



## Advisory Announcement

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### 2023 Upper Cook Inlet Sockeye Salmon Forecast

The Upper Cook Inlet sockeye salmon total run forecast of **5.12 million fish** (Table 1) is predicted to be **average**. The categorical ranges of sockeye salmon total run strength were developed from the 20<sup>th</sup>, 40<sup>th</sup>, 60<sup>th</sup>, and 80<sup>th</sup> percentiles of historical runs (Table 2). Fisheries salmon forecasts are inherently uncertain and are primarily used to gauge the general magnitude of expected runs and guide early-season management strategies.

Table 1.—Forecast of the 2023 Upper Cook Inlet sockeye salmon run, escapement, and harvest.

	Forecast Estimate (millions)	Forecast Range (millions)
<b>TOTAL PRODUCTION:</b>		
Total Run	5.12	3.70–6.54
Escapement	2.00	
Available Harvest	3.12	

Table 2.—Categorical ranges of Upper Cook Inlet sockeye salmon runs and this year’s forecast in bold.

Category	Range (million)	Percentile
Poor	Less than 2.0	Less than 20 <sup>th</sup>
Weak	2.0 to 4.0	20 <sup>th</sup> to 40 <sup>th</sup>
<b>Average</b>	<b>4.0 to 6.0</b>	<b>40<sup>th</sup> to 60<sup>th</sup></b>
Strong	6.0 to 8.0	60 <sup>th</sup> to 80 <sup>th</sup>
Excellent	Greater than 8.0	Greater than 80 <sup>th</sup>

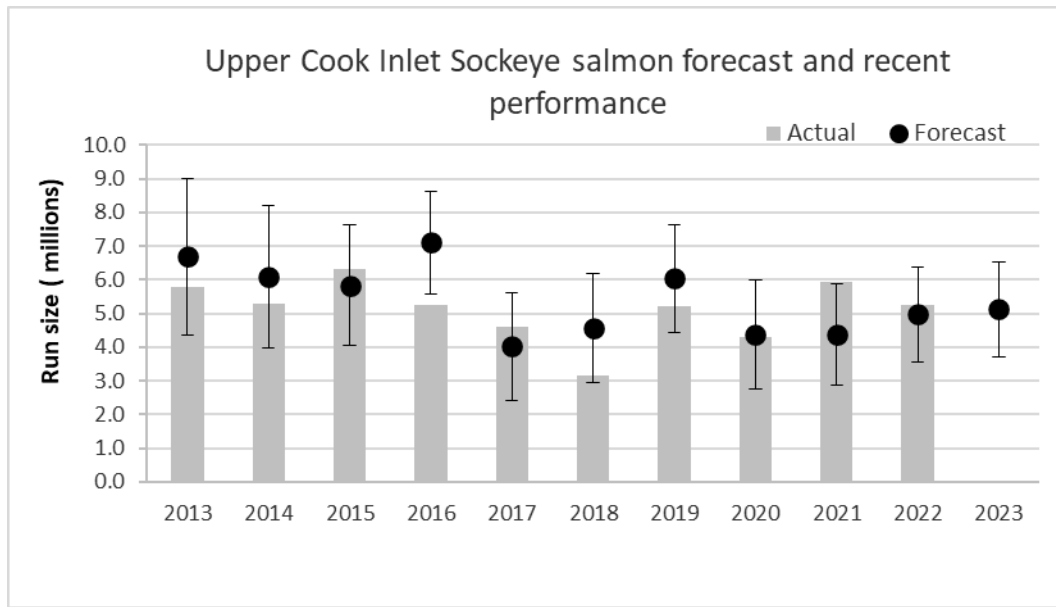


Figure 1.—Actual observed total run of sockeye salmon in Upper Cook Inlet compared to preseason total run forecasts, 2013–2022 and 2023 forecast. Error bars represent 80% confidence intervals of forecasts.

### Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet (UCI) are the Kenai, Kasilof, and Susitna Rivers, and Fish Creek. Available escapement (spawner abundance), return, sibling, fry, and smolt data were examined for Kenai and Kasilof River systems. Four model types were evaluated to forecast the total run of sockeye salmon to UCI in 2023: (1) brood-year spawners, (2) emigrating smolt, (3) fall fry, and (4) sibling returns. These forecast models were evaluated for the Kenai and Kasilof River age classes. Models that provided the smallest mean absolute percentage error (MAPE) between the forecasts and actual runs over the past 10 years were selected for the 2023 forecast (Table 3).

The 2023 sockeye salmon forecasts for Fish Creek and the Susitna River were estimated from recent 5-year averages.

The sockeye salmon forecast for unmonitored systems in UCI was estimated as 17% of the aggregate forecast for the four monitored stocks. Unmonitored stocks include Crescent River, Big River, McArthur River, Chilligan River, Coal Creek, Cottonwood Creek, Wasilla Creek, Eagle River, and many other smaller systems in the area. The fraction of the total run destined for unmonitored systems was calculated using genetic estimates of the stock composition of offshore test fishery harvests.

The estimated available harvest of sockeye salmon to all user groups was calculated by subtracting the aggregate escapement from the total run forecast for all stocks. Aggregate escapement was estimated as the sum of the midpoints of the escapement goal ranges for each of the monitored sockeye salmon-producing systems and the escapement into unmonitored systems.

## 2022 Run and Forecast

Overall, the 2022 UCI sockeye salmon run of 5.25 million was 0.28 million greater (6%) than the preseason forecast of 4.97 million fish. In 2022, the estimated total run was 2.56 million to the Kenai River; 1.68 million to the Kasilof River; 370,000 to the Susitna River; and 80,000 to Fish Creek. The 2022 run forecast was 2.90 million to the Kenai River; 941,000 to the Kasilof River; 310,000 to the Susitna River; and 89,000 to Fish Creek. In 2022, the commercial harvest of UCI sockeye salmon was 1.13 million fish.

## 2023 Forecast Discussion

In 2023, a run of approximately 5.12 million sockeye salmon is forecast to return to UCI with an estimate of 3.12 million available for harvest (commercial, sport, personal use, subsistence; Table 1). Based on the absolute percentage error (APE) for the recent 10-year (2013–2022) forecasted UCI runs compared with the estimated runs, there is an 80% probability that the 2023 UCI forecast range falls between 3.70 million and 6.54 million fish (Table 1). This UCI forecast is average compared to historical total run estimates from 1986 to present. The UCI preseason forecast has overestimated the total run by an average of 8% over the past 10 years with a range of -45% to 27% (Figure 1).

The Kenai River forecast of 2.82 million sockeye salmon is 765,000 less (21%) than the historical (1986–2022) average run of 3.59 million, but 300,000 less than the 5-year average of 3.12 million (Figure 2). The Kenai River preseason forecast has overestimated the total run by an average of 8% over the past 10 years with a range of -50% to 39%.

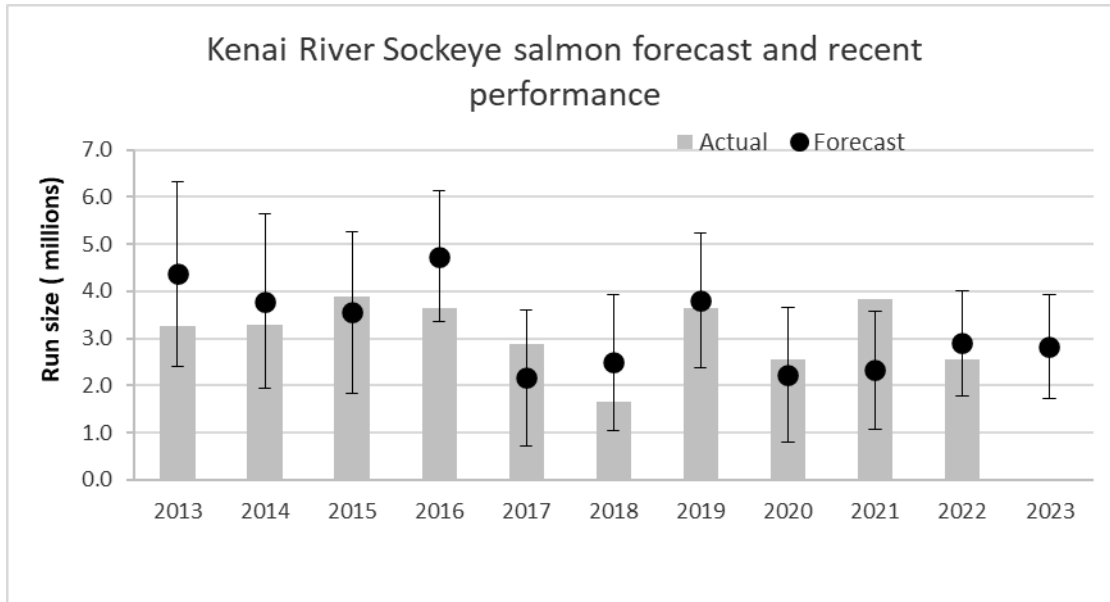


Figure 2.—Actual observed total run of Kenai River sockeye salmon compared to preseason total run forecasts, 2013–2022 and 2023 forecast. Error bars represent 80% confidence intervals of forecasts.

The Kasilof River sockeye salmon run forecast is approximately 1,126,000 fish. The Kasilof River preseason forecast has overestimated the total run by an average of 1% over the past 5 years with a range of -31% to 44%. The 2023 forecast is 180,000 greater (19%) than the historical (1986–2022) average but is 160,000 greater (17%) than the recent 10-year average.

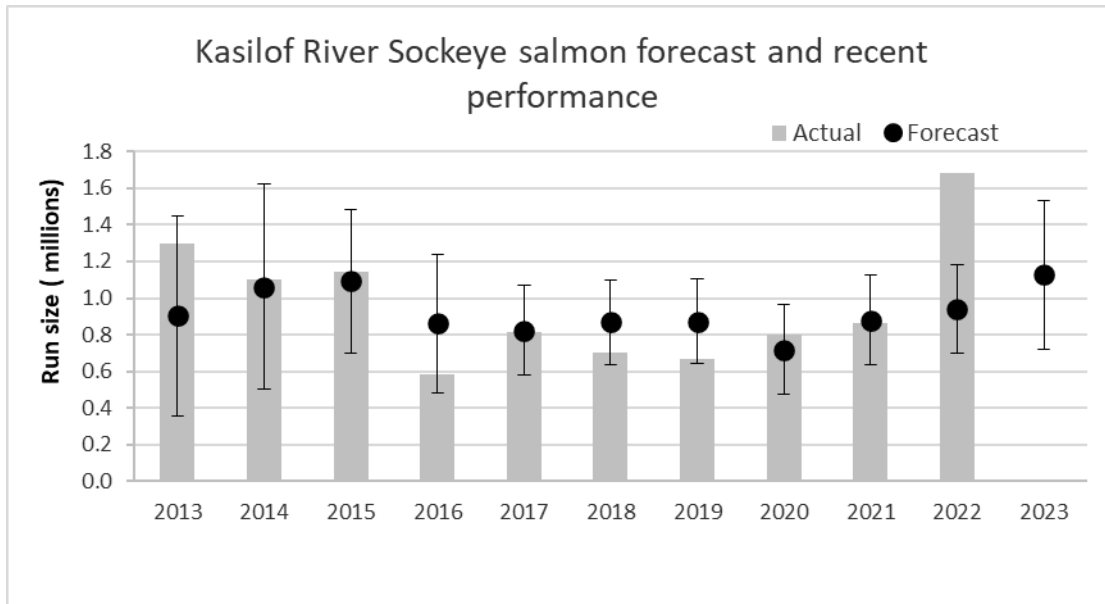


Figure 3.—Actual observed total run of Kasilof River sockeye salmon compared to preseason total run forecasts, 2013–2022 and 2023 forecast. Error bars represent 80% confidence intervals of forecasts.

The Susitna River sockeye salmon run 2023 forecast is 340,000 fish, which is the recent 5-year average run.

The Fish Creek sockeye salmon run forecast for 2023 is 90,000 fish. The 2023 forecast is the 5-year average run from 2016–2020. The years 2021 and 2022 were excluded from this analysis because the weir was not operated for the entire run.

Table 3.—2023 UCI forecast model, prediction, and 10-year MAPE. Boxes indicate values chosen for inclusion in the 2023 preseason forecast.

River	Age class	Model	Prediction	10-year MAPE
Kenai	1.2	Log R vs Log S	428,846	0.452
		Standard Ricker	377,781	0.440
		Exponential smoothing	415,776	0.496
		Moving average	411,677	0.452
	1.3	Log R = Log Fry CFSWT	1,338,224	0.311
		Log Sibling	2,653,114	0.310
		Exponential smoothing	2,026,445	0.466
		Moving average	1,960,312	0.414
	2.2	Log R vs Log S	194,921	0.761
		Log Sibling	268,679	0.685
		Log Sibling AR1	210,832	0.569
		Exponential smoothing	129,924	0.912
		Moving average	155,041	0.959
	2.3	Log Fry AR1	485,315	2.437
		Log Sibling	236,888	0.863
		Sibling	353,636	1.312
		Exponential smoothing	476,913	3.193
		Moving average	542,950	3.575
	ALL	2023 Forecast	2,821,170	
	Kasilof	1.2	Log R vs Log S	316,692
Log R vs Log S AR1			568,142	0.387
Log Sibling			245,443	0.400
Exponential smoothing			854,237	0.388
Moving average			752,663	0.449
1.3		Log Sibling	562,376	0.580
		Log R vs Log Smolt	300,197	0.625
		Exponential smoothing	235,027	0.599
		Moving average	208,402	0.591
2.2		Log R vs Log S	250,346	1.025
		Log R vs Log S AR1	256,877	0.637
		Sibling AR1	129,100	0.534
		Log Sibling	177,225	0.435
		Log Sibling AR1	166,305	0.527
		Exponential smoothing	163,140	0.582
2.3		Moving average	147,991	0.587
		Sibling	85,837	5.367
		Sibling AR1	66,673	5.367
		Log Sibling	19,602	4.703
		Log Sibling vs Log Smolt	70,170	2.195
	Exponential smoothing	17,465	4.057	
Moving average	15,068	4.086		
ALL	2023 Forecast	1,126,462		

\*—average (1,995,669) of models was used to forecast age-1.3 Kenai River sockeye salmon.

## OTHER SALMON SPECIES

Table 4.—Forecast of the 2023 Upper Cook Inlet commercial harvest of other salmon species is as follows:

	Commercial harvest forecasts
Pink salmon	83,000
Chum salmon	89,000
Coho salmon	157,000

### Forecast Methods

The recent 5-year average commercial harvest was used to forecast the commercial harvest of chum and coho salmon in 2023. The forecast for pink salmon is based upon the average harvest during the previous 5 odd-numbered years.

### Forecast Discussion

The recent 5-year average commercial harvest was used to develop the 2023 the forecast, because harvests in these years likely best represent harvests under current regulations.

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