

Lake Washington Sockeye Smolt Collection: 2011 Annual Report

Kelly Kiyohara

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

January 2013

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) Landsburg 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 Kishimoto 1996; Kiyohara and Zimmerman 2010).

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 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 relative 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 prohibits marking tools such as adipose clips and coded-wire tags typically used as external marks for other hatchery releases in Washington State. In 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 condition.

In 2004, WDFW began collection of sockeye smolts from Lake Union and Lake Washington. Collections typically occur in the month of May, which represents the sockeye outmigration period. Otoliths were retrieved from 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).

This report describes the 2011 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.

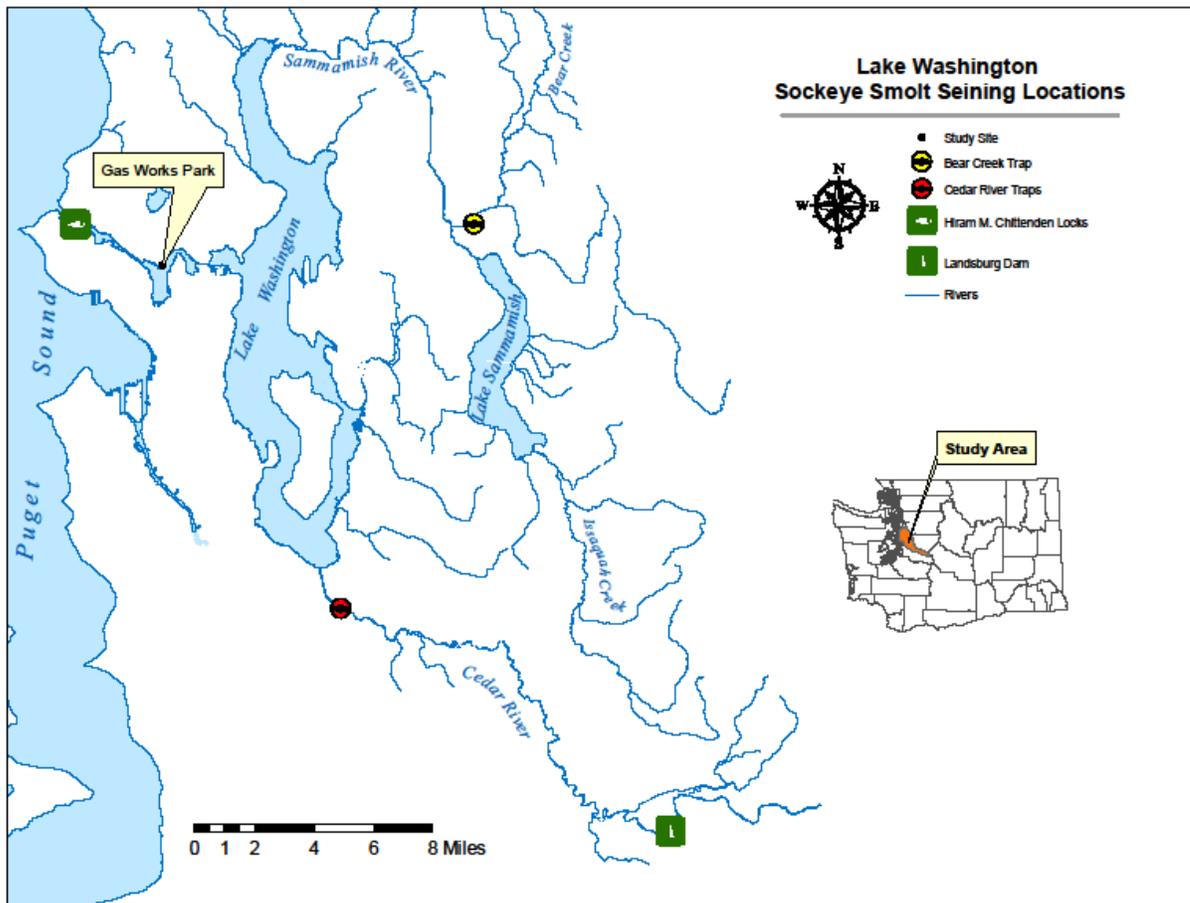


Figure 1. Location of the 2011 sockeye smolt collection site in Lake Washington basin.

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 four consecutive weeks in May and June 2011 (May 10, 19, 24, 31 and June 2). The last week of sampling spanned May and June and sampling occurred twice during the final week in order to achieve the expected number of samples. Weekly catches vary however weekly sockeye retention is started at 250 to equally sample and accurately represent the length of the migrations. Fish in excess of the weekly target are typically released. In previous years, multiple collection sites have been sampled to collect the target number of sockeye. In 2011, fish were numerous throughout the sampling period and the net was fished solely at Gas Works Park near the east buoy in Lake Union ((N 47°38.667' and W 122°19.776'). Between one and eight sets were made each day. Fishing times per set ranged from 35 to 70 minutes. If initial visual observations indicated a large catch of Chinook, the end of the net was let go and all the 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. 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

Eighteen sets were completed over the five sampling days in 2011 (Table 1). A total of 1,912 sockeye smolts were caught but only 1,039 were kept for sampling (Table 1). On the first day of collection, 600 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 our decision to retain 400 of the sockeye rather than target 250 with the anticipation of potentially declining catches in future sampling days. During the subsequent fishing days, all sets were made near Gas Works Park on Lake Union. This site was selected because most of the fish have been collected at this location in past years of this study. During the second and third weeks, target catches were easily obtained. However two days of sampling occurred the final

week because total sampling goal of 1,000 sockeye had not been reached due to declining catches and technical difficulties.

The size of sockeye smolts in 2011 were considerably smaller than previous years based on visual observations and past recollections. Actual length and weight measurements will be quantified and reported by WDFW's Otolith Lab.

In addition to sockeye smolts, a number of other salmonids were captured. Eighteen natural-origin Chinook, 321 hatchery-origin Chinook, 202 natural-origin coho, 771 hatchery-origin coho, 2 wild steelhead, 1 Chinook jack. Both juvenile and adult cutthroat were also caught; 7 juvenile and 7 adult. Three-spined sticklebacks (*Gasterosteus aculeatus*, n=61,250) were the only numerous non-salmonid species caught.

Table 1. Dates, locations and catches of purse seine collections of sockeye smolts from Lake Union, 2011.

Date	Location	Set	Start	End	Total Time	Sockeye		Wild Chinook	Hat. Chinook	Wild Coho	Hat. Coho	Chum	Pink	Juv. Cutt.	Adult Cutt.	Wild Steelhead	3 Spined	Jack Chinook
						Caught	Retained											
10-May	1	1	9:10	9:50	0:40	650	400			6							50	
19-May	1	1	9:15	10:00	0:45	132	131	2	1	19				2			400	
19-May	1	2	10:50	11:30	0:40	54	54			9							250	
19-May	1	3	11:50	12:45	0:55	35	16			2							200	
24-May	1	1	9:45	10:35	0:50	34	34	1	6	22	28						800	
24-May	1	2	11:15	12:10	0:55	101	101	2	20	28	51			4			4,700	
24-May	1	3	12:50	14:00	1:10	741	141		7	26	112			1			850	
31-May	1	1	9:15	10:15	1:00	17	17		68	5	11							1
31-May	1	2	11:00	12:10	1:10	10	10	7	35	15	155				7			
2-Jun	1	1	8:30	9:10	0:40	13	13		18	2	41						5,000	
2-Jun	1	2	9:25	10:15	0:50	17	17		49	15	81						7,000	
2-Jun	1	3	10:30	11:17	0:47	26	25	1	18	9	25					1	20,000	
2-Jun	1	4	11:40	12:35	0:55	23	23		7	5	12						5,000	
2-Jun	1	5	12:50	13:55	1:05	18	18	4	42	6	51						8,000	
2-Jun	1	6	14:15	15:00	0:45	19	19		18	9	89						4,000	
2-Jun	1	7	15:15	16:00	0:45	4	4		8	9	3							
2-Jun	1	8	16:15	16:50	0:35	18	16	1	24	15	112					1	5,000	
Total						1,912	1,039	18	321	202	771	0	0	7	7	2	61,250	1

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 volunteered to help with fish collection.

Citations

- Kiyohara, K. and M. Zimmerman. 2010. Evaluation of Juvenile Salmon Production in 2009 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