Submitted by Graphite Branch RC 123

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Fish and Game

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MEMORANDUM

TO: Distribution

DATE: December 26, 2019

FROM: Robert Begich, Fishery Biologist III
Division of Sport Fish, Region II

SUBJECT: Kenai River late run Chinook salmon 2020 outlook

The outlook for the late run of Kenai River Chinook salmon in 2020 is a forecast of 22,707 fish large fish (≥ 75 cm mideye-to-tail-fork-length [METF] or approximately ≥ 34 inches in total length. The 2020 forecasted total run of large fish is within the large fish sustainable escapement goal (SEG) of 13,500 to 27,000 fish. If realized, this run will: rank the 6th lowest (30th out of 35 years); be approximately 60% (8,900 fish) larger than the 2019 preliminary estimated total run of 12,780 large fish; be about half of the 1986–2019 average of approximately 43,000 large fish and be comparable to the recent 5-year 2015-2019 average total run of about 21,600 large fish (Table 1). The 80% prediction interval for the 2020 run of large fish is 13,225 to 29,337 fish.

The forecast of large fish is the sum of individual age-specific forecasts of abundance for ages 5, 6 and 7. Forecast abundance for each age class was calculated from models based on historical adult returns by age class (mean, median), recent age-specific run size (5-year mean) or sibling ratios from previous years (mean sibling, 5-year mean sibling, median sibling, most recent sibling) (Table 2). The model estimates selected for each of the age classes for inclusion in the 2020 large fish forecast had two or more minimum values of the follow statistics: mean absolute deviation (MAD), mean absolute percentage error (MAPE), and mean deviation (MD) in 2014 – 2018 hindcasts, as compared to the actual runs in those years (Table 3). In recent forecasts of Kenai River Chinook salmon run size, forecast estimates with the smallest estimates of each statistic and / or the minimum MAPE have provided the best forecast accuracy between observed and forecasted runs by age over recent years.

The recent 5-year mean model was selected a run of 9,530 age-5 fish (Table 3). The forecast is double the preliminary estimate of the 2019 run of this age class (4,664) and is less than the historical mean of 10,508 age-5 fish (Table 1).

The 5-year mean model estimate of 12,488 fish was selected for age-6 fish (Table 3). The 2020 age-6 large fish run forecast is about 60% less than the historical mean run of 30,469 age-6 fish. Of interest: the 2nd least variable forecast model was the most recent sibling model (MAD of 6,563, MAPE 53%, MD 3,366) with a much smaller forecast estimate of 6,019 age-6 fish and is less than the 2019 preliminary total run estimate of this age class of 7,839 age-6 fish (Tables 1 and 3).

The 5-year mean model was selected for a run of 689 age-7 fish. If realized, this would be considerably larger (255%) than the preliminary estimated 2019 run of 272 age-7 fish.

The 2019 forecast was for a total run of approximately 22,105 fish, while the preliminary estimated total run was approximately 12,780 large fish which is approximately 9,325 fish (42%) less than forecasted. The

error in the 2019 forecast was primarily due to over-forecasting production of age-5 and age-6 fish from the 2013 and 2014 brood years, the two lowest brood year escapements on record prior to 2019 with a preliminary estimated escapement of 11,555 fish (Table 1). The 2020 late run of large Kenai River Chinook salmon primarily originates from the 2014 and 2015 brood year escapements.

The best way to consider this large fish forecast is in terms of 3 broad categories: approximately average run, below average run or above average run. The 2020 forecast gives the expectation of a run in the below average category relative to the historical average (1986-2019) and comparable to the recent 5-year average (2015-2019) total run of about 21,600 fish, that originates in part (age-6 and age-7 components) from the 2nd and 3rd lowest brood year escapements on record.

Table 1. Estimated number of late-run Kenai River Chinook salmon ≥ 75 cm METF by age class and year, 1986 - 2019.

	Total Age in Years					
Year	4	5	6	7	Total Run	Escapement
1986		28,843	28,643	2,881	60,367	42,101
1987		20,049	53,373	1,315	74,737	48,393
1988		5,929	55,173	9,289	70,391	42,815
1989		6,559	29,895	5,161	41,615	26,253
1990		4,818	26,277	1,884	32,979	25,139
1991		8,331	26,933	2,381	37,645	27,133
1992		9,550	39,956	1,610	51,116	37,469
1993		9,510	46,669	3,341	59,520	33,432
1994		7,332	42,680	3,149	53,161	26,145
1995		10,074	30,070	3,353	43,497	24,874
1996		14,613	28,372	968	43,953	29,056
1997		9,872	34,222	1,251	45,345	25,221
1998		8,100	33,132	1,898	43,130	33,385
1999		10,198	33,151	2,308	45,657	29,100
2000		12,019	28,189	1,511	41,719	25,502
2001		9,976	34,200	1,578	45,754	29,531
2002		13,123	40,530	2,257	55,910	40,514
2003		17,229	49,350	1,405	67,984	48,461
2004		24,465	64,462	2,385	91,312	65,112
2005		15,010	65,599	3,580	84,189	55,688
2006		10,299	40,112	6,711	57,122	39,305
2007		12,498	27,552	4,371	44,421	29,664
2008		8,869	30,653	3,158	42,680	28,094
2009		4,703	21,594	1,747	28,044	18,251
2010		8,760	11,719	1,701	22,180	13,037
2011		6,843	18,636	902	26,381	15,731
2012		8,470	13,681	1,055	23,206	22,453
2013		3,622	9,994	766	14,382	12,305
2014		4,684	8,225	494	13,403	11,980
2015		6,302	15,302	1,192	22,796	16,825
2016		9,990	14,013	539	24,542	14,676
2017	104	15,299	13,923	1,082	30,408	20,634
2018		6,074	11,365	359	17,798	17,285
2019	6	4,664	7,839	272	12,780	11,555
Average	55	10,491	30,455	2,290	43,239	29,033
Recent 5-Year Average	55	8,466	12,488	689	21,665	16,195

Table 3.– Kenai River late run Chinook salmon forecasts in 2020 for large (≥ 75 cm METF) fish using several models, and the relative fit of hindcasts-of-forecasts of each model to the previous 5 years of actual runs. Transparent boxes indicate the lowest MAD, MAPE, and MD for each age class forecast. Shaded boxes indicate forecasts that were selected to be part of the total run forecast for each age class. See Table 2 for a description of each model.

Model	Forecast 2020	MAD[a]	5-year MAPE[a]	MD[b]
Age-5				
Mean	10,491	4,122	63%	2,268
5-year mean	8,466	3,715	43%	-1,361
Median	9,530	3,596	52%	1,112
Forecast estimate	**9,530**			
Age-6				
Mean	30,455	19,858	173%	19,858
5-year mean	12,488	2,206	21%	15
Median	29,269	17,704	156%	17,704
Mean sibling	14,020	14,363	127%	14,284
5-year mean sibling	8,318	7,719	66%	5,233
Median sibling	12,835	11,952	105%	11,059
Most recent sibling	6,019	6,563	53%	3,366
Forecast estimate	**12,488**			
Age-7				
Mean	2,290	1,773	390%	1,773
5-year mean	689	348	81%	156
Median	1,724	1,158	267%	1,158
Mean sibling	540	487	107%	209
5-year mean sibling	481	513	109%	196
Median sibling	469	456	92%	92
Most recent sibling	187	758	128%	208
Forecast estimate	**689**			
TOTAL RUN FORECAST	**22,707**			

[a]mean absolute deviation

[b]mean absolute percent error

[c]mean deviation

Distribution:
Headquarters: Rutz, Rabung, Bowers, Taube.
Anchorage: McKinley, M. Miller, Hasbrouck, Vania, Erickson, Howard, J. Miller, Dye, Blaine-Roth, Baumer, Lewis, Templin, Munro.
Palmer: Decovich, Ivey, Oslund.
Homer: Booz, Dickson.
Soldotna: Lipka, Gates, Eskelin, Wood, Key, Waldo, Massengill, Marston, Frothingham, Reimer, Shields, Decino.

Ask Hasbrook or Miller about creating goals around MSR

- what are the results to allocation?
- What are the impacts on future yield?

Set Net Discussion

OEG: 15,000 – 30,000	In River	Set Net
OEG projected to be achieved	Follow king plan	Follow sockeye plans
Paired restrictions to assure OEG is achieved	All sizes, no Bait	No more than 48 hours, Dept shall by EO implement use of shallow gear as presently in regulation, 600' from shore is exempt from hours
	Retention of >36", no bait	No more than 36 hours, Dept shall by EO implement use of shallow gear as presently in regulation, 600' from shore is exempt from hours
	No retention, no bait	No more than 24 hours per week, Dept shall by EO implement use of shallow gear as presently in regulation, 600 ' from shore is exempt from hours
Below OEG	Closed	Closed

- If any fishery starts at low abundance restrictions, all fisheries starts with low abundance restrictions.
- Applies to Kasilof beaches effective June 25
- If low abundance paired restrictions are in force at July 31, paired restrictions continue until the end of the commercial fishing season or until such time as both the king OEG is achieved and the upper bound of the inriver sockeye goal is exceeded.