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**FISH and  
WILDLIFE**

## 2008/09 LAKE SAMMAMISH LATE-RUN KOKANEE SURVEY AND ESCAPEMENT SUMMARY

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### INTRODUCTION

The Lake Washington-Sammamish Watershed is one of five watersheds in Washington (Baker, Whatcom, Wenatchee, and Chelan) that support native populations of resident *Oncorhynchus nerka* or kokanee. There are three distinct kokanee populations within the Lake Washington-Sammamish Watershed, including the early, middle, and late-runs. Late-run kokanee are known to be present in south Lake Sammamish tributaries, such as Lewis, Ebright, Laughing Jacobs, Vasa, and Pine Lake creeks.

The Washington Department of Fish and Wildlife Region 4 Fish Program, with assistance from King County Department of Natural Resources and Parks and volunteer stream walkers, annually surveys late-run kokanee spawner escapement within selected Lake Sammamish tributaries from November through January. Annual spawning ground surveys allows the Washington Department of Fish and Wildlife and other interested entities to better monitor late-run kokanee escapement trends and make timelier decisions regarding the management and/or conservation of this species.

### METHODS

Selected Lake Sammamish tributaries known to have late-run kokanee spawning were surveyed weekly from mid-November through January. Tributaries surveyed included Lewis, Laughing Jacobs, Ebright, and Pine Lake creeks. Vasa Creek was only spot checked a couple times during the 2008/09 spawning season due to time constraints. Surveyors walked upstream in each tributary counting all live and dead kokanee observed. All dead kokanee encountered were processed for biological data. Biological data collected included fork length (mm), sex, otoliths, and percent of unspawned eggs in females.

To determine escapement of late-run kokanee area under the curve (AUC) methodology was used. AUC consists of graphing live fish counts (y-axis) over survey dates (x-axis) and then finding the area underneath that curve. Specifically, the entire curve is sectioned into smaller geometric figures where the area for each is determined by multiplying number of days between two different survey events by the average number of live fish observed during those two surveys. The area for all individual geometric figures is then enumerated to calculate the area underneath the entire curve. The calculated AUC value, termed fish-days, is then divided by a

stream life (days) value for kokanee to determine total escapement. For Lake Sammamish kokanee a stream life value of 10 days was used. Stream life is an estimate of spawner residency time within a tributary and is based on values for kokanee and sockeye identified in the literature and from past and current field observations in Lake Sammamish tributaries. For Lewis Creek, AUC methodology and a 10-day stream life was used to estimate spawner escapement. However, for Laughing Jacobs and Ebright creeks, AUC was not used to estimate escapement because live kokanee were either observed during a single spawning ground survey or there was a considerable (> 10 days) number of days in-between live counts. Instead of using AUC for these tributaries live kokanee were simply enumerated to determine escapement.

## RESULTS

### **Vasa Creek:**

No live or dead kokanee were observed during the 3 spawning ground surveys conducted in late November and early December. It is possible that returning kokanee moved into the un-surveyed portion of Vasa Creek upstream of the West Lake Sammamish Drive culvert. For 2009/10, spawning ground surveys need to be expanded to the portion of Vasa Creek upstream of West Lake Sammamish Drive to determine whether or not kokanee are spawning in this portion of the creek. However, kokanee observed in the past have always been located in the portion of Vasa Creek downstream of West Lake Sammamish Drive.

### **Lewis Creek:**

Lewis Creek was surveyed 11 times from November 12<sup>th</sup>, 2008 to January 28<sup>th</sup>, 2009. However, during certain weeks Lewis Creek could not be surveyed because of heavy precipitation (i.e., rain and snow) impairing visibility. A total of 47 live and 15 dead kokanee were observed during spawning ground surveys (Figure 1). Peak spawning occurred on November 19<sup>th</sup> when 26 live kokanee were observed during surveys. Spawner escapement for Lewis Creek kokanee is estimated to be 29 fish using AUC methodology. The 2008/09 spawner escapement is only 5.1% of the 1996/97 to 2007/08 average (565).

A total of 16 kokanee carcasses were processed for biological information during spawning ground surveys. Of the total carcasses processed, 6 (37.50%) were female, 5 (31.25%) were male, and 5 (31.25%) could not be identified to sex. For males and females, average fork length was 449 mm and 416 mm, respectively. Lengths and sex identification of unidentified carcasses could not be determined because of extreme decay and/or carcasses being partially eaten by predators and/or scavengers. Otoliths were only taken from 3 carcasses and have not yet been read to determine age of spawners. Of the 6 female carcasses processed for biological data none contained unspawned eggs within their body cavity.

Even though the 2008/09 Lewis Creek kokanee escapement is the second worst in the dataset, it is possible that this year's escapement could be a slight underestimate. Reasons why the 2008/09 escapement could be an underestimate is problems associated with using the AUC methodology when spawner abundance is very low, the spawning season is short, and/or predators removing fish before they could be observed by surveyors.

AUC is a very useful method when assessing spawner abundance of species like coho or sockeye that enter the spawning grounds in relatively large numbers and over a long period of time. This method is also useful when surveyors know they will be counting the same fish two or more times while conducting frequent spawning ground surveys. Also, in order for an AUC escapement estimate to be valid an accurate stream life value is required in order to convert fish-days to fish. However, AUC can be problematic when spawner abundance is very low and

spawn timing is compressed into a short period of time, which was the case with Lewis Creek in 2008/09. For Lewis Creek, all live kokanee were observed during a 20-day period of time from November 12<sup>th</sup> to December 1<sup>st</sup>. During this time period, it was difficult for surveyors to accurately determine whether live kokanee observed were from a single group of fish that just slowly died out over that short period of time or if stream life was exceptionally short (< 10-days) and new spawners entered into Lewis Creek. If the former is the case, then the stream life value used was appropriate and the escapement estimate is probably reasonable. If the latter is the case, then escapement was likely underestimated to some extent. For example, if a stream life value of 5-days (which has been suggested for late-run kokanee) were used instead of 10-days, AUC escapement would then be 59 fish instead of 29 and infer that new fish entered Lewis Creek and were not observed by surveyors. Surveyors usually can determine the presence of “new” or “old” fish based on levels of decay and changes in sex ratios from nearly equal to mostly males. But in Lewis Creek, surveyors could not conclusively determine if any new fish had entered into the tributary based on those two variables.

Predators like blue heron, raccoon, and domestic dogs and cats observed at Lewis Creek could also affect escapement estimates by removing kokanee before surveyors could count them. For example, if predators on average removed one kokanee per day across the normal spawn timing (i.e., mid-November to January) it would decrease the escapement estimate by 50 fish using AUC methodology and the same 10-day stream life value. It is also possible that predators could be removing more than one spawner per day given the fact that Lewis Creek is very shallow and exposed in most places.

Regardless of whether the Lewis Creek kokanee escapement is 29 or 59 fish, both estimates are alarming low and depending upon the actual stream life value both may be inaccurate. Being able to accurately assess annual escapement and escapement trends for Lake Sammamish late-run kokanee is extremely important to the management and recovery of this species. Given the problems experienced using AUC to estimate escapement of late-run kokanee the past couple years, perhaps a better method to monitor spawner abundance would be to simply report the fish-days value instead. Using fish-days would allow managers to index spawner abundance and evaluate trends while eliminating any biases associated with stream-life that varies annually between and within tributaries during the spawning season. Another method to estimate and monitor late-run kokanee escapement would be to install weirs near the mouth of each tributary. Using weirs would effectively eliminate all biases associated with AUC and account for kokanee removed by predators upstream. Weirs would also be useful in collecting brood stock for WDFW’s late-run kokanee supplementation plan. The one downside to using weirs would be the staff required for operation.

**Figure 1. Summary of Lewis Creek late-run kokanee spawning ground surveys and escapement.**

<b>SURVEY DATE</b>	<b>LIVE FISH</b>	<b>DEAD FISH</b>	<b>FISH DAYS</b>
12-Nov	11	0	0
19-Nov	26	3	39
24-Nov	9	3	130
01-Dec	1	5	88
08-Dec	0	4	35
12-Dec	0	1	4
16-Dec	0	0	0
30-Dec	0	0	0
12-Jan	0	0	0
14-Jan	0	0	0
20-Jan	0	0	0

28-Jan	0	0	0
<b>TOTAL:</b>	<b>47</b>	<b>16</b>	<b>296</b>

**Laughing Jacobs Creek:**

Laughing Jacobs Creek was surveyed 11 times from November 12<sup>th</sup>, 2008 to January 28<sup>th</sup>, 2009. However, during certain weeks Laughing Jacobs Creek could not be surveyed because of heavy precipitation (i.e., rain and snow) impairing visibility. Only a single live kokanee was recorded during spawning ground surveys and represent the 2008/09 spawner escapement (Figure 2). The single fish observed during spawning ground surveys on Laughing Jacobs Creek is only 1.1% of the 1996/97 to 2007/08 average (90). No carcasses were observed during surveys.

**Figure 2. Summary of Laughing Jacobs Creek spawning ground surveys and escapement.**

<b>SURVEY DATE</b>	<b>LIVE FISH</b>	<b>DEAD FISH</b>	<b>FISH DAYS</b>
12-Nov	0	0	0
19-Nov	1	0	4
24-Nov	0	0	3
01-Dec	0	0	0
08-Dec	0	0	0
16-Dec	0	0	0
30-Dec	0	0	0
12-Jan	0	0	0
14-Jan	0	0	0
20-Jan	0	0	0
28-Jan	0	0	0
<b>TOTAL:</b>	<b>1</b>	<b>0</b>	<b>7</b>

**Ebright Creek:**

Ebright Creek was surveyed 12 times from November 12<sup>th</sup>, 2008 to January 28<sup>th</sup>, 2009. However, during certain weeks Ebright Creek could not be surveyed because of heavy precipitation (i.e., rain and snow) impairing visibility. A total of 12 live kokanee were recorded during spawning ground surveys (Figure 3). Peak spawning occurred on November 19<sup>th</sup> when 11 live kokanee were observed during surveys. Spawner escapement for Lewis Creek kokanee is estimated to be 12 fish based on simple enumeration of adults observed during spawning ground surveys. The 2008/09 spawner escapement is only 5.4% of the 1996/97 to 2007/08 average (224). No carcasses were observed during surveys.

**Figure 3. Summary of Ebright Creek spawning ground surveys and escapement.**

<b>SURVEY DATE</b>	<b>LIVE FISH</b>	<b>DEAD FISH</b>	<b>FISH DAYS</b>
12-Nov	0	0	0
19-Nov	11	0	39
24-Nov	0	0	28
01-Dec	0	0	0
08-Dec	0	0	0
16-Dec	0	0	0
23-Dec	1	0	4
30-Dec	0	0	4
12-Jan	0	0	0
14-Jan	0	0	0
20-Jan	0	0	0
28-Jan	0	0	0
<b>TOTAL:</b>	<b>12</b>	<b>0</b>	<b>75</b>

**Pine Lake Creek:**

Pine Lake Creek was surveyed daily by a volunteer stream walker from November 2008 through January 2009. No live or dead kokanee were observed during surveys.

**Late-Run Kokanee Escapement Trends:**

Total combined escapement for Lewis, Laughing Jacobs, and Ebright creeks was 42 fish, which is only 4.8% of the 1996/97-2007/08 average (879). The combined 2008/09 late-run kokanee escapement is the worst estimate in the dataset (Figures 4 and 5). Additionally, kokanee appear to be entering and spawning in south Lake Sammamish tributaries significantly earlier during the past 2 years than normal. Kokanee are typically present in spawning tributaries from late November through January, with peak spawning occurring in middle December. Now, kokanee run and spawn timing is completed by the first week of December. During the last two spawning seasons only 8 live kokanee have been observed after December 10<sup>th</sup>. At the moment it is unclear why late-run kokanee run and spawn timing is earlier than normal. One possibility why kokanee are not present later during the spawning season could be predators removing fish staging at the mouth of the tributaries during low flow conditions. Local residents over the past 2 years have commented that otters have been feeding on kokanee near the mouths of Lewis and Ebright creeks. Another explanation could be that beach spawning is now a greater component of the late-run kokanee population than originally thought. Beach spawning has been observed in the past, but not quantified. Currently, beach spawning is not monitored and efforts should be made to determine the extent to which it occurs in Lake Sammamish.

**Figure 4. Escapement trends and average escapement levels of late-run kokanee.**

<b>YEAR</b>	<b>LEWIS</b>	<b>EBRIGHT</b>	<b>L.J.</b>	<b>COMBINED</b>
1996-97	219	70	170	459
1997-98	10	15	29	54
1998-99	43	40	0	83
1999-00	247	134	27	408
2000-01	143	362	92	597
2001-02	722	110	2	834
2002-03	1,002	319	384	1,705
2003-04	3,296	1,063	232	4,591
2004-05	442	134	18	594
2005-06	217	135	44	396
2006-07	330	292	65	687
2007-08	111	17	15	143
2008-09	29	12	1	42
<b>AVE (96/97-07/08):</b>	<b>565</b>	<b>224</b>	<b>90</b>	<b>879</b>
<b>AVE (96/97-08/09):</b>	<b>524</b>	<b>208</b>	<b>83</b>	<b>815</b>
<b>AVE (w/o 03/04):</b>	<b>293</b>	<b>199</b>	<b>58</b>	<b>741</b>
<b>4-YEAR AVE (04/05-08/09):</b>	<b>172</b>	<b>114</b>	<b>31</b>	<b>317</b>

Figure 5. Escapement trends of late-run kokanee.

