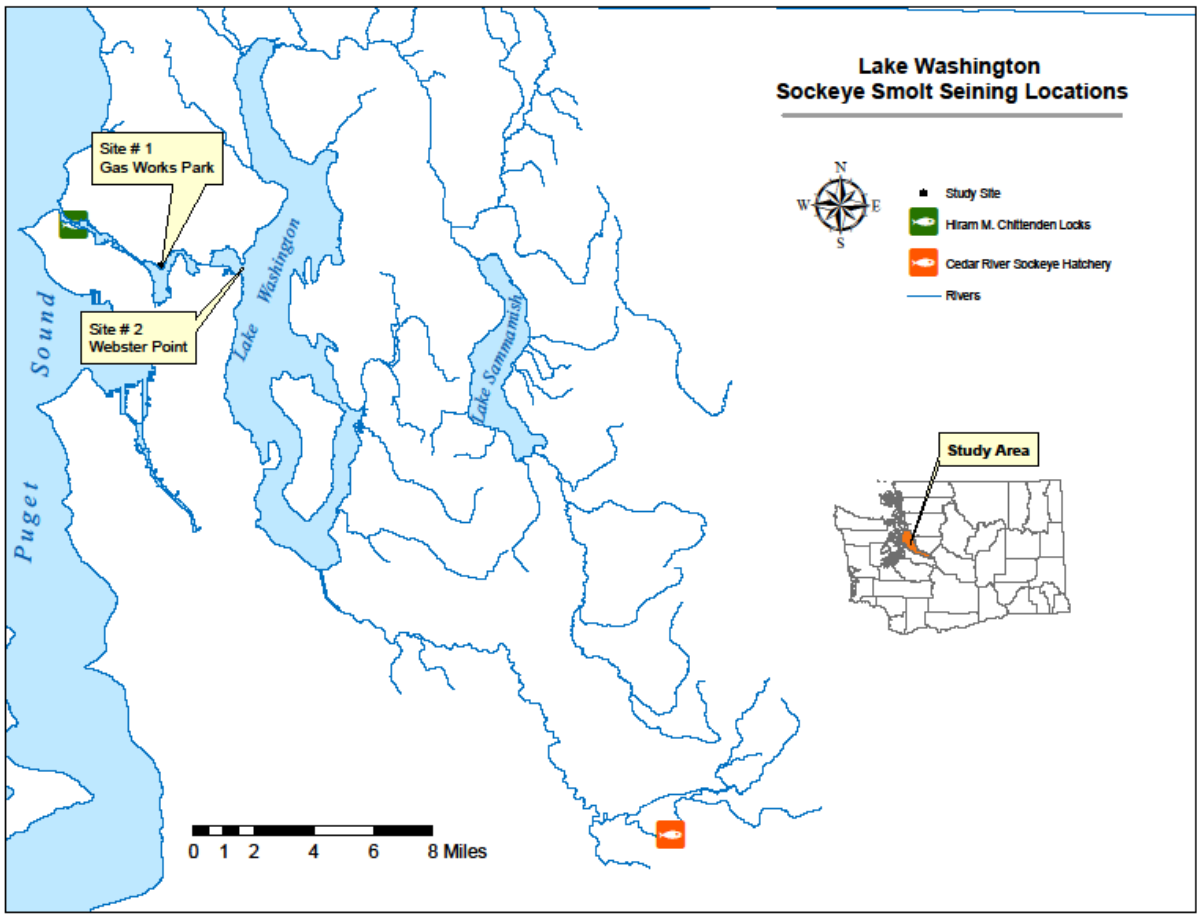

Figure 1. Locations of the 2012 sockeye smolt collection site in Lake Washington basin.

Methods

Gear

A seine net was deployed from a 10-m pontoon barge powered by an outboard motor. The net had 2-cm mesh and was 206 m in length and 11 m in depth. The net was assembled on the barge and deployed by an outboard powered skiff. The skiff pulled the net off the barge in a manner similar to that of commercial purse seine operations. The net was deployed, towed for a length of time, and rounded back to the barge. The bottom of the net was closed up or "pursed" and catches were examined.

Collection

Collection of sockeye smolts occurred once a week, with one exception, during three consecutive weeks in May 2012 (May 8, 15, 22, and 24). Catches were low on May 15 and 22 so sampling occurred twice during the third week in May in order to achieve the target sample size before the migration ended. Weekly catches varied however weekly sockeye retention is targeted at 250 to equally sample and accurately represent the migration period. Fish in excess of the weekly target are typically released. In previous years, multiple collection sites have be sampled to collect the target number of sockeye. In 2012, large schools of fish were difficult to find, requiring sampling at both Gas Works (site #1) and Webster Point (site #2) with intentions of collect more sockeye. Between one and six sets were made each day. Fishing times per set ranged from 30 to 70 minutes. If initial visual observations indicated a large catch of Chinook, the end of the net was let go and all fish were released. This approach was adopted in order to minimize stress on juvenile Chinook which are listed as threatened under the Endangered Species Act.

At the end of each set, fish were removed from the seine net with a large dip net and placed in a large tote for processing. Captured sockeye were saved for analysis until the target of 250 sockeye per week was met or 1,000 for the sampling period. Often extra sockeye are kept for otolith analysis in the event total count is incorrect or otoliths are not recovered from some sockeye. All other fish were returned to the lake. Sockeye kept for analysis were euthanized using MS-222, held in a cooler, and transported to the WDFW Otolith Lab in Olympia.

Results and Discussion

Sixteen sets were completed over the four sampling days in 2012 (Table 1). A total of 1,093 sockeye smolts were caught but only 1,005 were kept for sampling (Table 1). On the first day of collection, 316 sockeye smolts were captured in one set at the Gas Works Park location in Lake Union. High catches on this day indicated that smolt outmigration had already begun and influenced the decision to retain all of the sockeye rather than target 250 with the anticipation of potentially declining catches in future sampling days. During the subsequent fishing days, all but three sets were made near Gas Works Park on Lake Union. The remaining three sets were fished

at Webster Point in Lake Washington on days when catches at Gas Works did not yield many sockeye smolts.

During the second and third weeks, target catches were low. Eleven sets were fished to harvest 352 sockeye over two days of effort. Typically the four days of effort are spread over four consecutive weeks, however due to the amount of effort for few fish, the forth days' effort was moved forward to the third week due to fears of not reaching the target number of samples. The final fishing day (May 24) over 350 sockeye were collected during 4 sets to obtain the target sample size of 1,000 sockeye.

In addition to sockeye smolts, a number of other salmonids were captured. Seventy-six natural-origin Chinook, 1,076 hatchery origin-Chinook, 395 natural-origin coho, 249 hatchery-origin coho, one wild steelhead, one 1+ hatchery Chinook, 2 chum, one adult rainbow trout, and one 0+ sockeye. Both juvenile and adult cutthroat were also caught; 17 juvenile and 1 adult. Non-salmonid species were not enumerated. Three-spined sticklebacks (*Gasterosteus aculeatus)* were the most abundant non-salmonid. Yellow perch (*Perca flavescens)*, northern pikeminnow (*Ptychocheilus oregonensis)*, sculpin (Cottoidea), pumpkinseed (*Lepomis gibbosus)*, and surf smelt (*Hypomesus pretiosus)* were also caught.

Table 1. Dates, locations and catches of purse seine collections of sockeye smolt from Lake Union, 2012.
Site 1 location is Gas Works Park, and site 2 location is Webster Point.

					Fishing	Sockeye		Wild	Hat.	Wild	Hat.		Juv.	Adult	Wild	3
Date	Site	Set	Start	End	Time	Caught	Retained	Ck	Ck	Coho	Coho	Chum	Cutt.	Cutt.	Steelhead	Spined
08-May	1	1	9:30	10:15	0:45	316	316			8						80
15-May	1	1	8:30	9:40	1:10	49	49			20	1					800
15-May	1	2	9:50	10:20	0:30	76	76			38	3					150
15-May	1	3	10:30	11:20	0:50	20	20			18	2				1	200
15-May	2	4	11:45	12:45	1:00	49	49	7	128	28	26		9			3,500
15-May	1	5	14:00	15:00	1:00	57	57			6						250
15-May	1	6	15:15	15:50	0:35	11	11			12						150
22-May	1	1	8:10	8:45	0:35	6	6		17	1						60
22-May	2	2	9:50	10:25	0:35	9	9	29	568	32	4		3			850
22-May	1	3	12:15	13:00	0:45	42	42		29	5	1					450
22-May	1	4	13:15	15:50	2:35	2	2		41	2	1					200
22-May	1	5	14:20	15:30	1:10	3	3	2	36	2						300
24-May	1	1	8:15	9:05	0:50	1	1		13			1				2,000
24-May	1	2	9:20	10:05	0:45				19			1				1,000
24-May	2	3	10:30	11:30	1:00	352	352	38	220	173	211		5			1,000
24-May	1	4	12:10	13:05	0:55	100	12			50				1		1,000
						1,093	1,005	76	1,071	395	249	2	17	1	1	11,990

Acknowledgements

Collection of sockeye smolts in Lake Washington was funded by Seattle Public Utilities. Fish collection was conducted by WDFW biologist Pete Topping (pontoon barge) and WDFW technician Dan Estell (out-board skiff). Seine deployment and fish collection was completed by WDFW Biologist Josh Weinheimer, and WDFW technicians Paul Lorenz, Randy Jeric, and Samantha Sadosky. Special thanks to Michele Koehler of SPU who also helped with fish collection.

Citations

Kiyohara, K. and M. Zimmerman. 2012. Evaluation of Juvenile Salmon Production in 2011 in the Cedar River and Bear Creek. WDFW. Olympia, WA. 2

Kolb, R. 1971. A review of Lake Washington sockeye (*Oncorhynchus nerka*) age and racial characteristics as determined by scale pattern analysis. Supplemental progress report marine fisheries investigations, Washington Department of Fisheries, Olympia, WA. 2

Schroder, S.L., J.J. Grimm, D. Fieldman, D. Anderson, & L. Nguyen. 2009. Results Of The Otolith Decodes Performed On Sockeye Smolts Leaving Lake Washington In 2008. WDFW. Olympia, WA... 3

Seiler, D. and L. Kishimoto. 1996. Annual Report: 1995 Cedar River sockeye salmon fry production evaluation program. WDFW Olympia WA. 2

Volk, E.C., S.L. Schroder and K.L. Fresh. 1990. Inducement of unique otolith banding patterns as a practical means to mass-mark juvenile Pacific Salmon. Am Fish Soc. Symp 7:203-215 3