Yale Reservoir Kokanee (*Oncorhynchus nerka*) Escapement Report

2019

North Fork Lewis River Hydroelectric Project
*Yale FERC No. 2071*

Prepared by:

*Jeremiah Doyle, PacifiCorp*
1.0 INTRODUCTION

Since 1979, PacifiCorp biologists, along with various state and federal agencies, have conducted annual surveys to estimate spawning escapement of kokanee in Cougar Creek, a tributary to Yale Reservoir. This report presents results of kokanee spawner surveys conducted on Cougar Creek and the Constructed Channel within the Swift Bypass Reach in 2019. Surveys are performed per Article 402(b) of the Yale and Swift Federal Energy Regulatory Commission (FERC) operating licenses and Article 402(c) of the Merwin FERC operating license.

2.0 STUDY AREA

Surveys for kokanee spawners were performed on Cougar Creek and the Constructed Channel in 2019. Cougar Creek is a third order stream and tributary to Yale Reservoir in Southwest Washington. Cougar Creek originates from an underground lava tube and flows for approximately 1,700 meters before entering Yale Reservoir.

The Constructed Channel flows from a valve off of the Swift Power Canal for approximately 200 meters before entering the Lewis River channel within the Swift Bypass Reach. The valve that controls flow into the Constructed Channel is set to a level to contribute a constant flow of 14 cubic feet per second (cfs) (Figure 1).

![Survey area map](image)

Figure 1. Survey area map.
3.0 METHODS

To enumerate kokanee spawners, two biologists, one on each side of the stream, walk together from the stream mouth upstream to its anadromous fish barrier. Each biologist counts spawning and holding kokanee on his/her side of the stream, including side-channels. This process is repeated on three to four occasions over the course of the kokanee spawn time-frame, mid-September through early-November, to estimate the numbers of live kokanee and estimate the peak timing of the spawning run. The highest count during the survey period is considered the peak, and is preceded and followed by surveys with a lower kokanee count.

4.0 RESULTS

Cougar Creek
Peak kokanee escapement estimates decreased for the second year in a row from 2017 (7,429) and 2018 (6,118) to 2019 (3,703). The 2019 spawning estimate of 3,703 fish (Figure 2) is the second lowest count on record (1978-2019) and follows a trend of low population estimates since 2016.

As in previous years, Cougar Creek was surveyed on foot with two surveyors. Kokanee were enumerated from the stream mouth upstream to its origin, a distance of approximately 1,700 meters. For survey purposes, the accessible anadromous fish habitat in Cougar Creek is broken into five survey reaches. There are a series of three major log jams in Reach 2 and 3 of Cougar Creek. In 2019, the upper extent of kokanee spawning was observed to be just below the first log jam in Reach 2 which is the first of three major log jams encountered.

Cougar Creek was surveyed for kokanee three times in 2019 (Table 1). Survey conditions during the sampling time period (Sep – Nov) were ideal and water clarity very good throughout the survey season.

4.1 Distribution and Timing

The peak kokanee count was recorded on October 16, 2019 (Table 1). This peak timing of kokanee abundance in 2019, though late on the timing spectrum, is within historical timeframes on record (1978-2019). Most kokanee were observed in Reach 2, which is consistent with prior years. This largest concentration of kokanee occurs just below the first log jam encountered on their travel upstream.
Table 1. Distribution and peak counts of kokanee in Cougar Creek in 2019
* Estimate uses a 2.3 multiplier of the peak count (Graves unpublished data, 1982)

<table>
<thead>
<tr>
<th>Reach</th>
<th>Survey Date</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10/08</td>
<td>10/16</td>
<td>11/05</td>
</tr>
<tr>
<td>1</td>
<td>360</td>
<td>430</td>
<td>110</td>
</tr>
<tr>
<td>2</td>
<td>300</td>
<td>1,180</td>
<td>760</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Spawning Estimate</strong></td>
<td><strong>1,518</strong></td>
<td><strong>3,703</strong></td>
<td><strong>2,001</strong></td>
</tr>
</tbody>
</table>

4.2 Escapement

The kokanee spawning escapement in 2019 is estimated at 3,703 fish (Figure 2). This is the second lowest spawner count on record, and a decrease from the peak observed in 2018 (6,118). Kokanee escapement into Cougar Creek has been less than the historical running average of 71,519 since 2003. This year’s estimate is also well below the ten-year average of 22,426 fish (Table 3).

![Kokanee Spawning Population Trend - Cougar Creek](image)

Figure 2. Kokanee spawning estimates for Cougar Creek, 1978-2019
4.3 Length Distribution

Due to low escapement numbers, kokanee carcasses were difficult to find in 2019, therefore lengths were only measured from 12 male and 20 female kokanee (Figure 3). Lengths came from both Cougar Creek and Constructed Channel kokanee. Lengths of kokanee in both reaches were similar to each other in 2019, and due to the low numbers of recovered carcasses, were pooled. The average lengths of male and female kokanee in 2019 were 337 and 315 millimeters, respectively.

Combined mean fork length of all kokanee observed in 2019 (323 millimeters) was slightly larger than what was observed during 2018 (318 millimeters). Historically, mean fork length follows a density dependent inverse relationship with estimated escapement. In years, when escapement is lower than average, kokanee length tends to be above average, and vice versa.

The average length of this year’s female kokanee (315 mm) was approximate to the average female length observed in 2018 (316 mm). The average female fork length in 2019 is greater than the historical running average of 288 millimeters (1978-2019).

With the regression line established in Figure 4, the average fork length size for females in 2019 is over-estimated from the equation by 1.3 percent. The fitted line suggests that given the spawning population estimate the female average length should be 311 millimeters, instead of the observed average of 315 millimeters, an overestimate of 4 millimeters. This observed difference in estimation of 1.3 percent is negligible and may indicate that during the reservoir life-cycle of this brood year that productivity was ideal for proper fish growth and development for this brood escapement estimation.
The size at spawning estimate may be a good indication of reservoir production in terms of food availability and fish growth. When kokanee are smaller than anticipated (based on size at spawning and spawning escapement) it may be an indication that reservoir productivity was limited at some point during their residency in Yale Reservoir.

4.4 Constructed Channel

One Constructed Channel kokanee spawner survey was completed on October 21, 2019 from its confluence with the Swift Bypass Reach upstream to its anadromous fish barrier, a distance of approximately 200 meters. A peak count of 1,250 kokanee spawners was recorded, this compares to a peak count of 1,380 kokanee spawners recorded in 2018 (Table 2).

The escapement estimate in 2019 (2,875) is very similar to what was estimated in 2018 (3,174) (Table 2). It is important to note that the flows within the Constructed Channel come straight off the Swift Power Canal via a mechanically controlled stem valve that is set to release a constant 14 cfs. Habitat improvements to the Constructed Channel were completed by PacifiCorp in 2010, and the constant flow rate of 14 cfs has been in effect since that time.
### Table 2. Historical Constructed Channel peak counts and estimated spawning escapement.

<table>
<thead>
<tr>
<th>Year</th>
<th>Peak Count</th>
<th>Estimated Spawning Escapement</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>410</td>
<td>943</td>
</tr>
<tr>
<td>2011</td>
<td>500</td>
<td>1,150</td>
</tr>
<tr>
<td>2012</td>
<td>3,400</td>
<td>7,820</td>
</tr>
<tr>
<td>2013</td>
<td>450</td>
<td>1,035</td>
</tr>
<tr>
<td>2014</td>
<td>450</td>
<td>1,035</td>
</tr>
<tr>
<td>2016</td>
<td>890</td>
<td>2,047</td>
</tr>
<tr>
<td>2017</td>
<td>1,190</td>
<td>2,553</td>
</tr>
<tr>
<td>2018</td>
<td>1,380</td>
<td>3,174</td>
</tr>
<tr>
<td>2019</td>
<td>1,250</td>
<td>2,875</td>
</tr>
</tbody>
</table>

### Table 3. Summary of data collected from Cougar Creek kokanee surveys from 1978 to 2019.

<table>
<thead>
<tr>
<th>Year</th>
<th>Peak Count</th>
<th>Date</th>
<th>Estimated Escapement*</th>
<th>Moving Average</th>
<th>Number of Females**</th>
<th>Mean Females</th>
<th>Mean Fecundity+</th>
<th>Total Eggs</th>
<th>Egg to Adult % Survival^</th>
</tr>
</thead>
<tbody>
<tr>
<td>1978</td>
<td>32,000</td>
<td>9/15/1978</td>
<td>60,000</td>
<td>66,930</td>
<td>35,056</td>
<td>300</td>
<td>515</td>
<td>15,485,658</td>
<td></td>
</tr>
<tr>
<td>1982</td>
<td>890</td>
<td>10/10/1982</td>
<td>1,190</td>
<td>2,553</td>
<td>35,056</td>
<td>300</td>
<td>515</td>
<td>2,522,230</td>
<td></td>
</tr>
<tr>
<td>1983</td>
<td>1,190</td>
<td>10/14/1983</td>
<td>1,380</td>
<td>3,174</td>
<td>35,056</td>
<td>300</td>
<td>515</td>
<td>3,174</td>
<td></td>
</tr>
</tbody>
</table>

*Peak Count x 2.3 (Graves unpublished data, 1983)  
**Assuming a 1:1 ratio  
^Survival estimate
+ From the model: Fecundity = \(-288.78 + 2.68 \times \text{Length of Females}\) (Graves unpublished data, 1983)

^ Estimated Escapement of Adults (3 year-olds) / estimated number of eggs