MEMORANDUM

STATE OF ALASKA
DEPARTMENT OF FISH AND GAME
Division of Sport Fish

TO:	Distribution	DATE:	2/9/2015
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SUBJECT: Outlook for the Kenai River Chinook salmon early run

The outlook for the early run of Kenai River Chinook salmon in 2015 is well below average, with a forecast total run of approximately 5,265 fish. If realized, this run will rank the 2nd lowest measured (29th out of 30 years), be nearly identical in abundance to the run in 2012 and 2014, and be about one-half the 1986–2014 average. The 2015 forecasted run approximates the lower end of the optimum escapement goal (OEG) of 5,300 to 9,000 fish.

The forecast of total run is calculated from the sum of individual age-specific forecasts of abundance for fish ages 3 to 7. Forecast abundance for each age class (Table 1) was calculated from several models based on relationships between adult returns or siblings from previous years (Table 2). With one exception (age-5) the model estimates selected for each age class for inclusion in the 2015 forecast were those that had the minimum mean absolute percent error (MAPE) in 2010 – 2014 hindcasts of forecasts, as compared to the actual runs in those years. Most forecast models are chosen based on MAPE (from hindcasts going back 3 to 5 years), as it typically provides forecasts that are closest to the actual run (best accuracy). Mean absolute deviation (MAD) and mean percent error (MPE) were also used to evaluate accuracy and precision (respectively) between hindcasts and actual runs of the previous five years.

For age-3 fish, the recent 5-year mean forecast estimate was selected (a run of 373 fish). Fewer models can forecast abundance for this age class as there are no prior sibling returns to provide insights. The maximum number of fish observed in this age has been ~700 fish; hence typically this has a small contribution to the run and run forecast.

For age-4 fish, the median was selected (a run of 1,013 fish). This is approximately twice the number that returned in 2012 and 2013, and less than one-half of the number that returned in 2011 and 2014.

For age-5 fish, the recent 5-year mean forecast (2,286) was selected even though the recent 5-year mean sibling model had a lower MAPE. We believe the mean model a better forecast estimate as it has the lowest MAD, and because the recent 5-year mean sibling model forecast is approximately double the returns in 4 of the last 5 years. The selected forecast approximates the 2014 return of this age class.

Historically age-6 fish are the predominant age class for early-run Kenai River Chinook salmon. The most recent sibling model is considered the best estimate for this age class for 2015, a forecast of only 1,576 fish.   This forecast of age-6 fish is more than 3 times the return of this age class in 2014, but only approximately one-quarter of the historic mean.

For age-7 fish, the most recent sibling model was selected, and forecast a run of 17 fish in 2015. If realized, this would also be an historic low for this age class, but still on the scale of returns in the last few years.

There is some uncertainty in the 2015 forecast estimate. The 2013 forecast was for a total run of approximately 5,330 fish while the estimated total run is approximately 2,150 fish, less than one-half the forecast. The 2014 forecast was for a total run of approximately 2,230 fish while the preliminary

estimated total run is approximately 5,400 fish (more than double). Probably the best way to consider this salmon forecast is in terms of 3 broad categories: approximately average run, below average run or above average run. Clearly the 2015 forecast gives the expectation of a run in the below average category.

Table 1.–Chinook salmon forecasts for the 2015 Kenai River early run using several models, and the fit of each model to the previous 5 years of actual runs. Shaded boxes around values indicate those with the lowest associated 5-year MAPE and hence were generally selected to be part of the total run forecast. See Table 2 for a description of each model.

Model	Forecast 2015	5-Year MAD[a]	5-Year MAPE[b]	5-Year MPE[c]
Age-3				
5-year mean	373	215	51	18
Mean	107	294	69	69
Forecast estimate	**373**			
Age-4				
5-year mean	1,530	924	134	102
Mean	1,649	835	122	-92
Median	1,013	989	83	-15
Mean sibling	3,115	856	91	-38
Median sibling	-	1,531	100	100
Most recent sibling	9,939	1,509	109	-33
5-year mean sibling	4,491	1,624	138	-109
Forecast estimate	**1,013**			
Age-5				
5-year mean	2,286	929	104	102
Mean	3,600	1,504	151	-151
Median	3,362	1,289	130	-126
Mean sibling	7,594	1,366	80	-69
Median sibling	7,340	1,261	75	-60
Most recent sibling	10,253	1,874	73	21
5-year mean sibling	**4,997**	1,050	**47**	28
Forecast estimate	**2,286**			
Age-6				
5-year mean	1,915	2,444	232	101
Mean	6,066	4,644	482	-482
Median	5,961	4,346	467	-467
Mean sibling	3,677	1,944	133	-133
Median sibling	3,351	1,428	104	-104
Most recent sibling (5's and 4's)	1,021	952	58	-23
Most recent sibling	1,576	403	29	-1
5-year mean sibling	1,669	521	37	-31
5-year mean sibling (5's and 4's)	1,218	709	54	-46
Forecast estimate	**1,576**			
Age-7				
5-year mean	59	153	322	-105
Mean	434	417	853	-853
Median	338	346	713	-713
Mean sibling	25	88	204	-199
Median sibling	26	86	200	-195
Most recent sibling	17	58	98	-40
5-year mean sibling	13	57	127	-95
Forecast estimate	**17**			
TOTAL RUN FORECAST	**5,265**			

[a]mean absolute deviation
[b]mean absolute percent error
[c]mean percent error

Table 2.–Description of models used in forecasting the Kenai River Chinook salmon early run, 2015.

Model	Description
5-year mean	Mean of the 2010-2014 run for the specified age class.
Mean	Mean using all brood years (1983-2008, except thru 2007 for age-7).
Median	Median return of all brood years (1983-2008, except thru 2007 for age-7).
Mean sibling	Mean of sibling ratios (age/age minus 1) for all returns (1983-2008 brood years) multiplied by the return of age minus 1 siblings.
Median sibling	Median of sibling ratios (age/age minus 1) for all returns (1983-2008 brood years) multiplied by return of age minus 1 siblings.
Most recent sibling(5's and 4's)	Most recent ratio of (age-6)/(age-5+ age-4), multiplied by the return of age-5 and age-4 siblings.
Most recent sibling	Most recent sibling ratio (age/age minus 1), multiplied by the return of age minus 1 siblings.
5-year mean sibling	Mean of sibling ratios (age/age minus 1) for previous 5 brood years multiplied by the return of age minus 1 siblings.
5-year mean sibling (5's and 4's)	Mean of sibling ratios (age/ age minus 1+ age minus 2) for previous 5 brood years multiplied by return of age-5 and age-4 siblings.