



# MEMORANDUM

## Department of Fish and Wildlife

### Intra Departmental

**Date:** December 21, 2015

**To:** Files

**From:** Jeff Whisler

**Subject:** 2015 Willamette River Spring Chinook Run and 2016 Forecast

#### **Summary of 2015 Willamette River Spring Chinook Return**

The final 2015 Willamette River spring Chinook return is estimated at 87,071 total fish to the Columbia River mouth (Table 1). An estimated 13,569 of these were unmarked fish (16%). The 2015 total return was 157% of forecast. The Clackamas River component was similar to forecasted, with 8,446 spring Chinook returning to the Clackamas River compared to an expected 8,700.

The total return of adipose-fin-marked hatchery fish in 2015 is estimated at 73,502 fish at the Columbia River mouth, compared to 45,210 fish expected. Counts at the Willamette Falls fishway indicate that 43,660 fin-marked hatchery fish and 9,428 unmarked fish passed the fish ladder. The full reconstruction of the 2015 return is shown in Table 2.

Table 1. 2015 Willamette River forecasted and actual return (to Columbia River mouth).

	Columbia River Mouth Return				Total
	Age 3	Age 4	Age 5	Age 6	
<b>2015 Forecast</b>	<b>2,300</b>	<b>36,300</b>	<b>16,700</b>	<b>140</b>	<b>55,440</b>
Lower	2,300	28,400	12,600	140	43,440
Upper	2,300	44,300	22,400	140	69,140
<b>2015 Actual Return</b>	<b>2,539</b>	<b>63,223</b>	<b>21,258</b>	<b>51</b>	<b>87,071</b>

The forecast for 2015 assumed that 18% of the return would be comprised of unmarked fish, based on the average percentage of unmarked fish seen in the 2010–2014 returns. The actual unmarked rate for the full 2015 return is estimated to have been 16%.

Table 2. Preliminary summary of the 2015 Willamette River spring Chinook return.

<b>Catch</b>	<b>Age 3</b>	<b>Age 4</b>	<b>Age 5</b>	<b>Age 6</b>	<b>Total</b>
LCR Commercial	0	1,074	188	0	1,262
LCR Commercial (release mortality)	0	41	7	0	48
Select Area Commercial	23	574	658	0	1,255
LCR Sport (kept catch)	24	2,553	850	0	3,427
LCR Sport (release mortality)	0	29	10	0	39
L. Will. Sport Fishery (kept catch)	89	9,941	3,284	10	13,324
L. Will. Sport Fishery (release mortality)	2	170	56	0	228
Lower Clackamas Sport (kept catch)	0	325	87	0	412
Lower Clackamas Sport (rel. mortality)	0	5	1	0	6
<b>Totals</b>	<b>138</b>	<b>14,712</b>	<b>5,141</b>	<b>10</b>	<b>20,001</b>
<b>Escapement</b>					
Willamette Falls Count	2,044	38,340	12,667	37	53,088
Mortality Below Falls	5	550	182	0	737
Clackamas Hatchery swim-ins	177	2,501	865	0	3,543
Clackamas Hatchery transfers from N.F. Dam	19	1,331	461	0	1,811
Eagle Creek Hatchery Return	4	61	21	0	86
North Fork Dam, Passed Upstream	116	1,826	632	0	2,574
North Fork Dam, Recycled Downstream	0	3	1	0	4
Natural Spawn Bel. N.F. Dam	1	7	2	0	10
Sea Lion Predation	35	3,892	1,286	4	5,217
<b>Totals</b>	<b>2,401</b>	<b>48,511</b>	<b>16,117</b>	<b>41</b>	<b>67,070</b>
<b>Run Entering Columbia</b>	<b>2,539</b>	<b>63,223</b>	<b>21,258</b>	<b>51</b>	<b>87,071</b>
<b>Run Entering Willamette</b>	<b>2,492</b>	<b>58,952</b>	<b>19,545</b>	<b>51</b>	<b>81,040</b>
<b>Run Entering Clackamas</b>	<b>317</b>	<b>6,059</b>	<b>2,070</b>	<b>0</b>	<b>8,446</b>

### **Forecasted Willamette River Spring Chinook Return for 2016**

#### **Projections for Age-3 fish returning in 2016**

In recent years, a regression of the observed Age-2:Age-3 cohort ratios versus Age-2 returns has been used to estimate the cohort ratio and forecast the return of Age-3 (jack) spring Chinook. For 2016, this method produces a point estimate of 1,400 Age-3 fish returning to the Columbia River mouth. Alternative methodologies have not proven to be useful in explaining variation in projected returns, therefore no lower or upper bounds are provided.

### Projections for Age-4 fish returning in 2016

A regression of natural log transformed age-3 returns versus natural log transformed age-4 returns plus incorporation of an ocean productivity variable (the ranking of NOAA ocean ecosystem indicators) predicts 40,300 age-4 fish will return and is used as the 2016 abundance forecast of age-4 spring Chinook at the Columbia River mouth. The lower and upper bound projections for the age-4 component are 35,400 (using a linear regression of the cohort relationship between age-2+age-3 combined versus age-4 returns) and 47,900 (using a regression of age-3 versus age-4 observed returns plus incorporation of a recent-year trend variable).

### Projections of Age-5 fish returning in 2016

For 2016, an average of the output of the best-fitted models predicts a return of 28,200 age-5 spring Chinook to the Columbia River mouth. The lower and upper bounds are 20,400 (using the five-year running average of the age-4:age-5 cohort ratio) and 35,300 (using a regression of natural log transformed age-4 returns versus natural log transformed age-5 returns plus incorporation of an ocean productivity variable (the ranking of NOAA ocean ecosystem indicators)).

Performance of the age-5 predictor models is hindered by the recent change in age structure of the run. Over the past ten years, the run has become age-4 dominant whereas in the past the run would vary between age-4 dominant, age-5 dominant, or a 50/50 mix. The 2016 projection is greater than the recent five-year average age-5 return.

### Projections for Age-6 fish returning in 2016

The age-6 component makes up a very small portion of annual returns and, as a result, is difficult to correlate with prior year returns of the same cohort, but also contributes minimally to forecast errors. The 2016 projection is 200 spring Chinook to the Columbia River mouth, based on the running 5-year average age-5:age-6 cohort ratio.

### 2016 Clackamas River Forecasted Return

Using a regression of the sum of the prior two year's jack (age-3) returns versus the total return size produces a projected 8,300 spring Chinook returning to the mouth of the Clackamas River. Age-specific forecasts are not presented here but were calculated based on the average proportions of each age in Clackamas returns.

### 2016 Forecast Summary

Table 3. 2016 Projected Willamette basin spring Chinook return to Columbia River mouth.

	Columbia River Mouth Return				
	Age 3	Age 4	Age 5	Age 6	Total
<b>2016 Forecast</b>	<b>1,400</b>	<b>40,300</b>	<b>28,200</b>	<b>200</b>	<b>70,100</b>
Lower	1,400	35,400	20,400	200	57,400
Upper	1,400	47,900	35,300	200	84,800

The 2015 return included an estimated 16% unmarked fish. Using the most recent five-year average of unmarked fish (18%), the number of hatchery fish returning to the Columbia River mouth in 2016 is forecasted to be 57,400 (Table 4).

Table 4. 2016 Projected Willamette basin (Clackamas included) spring Chinook **hatchery** fish return to Columbia River mouth.

	Columbia River Mouth Returns (hatchery fish only)				
	Age 3	Age 4	Age 5	Age 6	Total
<b>2016 Forecast</b>	<b>1,100</b>	<b>33,000</b>	<b>23,100</b>	<b>160</b>	<b>57,360</b>
Lower	<b>1,100</b>	29,000	16,700	<b>160</b>	46,960
Upper	<b>1,100</b>	39,300	28,900	<b>160</b>	69,460

### **Hatchery Surplus Estimates**

The harvestable surplus of the 2016 return of hatchery fish is calculated by subtracting the hatchery fish escapement goals specified in the Willamette River Spring Chinook Fisheries Management and Evaluation Plan (FMEP) from the total forecasted hatchery component of the return. Based on the FMEP, at a total hatchery-fish run size of 57,360 fish the escapement goals for Willamette Falls and the Clackamas River are 24,000 and 3,600 fish, respectively. This results in a harvestable surplus of 29,760 fish. Per the allocation schedule included in the FMEP these fish are to be shared 76%/24% for recreational and commercial fisheries, respectively.