Advisory Announcement
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2025 Upper Cook Inlet Sockeye Salmon Forecast

The Upper Cook Inlet sockeye salmon total run forecast of **6.93 million fish** (Table 1) is predicted to be **excellent**. The categorical ranges of sockeye salmon total run strength were developed from the 20th, 40th, 60th, and 80th percentiles of historical runs (Table 2). Forecasts of salmon fisheries 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 2025 Upper Cook Inlet sockeye salmon run, escapement, and harvest in millions of fish. Forecast range is indicated in parenthesis.

Production component	Forecast estimate
Total run	6.93 (5.41 – 8.45)
Escapement	2.00
Available harvest	4.93

Table 2. – Categorical ranges of Upper Cook Inlet sockeye salmon runs 1986 to 2024 and the 2025 forecast in bold.

Category	Range (million)	Percentile
Poor	Less than 4.2	Less than 20th
Weak	4.2 to 5.2	20th to 40th
Average	5.2 to 5.9	40th to 60th
Strong	5.9 to 6.5	60th to 80th
Excellent	**Greater than 6.5**	**Greater than 80th**

Forecast Methods

The major sockeye salmon systems in Upper Cook Inlet (UCI) are the Kenai, Kasilof, and Susitna Rivers, and Fish Creek. Five model types were evaluated to forecast the total run of sockeye salmon to the Kenai and Kasilof Rivers in 2025: (1) brood-year spawners, (2) emigrating smolt, (3) fall fry, (4) sibling returns and (5) average returns (Table 3). Forecast model performance was assessed using the mean arctangent absolute percent error (MAAPE) between the forecasts and actual runs over the past 10 years (2015–2024; Table 4). The top three models with the lowest

MAAPE and statistically significant parameters were selected for each age class and a weighted hybrid model approach was applied (Table 3). Model weights were assigned based on the MAAPE of each selected model, with a lower MAAPE receiving a greater weight towards the forecast estimate. Weighted forecast estimates were summed across age classes for stock specific run estimates.

For Susitna River sockeye salmon, returns of age-0.3, -1.2, -1.3, -2.2 and -2.3 fish in 2025 were forecasted using mean return per spawner by age class spanning brood years 2006–2020. Spawners for brood years 2019-2021 were estimated by subtracting the projected commercial harvest, (average harvest rate of 42% from 2007−2015), from the forecasted total run.

The 2025 forecast for Fish Creek sockeye salmon was estimated using the recent 5-year (2020-2024) average of total runs to the system. Total run estimates for Fish Creek sockeye salmon in 2021 and 2022 are assumed to be biased low because weir operations were stopped early, and escapement estimates for these years were not expanded to account for unmonitored passage.

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, Packers Creek, 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 harvestable surplus of sockeye salmon 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.

Table 3. – Description of models used to forecast returns of sockeye salmon to the Kasilof and Kenai Rivers, 2025.

Model	Description
5-year moving average	Unweighted average of the previous 5-year's returns for the specified age class.
Exponential smoothing	An exponential function used to assign exponentially decreasing weights over time for the specified age class.
Standard Ricker	Regression between the ratio of recruits of the specified age class and spawners from the same brood year and the number of spawners from the same brood year.
Sibling	Regression between the returns of a specified age class and the most recent returns from the same brood year.
Fry	Regression between the returns of a specified age class and the aggregate total abundance of sockeye salmon fry in Kenai and Skilak Lakes from the same brood year.
Fry CFSWT	Regression between the returns of a specified age class and the aggregate total abundance of age-0 sockeye salmon fry and their average total weight in Kenai and Skilak Lakes from the same brood year.
S AR1	Autoregressive integrated moving average (ARIMA) analysis on the returns of the specified age class with a covariate for the abundance of spawners from the same brood year.
Smolt	Regression between the returns of a specified age class and the abundance of smolt from the same brood year.
Smolt AR1	Autoregressive integrated moving average (ARIMA) analysis on the returns of the specified age class with a covariate for the abundance of smolt from the same brood year.

Note: Log transformation may be needed to meet assumptions of a linear regression.

2024 Run and Forecast Performance

Overall, the 2024 UCI sockeye salmon run of 6.64 million was 1.5 million greater (26%) than the forecast of 5.12 million fish. In 2024, the estimated total run was 3.93 million to the Kenai River; 1.47 million to the Kasilof River; 303,000 to the Susitna River; and 85,590 to Fish Creek. Escapement of Susitna River sockeye salmon in 2024 was estimated by subtracting the projected commercial harvest (average harvest rate of 42% from 2007−2015) from the 2024 run forecast of 303,400 fish. The 2024 run forecast was 3.38 million to the Kenai River; 1.11 million to the Kasilof River; and 87,000 to Fish Creek. In 2024, the commercial harvest of UCI sockeye salmon was 1.87 million fish.

2025 Forecast Results and Discussion

In 2025, a run of approximately 6.93 million sockeye salmon is forecast to return to UCI with an estimate of 4.93 million available for harvest (Table 1). Based on the absolute percentage error (APE) for the recent 10-year (2015–2024) forecasted UCI runs compared with the estimated runs, there is an 80% probability that the 2025 UCI forecast range falls between 5.41 million and 8.45 million fish (Table 1). This UCI forecast is excellent compared to historical total run estimates from 1986 to present (Table 2). Forecast error for UCI has ranged from 27% below forecast to 45% above forecast over the last ten years with a mean absolute percent error (MAPE) of 18% (Figure 1).

The Kenai River sockeye salmon forecast is approximately 4.19 million fish (Table 4). The 2025 Kenai River forecast is 302,400 (7.5%) fish more than the historical (1986–2024) average run of 3.88 million and 968,000 (26%) fish more than the recent 10-year (2015–2024) average run of 3.22 million (Figure 1). Forecast error for the Kenai River has ranged from 42% below forecast to 59% above forecast over the last ten years with a MAPE of 21% (Figure 1).

The Kasilof River sockeye salmon run forecast is approximately 1.24 million fish (Table 4). Over the past 10 years, the Kasilof River forecast has experienced a MAPE of 25%, with errors ranging from 35% under forecast to 79% over forecast. The 2025 forecast is 311,000 fish (28%) greater than the historical (1986–2024) average run of 930,000 fish and 261,000 fish (23.5%) greater than the recent 10-year (2015–2024) average run.

Approximately 404,800 and 105,000 sockeye salmon are forecast to return to the Susitna River and Fish Creek respectively in 2025. The 2025 Susitna River sockeye salmon forecast is approximately 22,600 fish (6%) below the historical (2002–2024) average run of 430,000 fish but approximately 29,500 fish (7.5%) greater than the recent 10-year (2015–2024) average run of 380,000 fish. The 2025 Fish Creek sockeye salmon forecast is approximately 2,600 fish greater than the recent 10-year average run size (2.5%) of 102,400 fish.
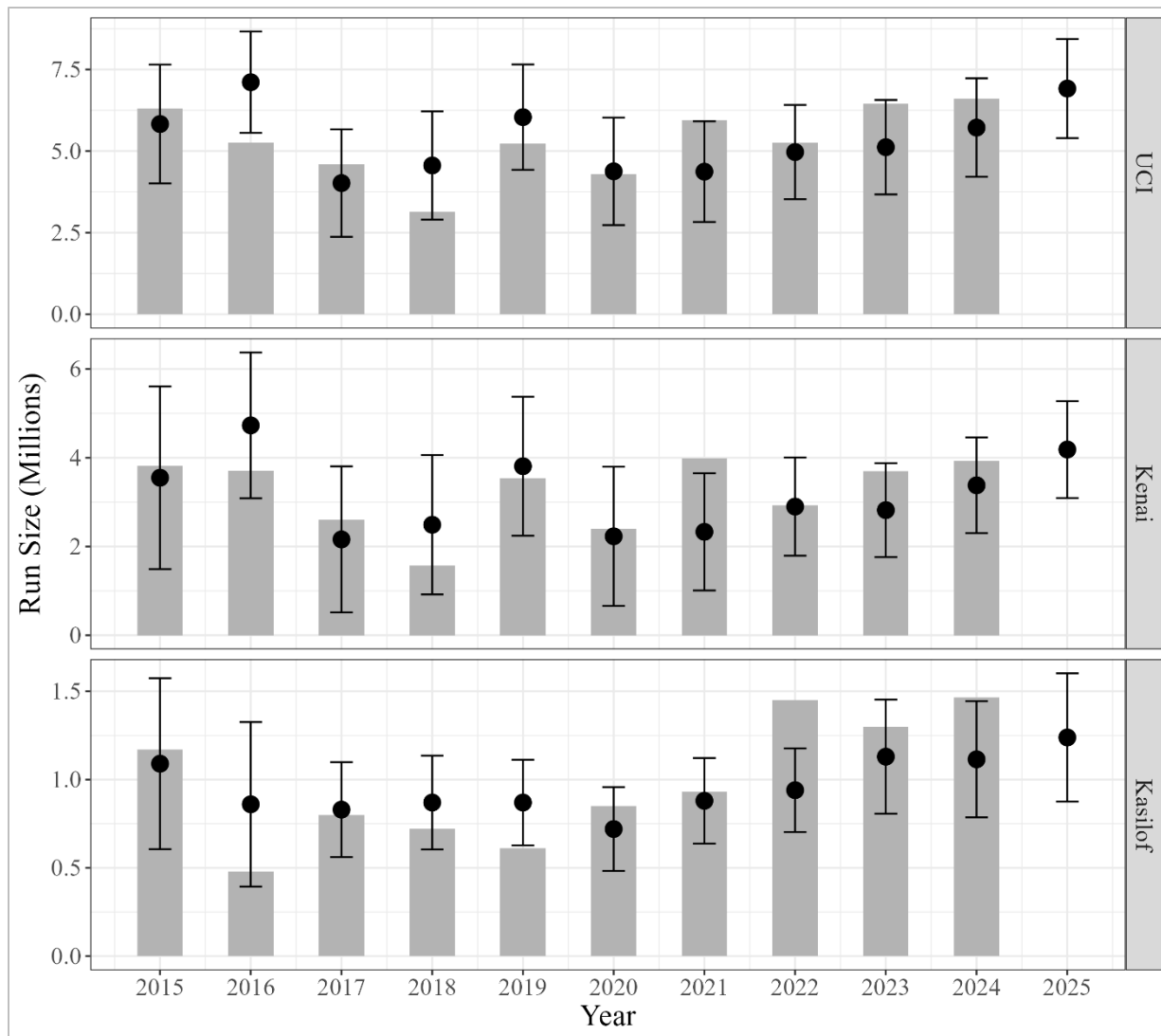
Figure 1. – Estimated total runs (grey bars) of Upper Cook Inlet (top panel), Kenai River (middle panel), and Kasilof River (bottom panel) sockeye salmon compared to total run forecasts (black points), 2015–2024 and 2025 forecast. Error bars represent 80% confidence intervals of forecasts.

Table 4. – Kenai and Kasilof River sockeye salmon forecast estimates, 2025.

River	Age Class	Model	MAAPE	Weight	Prediction	Weighted Prediction	Subtotal	Total
Kenai	1.2	5-Year Moving Average	47.41	0.36	728,136	260,604		
		Exponential Smoothing	51.40	0.33	666,229	219,927		
		Standard Ricker	54.39	0.31	409,512	127,762	608,294	
	1.3	Log Sibling	18.45	0.44	3,931,242	1,722,860		
		Log R vs Log Fry CFSWT	27.00	0.30	1,095,289	328,057		
		5-Year Moving Average	30.83	0.26	2,023,528	530,641	2,581,558	
	2.2	Log R vs Log S AR1	22.22	0.36	230,597	82,898		
		Log Sibling	23.46	0.34	161,843	55,100		
		Log Sibling AR1	26.62	0.30	181,407	54,432	192,430	
	2.3	Fry	41.10	0.38	1,383,688	523,161		
		Exponential Smoothing	44.60	0.35	525,733	183,173		
		5-Year Moving Average	56.81	0.27	358,288	97,990	804,324	**4,186,605**
Kasilof	1.2	Exponential Smoothing	35.30	0.37	670,532	244,791		
		5-Year Moving Average	39.96	0.32	611,557	197,188		
		Log R vs Log S AR1	41.23	0.31	358,933	112,165	554,144	
	1.3	Log Sibling	34.78	0.41	446,377	183,052		
		Exponential Smoothing	46.01	0.31	529,014	163,962		
		Log R vs Log Smolt	50.94	0.28	274,950	76,980	423,994	
	2.2	Log Sibling	31.88	0.40	216,259	86,106		
		Log R vs Log S AR1	41.30	0.31	252,996	77,755		
		Log Sibling AR1	43.10	0.29	179,085	52,740	216,602	
	2.3	Log R vs Log Smolt AR1	55.41	0.34	53,448	18,088		
		Sibling	55.67	0.34	58,652	19,757		
		Exponential Smoothing	57.75	0.32	19,052	6,187	44,032	**1,238,771**

OTHER SALMON SPECIES

Table 5. – Recent average commercial harvest for other salmon species in Upper Cook Inlet, 2025.

Species	5-year average
pink salmon	86,800
chum salmon	79,800
coho salmon	99,600

Recent Harvest Discussion

Due to the lack of information, the department does not formally forecast these species. The recent 5-year average commercial harvests are presented for chum and coho salmon (Table 5). Pink salmon commercial harvest average is based upon the previous 5 odd-numbered years (Table 5). Harvests in these years represent current management strategies. In 2025, harvest opportunities will be based on inseason information.

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