# MEMORANDUM STATE OF ALASKA

DEPARTMENT OF FISH AND GAME

Division of Sport Fish

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SUBJECT: Outlook for the 2016 Kenai River Chinook salmon early run

The outlook for the early run of Kenai River Chinook salmon in 2016 is below average, with a forecast total run of approximately 5,206 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 less than half of the 1986–2015 average. The 2016 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). The model estimates selected for each age class for inclusion in the 2016 forecast were those that had the minimum mean absolute deviation (MAD) in 2011 – 2015 hindcasts of forecasts, as compared to the actual runs in those years. In recent forecast of Kenai River Chinook salmon run size models with the smallest MAD have provided the best forecast accuracy.

For age-3 fish, the recent 5-year mean forecast estimate was selected (a run of 333 fish). Fewer models can forecast abundance for this age class as there are no prior sibling returns to provide insights. This forecast of age-3 fish approximates the run of this age class in 2015.

For age-4 fish, the mean forecast estimate was selected (a run of 1,679 fish). This is approximately three times the run size in 2012 and 2013, and three-quarters the run size in 2014 and 2015.

For age-5 fish, the recent 5-year mean forecast estimate was selected (a run of 1,941 fish). The forecast approximates the 2014 and 2015 runs of this age class.

For age-6 fish the most recent sibling forecast estimate was selected (a run of 1,167 fish). Historically age-6 fish are the predominant age class for early-run Kenai River Chinook salmon. This forecast of age-6 fish approximates the run of this age class in 2015, but is only one-fifth of the historical mean.

For age-7 fish, the most recent sibling forecast estimate was selected (a run of 86 fish). If realized, this would approximate the run of this age class in 2015 and exceed the runs in 2012-2014.

There is much uncertainty in the 2016 forecast estimate. The 80% prediction interval for the 2016 total run forecast is 1,422 to 8,989 fish. In 2014, the forecast was for a total run of approximately 2,200 fish while the estimated total run is approximately 5,300 fish, over twice the forecast. The 2015 forecast was for a total run of approximately 5,300 fish while the preliminary estimated total run is approximately 6,300 fish, one thousand fish more than forecast. 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. The 2016 forecast gives the expectation of a run in the below average category.

Table 1.–Chinook salmon forecasts for the 2016 Kenai River early run using several models, and the fit of each model to the previous 5 years of actual runs. Shaded boxes indicate forecasts with the lowest associated MAD and hence were selected to be part of the total run forecast for each age class. Transparent boxes indicate the lowest MAD for each age class. See Table 2 for a description of each model.

| | Forecast | 5-year | | |
|---|---|---|---|---|
| **Model** | **2016** | **MAD[a]** | **MAPE[b]** | **MD[c]** |
| | **Age-3** | | | |
| Mean | 119 | 244 | 65% | 244 |
| 5-yr mean | 333 | 128 | 34% | 76 |
| **Forecast estimate** | **333** | | | |
| | **Age-4** | | | |
| Mean | 1,679 | 955 | 127% | -36 |
| 5-year mean | 1,637 | 959 | 135% | -218 |
| Median | 1,055 | 1,087 | 86% | 629 |
| Mean sibling | 4,329 | 3,910 | 364% | -3,862 |
| 5-year mean sibling | 1,897 | 2,721 | 202% | -2,152 |
| Median sibling | 4,873 | 4,191 | 385% | -4,191 |
| Most recent sibling | 1,334 | 2,359 | 121% | -1,601 |
| **Forecast estimate** | **1,679** | | | |
| | **Age-5** | | | |
| Mean | 3,550 | 1,806 | 166% | -1,806 |
| 5-year mean | 1,941 | 927 | 105% | -927 |
| Median | 3,314 | 1,461 | 141% | -1,461 |
| Mean sibling | 8,944 | 3,906 | 210% | -3,674 |
| 5-year mean sibling | 4,787 | 1,389 | 74% | -842 |
| Median sibling | 8,724 | 3,642 | 196% | -3,389 |
| Most recent sibling | 2,560 | 3,207 | 148% | -2,497 |
| **Forecast estimate** | **1,941** | | | |
| | **Age-6** | | | |
| Mean | 5,902 | 4,608 | 514% | -4,608 |
| 5-year mean | 1,819 | 1,548 | 181% | -1,548 |
| Median | 5,952 | 4,364 | 495% | -4,364 |
| Mean sibling | 3,676 | 2,497 | 171% | -2,497 |
| 5-year mean sibling | 1,561 | 591 | 41% | -591 |
| Median sibling | 3,392 | 1,960 | 140% | -1,960 |
| Most recent sibling | 1,167 | 501 | 37% | -201 |
| 5-year mean sibling (5's and 4's) | 2,032 | 660 | 49% | -343 |
| Most recent sibling (5's and 4's) | 1,943 | 964 | 60% | -202 |
| **Forecast estimate** | **1,167** | | | |
| | **Age-7** | | | |
| Mean | 423 | 389 | 630% | -389 |
| 5-year mean | 75 | 81 | 109% | -64 |
| Median | 331 | 308 | 502% | -308 |
| Mean sibling | 71 | 75 | 112% | -39 |
| 5-year mean sibling | 86 | 51 | 63% | 11 |
| Median sibling | 67 | 76 | 113% | -39 |
| Most recent sibling | 266 | 82 | 103% | 1 |
| **Forecast estimate** | **86** | | | |
| **TOTAL RUN FORECAST** | **5,206** | | | |

[a]Mean Absolute Deviation.

[b]Mean Absolute Percent Error.

[c]Mean Deviation (actual-forcast).

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

| Model | Description |
|---|---|
| Mean | Mean using all brood years[a] |
| 5-year mean | Mean of the 2011-2015 run for the specified age class. |
| Median | Median return of all brood years |
| Mean sibling | Mean of sibling ratios (age/age minus 1) for all returns 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. |
| Median sibling | Median of sibling ratios (age/age minus 1) for all returns multiplied by return of age minus 1 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 (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. |
| 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. |

a-1983-2012 for 3 year olds, 1982-2011 for 4 year olds, 1981-2010 for 5 year olds, 1980-2009 for 6 year olds, 1979-2008 for 7 year olds.

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