MEMORANDUM

Department of Fish and Wildlife
Intra Departmental

Date: December 12, 2014
To: Files
From: Jeff Whisler
Subject: 2014 Willamette River Spring Chinook Run and 2015 Forecast

Summary of 2014 Willamette River Spring Chinook Return

The final 2014 Willamette River spring Chinook return is estimated at 51,794 total fish to the Columbia River mouth (Table 1). An estimated 8,701 of these were unmarked fish (17%). The 2014 total return was 88% of forecast. The Clackamas River component was less than forecasted, with 5,612 spring Chinook returning to the Clackamas River compared to an expected 8,200.

The total return of adipose-fin-marked hatchery fish in 2014 is estimated at 43,093 fish at the Columbia River mouth, compared to 46,230 fish expected. Counts at the Willamette Falls fishway indicate that 24,924 fin-marked hatchery fish and 6,745 unmarked fish passed the fish ladder. The full reconstruction of the 2014 return is shown in Table 2.

Table 1. 2014 Willamette River forecasted and actual return (to Columbia River mouth).

	Columbia River Mouth Return				
	Age 3	Age 4	Age 5	Age 6	Total
2014 Forecast	**3,000**	**34,000**	**21,400**	**290**	**58,690**
Lower	3,000	32,400	9,200	290	44,890
Upper	3,000	52,400	35,500	290	91,190
2014 Actual Return	**2,029**	**39,176**	**10,532**	**57**	**51,794**

The forecast for 2014 assumed that 21% of the return would be comprised of unmarked fish, based on the average percentage of unmarked fish seen in the 2009–2013 returns. The actual unmarked rate for the full 2014 return is estimated to have been 17%.

Table 2. Preliminary summary of the 2014 Willamette River spring Chinook return.

Catch	Age 3	Age 4	Age 5	Age 6	Total
LCR Commercial	6	440	133	0	579
LCR Commercial (release mortality)	0	25	6	0	31
Select Area Commercial	0	281	372	2	648
LCR Sport (kept catch)	33	1,740	489	1	2,263
LCR Sport (release mortality)	0	29	9	0	38
L. Will. Sport Fishery (kept catch)	116	6,075	1,718	10	7,919
L. Will. Sport Fishery (release mortality)	2	132	37	0	171
Lower Clackamas Sport (kept catch)	30	242	65	0	337
Lower Clackamas Sport (rel. mortality)	1	4	1	0	6
Totals	**188**	**8,968**	**2,830**	**13**	**11,999**
Escapement					
Willamette Falls Count	1,598	23,411	6,620	40	31,669
Mortality Below Falls	2	105	30	0	137
Clackamas Hatchery swim-ins	144	2,570	258	0	2,972
Clackamas Hatchery transfers from N.F. Dam	1	1,057	106	0	1,164
Eagle Creek Hatchery Return	6	99	10	0	115
North Fork Dam, Passed Upstream	48	850	85	0	983
Natural Spawn Bel. N.F. Dam	2	30	3	0	35
Sea Lion Predation	40	2,086	590	4	2,720
Totals	**1,841**	**30,208**	**7,702**	**44**	**39,795**
Run Entering Columbia	**2,029**	**39,176**	**10,532**	**57**	**51,794**
Run Entering Willamette	**1,990**	**36,661**	**9,523**	**54**	**48,228**
Run Entering Clackamas	**232**	**4,852**	**528**	**0**	**5,612**

Forecasted Willamette River Spring Chinook Return for 2015

Projections for Age-3 fish returning in 2015

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 2015, this method produces a point estimate of 2,300 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 2015

Averaging the output of the best-performing models predicts 36,300 Age-4 fish will return and is used as the 2015 abundance forecast of Age-4 spring Chinook at the Columbia River mouth. The lower and upper bound projections for the Age-4 component are 28,400 (using a linear regression of Age-3 versus Age-4 observed returns) and 44,300 (using a regression of natural log transformed Age-3 returns versus natural log transformed Age-4 returns and incorporating an ocean productivity variable (the ranking of NOAA ocean ecosystem indicators)).

Projections of Age-5 fish returning in 2015

For 2015, an average of the output of the best-fitted models predicts a return of 16,700 Age-5 spring Chinook to the Columbia River mouth. The lower and upper bounds are 12,600 (using the three-year running average of the Age-4:Age-5 cohort ratio) and 22,400 (using a regression of natural log transformed Age-4 returns (including a trend function) versus observed Age-5 returns).

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 2015 projection is similar to the recent 5-year average Age-5 return.

Projections for Age-6 fish returning in 2015

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 2015 projection is 140 spring Chinook to the Columbia River mouth, based on the running 5-year average Age-5:Age-6 cohort ratio.

2015 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 8,700 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.

2015 Forecast Summary

Table 3. 2015 Projected Willamette spring Chinook return to Columbia River mouth.

	Columbia River Mouth Return				
	Age 3	Age 4	Age 5	Age 6	Total
2015 Forecast	**2,300**	**36,300**	**16,700**	**140**	**55,440**
Lower	2,300	28,400	12,600	140	43,440
Upper	2,300	44,300	22,400	140	69,140

The 2014 return included an estimated 17% 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 2015 is forecasted to be 45,200 (Table 4).

Table 4. 2015 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
2015 Forecast	**1,900**	**29,600**	**13,600**	**110**	**45,210**
Lower	**1,900**	23,200	10,300	**110**	35,510
Upper	**1,900**	36,100	18,300	**110**	56,410

Hatchery Surplus Estimates

The harvestable surplus of the 2015 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 45,210 fish the escapement goals for Willamette Falls and the Clackamas River are 22,000 and 3,300 fish, respectively. This results in a harvestable surplus of 19,910 fish.