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Advisory Announcement

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2020 Upper Cook Inlet Sockeye Salmon Forecast

The forecasts of the 2020 Upper Cook Inlet sockeye salmon run and harvests are as follows:

	Forecast Estimate (millions)	Forecast Range (millions)
TOTAL PRODUCTION:		
Total Run	4.3	3.4–5.2
Escapement	2.0	
Harvest	2.3	

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 each system. Four models were evaluated to forecast the total run of sockeye salmon to UCI in 2020: (1) the relationship between adult returns and spawners, (2) the relationship between adult returns and fall fry, (3) the relationship between adult returns and emigrating smolt, and (4) the relationship between sibling returns. Several forecast models were evaluated for each stock and age class. Model that provided the smallest mean absolute percent error (MAPE) between the forecast and actual runs over the past 10 years were selected. Forecast model predictions were compared to evaluate uncertainty.

The return of age-1.3 Kenai River sockeye salmon in 2020 was forecasted using a fry model. The fry model prediction of the return of age-1.3 salmon is based on the abundance estimates of age-0 sockeye salmon fry that reared in Kenai and Skilak lakes in 2016. A spawner-recruit model was used to predict the age-1.2 salmon return based upon the spawning escapement in 2016. The Kenai River return of age-2.2 salmon was forecasted using a sibling model based upon the abundance of age-2.1 salmon that returned in 2019, and the return of age-2.3 salmon was forecasted using a sibling model based upon the abundance of age-2.2 salmon that returned in 2019.

The returns of age-1.2, -1.3, and -2.2, Kasilof River sockeye salmon in 2020 were all forecasted using sibling models based upon returns of age-1.1, -1.2, and -2.1 salmon in 2019. The return of age-2.3, Kasilof River sockeye salmon in 2020 were forecasted using smolt model of age-2 smolt emigrating in spring 2016.

The returns of age-0.3, -1.2, -1.3, -2.2 and -2.3 Susitna River sockeye salmon were forecasted using mean return per spawner by age class for brood years 2006–2015. Mark-recapture estimates of inriver run and genetic estimates of commercial harvest were available for these brood years.

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 estimated using genetic estimates of the stock composition of offshore test fishery harvests.

The total harvest by all user groups was estimated by subtracting the aggregate escapement from the total run forecast for all stocks. Aggregate escapement was estimated from 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, which was estimated as 17% of the escapement into monitored systems.

The 2020 total UCI run forecast range was calculated by multiplying the forecast by the MAPE of the actual UCI runs from published UCI run forecasts from 2010 through 2019.

2019 Run and Forecast

In 2019, the commercial harvest of sockeye salmon in UCI (1.7 million) was 1.3 million less than the preseason forecast of 3.0 million. In 2019, the estimated total run was 3.6 million to the Kenai River; 669,000 to the Kasilof River; 260,000 to the Susitna River; and 90,000 to Fish Creek. The 2019 run forecast was 3.8 million to the Kenai River; 873,000 to the Kasilof River; 343,000 to the Susitna River; and 124,000 to Fish Creek. Overall, the 2019 sockeye salmon run (5.2 million) was 13% below forecast (6.0 million), due to either over forecasting the 2-ocean fish (age-1.2 and -2.2) and one 3-ocean age class (age-2.3) or unfavorable ocean survival.

2020 Forecast Discussion

In 2020, a run of approximately 4.3 million sockeye salmon is forecasted to return to UCI with a commercial harvest of 1.7 million. The forecasted commercial harvest in 2020 is 1 million less than the 20-year average annual harvest.

The run forecast for the Kenai River is approximately 2.2 million sockeye salmon, which is 1.4 million less (38%) than the 20-year average run of 3.6 million. A fry model based upon the age-0 fry rearing in Kenai and Skilak lakes in 2016 (26.1 million; 19.3 million 20-year average) and the average weight of age-0 fall fry rearing in Skilak Lake (0.8 grams; 1.0 grams 20-year average) predicts a return of 1.4 million age-1.3 salmon in 2020. A sibling model from return of age-1.2 salmon in 2019 (248,000; 393,000 20-year average) also predicted a return of 1.4 million age-1.3 fish. The fry model was selected for this forecast because the 10-year MAPE was lower for the fry model (25%) compared to the sibling model (29%). A sibling model based upon the return of age-2.2 salmon in 2019 (91,000; 229,000 20-year average) predicted a return of 300,000 age-2.3 fish. A fry model based upon the abundance of age-1 fry rearing in Skilak and Kenai lakes in the fall of 2016 (1.4 million; 2.1 million 20-year average) predicted a return of 361,000 age-2.3 fish. The sibling model was selected for the forecast, because the 10-year MAPE was lower for the sibling model (98%) compared to the fry model (130%), but it should be noted that both methods have relatively high uncertainty compared to other age classes. The predominant age classes in

the 2020 run forecast are age 1.2 (17%), age 1.3 (63%) and age 2.3 (13%). The 10-year MAPE for the set of models used for the 2020 Kenai sockeye salmon run forecast is 19%.

The Kasilof River sockeye salmon run forecast is 723,000 fish, which is 248,000 less (26%) than the 20-year average of 971,000. A sibling model based upon the return of age-1.2 salmon in 2019 (321,000; 326,000 20-year average) was used to forecast a return of 297,000 age-1.3 salmon in 2020 with a corresponding MAPE of 58%. A sibling model based upon the return of age-1.1 salmon in 2019 was selected to forecast a return of 213,000 age-1.2 salmon in 2020. A spawner-recruit model based upon spawner abundance in 2016 forecasted a return of 220,000 age-1.2 salmon. The sibling model was selected for this forecast, because the 10-year MAPE was lower for the sibling (38%) than the spawner-recruit model (46%). A sibling model based upon the return of age-2.1 salmon in 2019 was used to forecast a return of 188,000 age-2.2 salmon in 2020. A spawner-recruit model forecast for age-2.2 salmon was 155,000. The sibling model was selected for this forecast, because the 10-year MAPE was lower for the sibling model (24%) compared to the spawner-recruit model (37%). The predominant age classes in the 2020 run forecast are age 1.2 (29%), age 1.3 (41%), and age 2.2 (26%). The 10-year MAPE for the set of models used for the 2020 Kasilof sockeye salmon run forecast is 21%.

The Susitna River sockeye salmon run forecast is 571,000 fish, which is 223,000 greater (49%) than the 10-year average of 384,000. This forecast was derived using mean return per spawner by age class and mark–recapture estimates of spawner abundance for brood years 2006–2014. Sonar estimates of spawner abundance were not used, because mark–recapture studies have shown that the Yentna sonar project underestimated sockeye salmon escapement causing estimates of adult returns to also be underestimated. The 5-year MAPE for this forecast method is 23%. The predominant age classes in the 2020 Susitna sockeye salmon run forecast are age 1.2 (25%) and age 1.3 (54%).

The Fish Creek sockeye salmon run forecast is 121,000 fish, which is 35,000 greater (42%) than the 20-year average run of 86,000. A sibling model based upon the return of age-1.1 salmon in 2019 (4,000; 3,000 20-year average) was used to forecast a return of 72,000 age-1.2 salmon. A spawner-recruit model forecasted a return of 69,000 age-1.2 salmon. The sibling model was used for this forecast, because the 10-year MAPE was lower for the sibling (65%) than the spawner-recruit model (104%). Sibling models were also used to forecast the returns of age-1.3, -2.2 and -2.3 salmon. The predominant age classes in the 2020 Fish Creek run forecast are age 1.2 (58%) and age 1.3 (22%). The 10-year MAPE for the Fish Creek sockeye salmon run forecast is 70%.

Table 1.—Sockeye salmon run forecasts, 20-year average runs and escapement goals (in thousands of fish) to individual freshwater systems in Upper Cook Inlet:

		Major age classes				Total	Escapement
System		1.2	1.3	2.2	2.3	run[a]	goals[b]
Kenai River	**Forecast**	**369**	**1,403**	**114**	**300**	**2,231**	**900 – 1,100[c]**
	20-yr average	393	2,133	229	750	3,578	
Kasilof River	**Forecast**	**213**	**297**	**188**	**10**	**723**	**160 – 340**
	20-yr average	326	305	244	76	971	
Susitna River	**Forecast**	**141**	**308**	**45**	**22**	**571**	**Lakes Goals[d]**
	20-yr average	106	181	24	36	384	
Fish Creek	**Forecast**	**72**	**27**	**9**	**1**	**121**	**15 – 45**
	20-yr average	50	19	6	2	86	
Unmonitored	**Forecast**	**136**	**348**	**61**	**57**	**624**	**No Goal**
	20-yr average	149	451	86	148	858	
Total Run	**Forecast**	**931**	**2,383**	**417**	**389**	**4,270**	
	20-yr average	1,024	3,089	589	1,012	5,877	

Note: BEG = Biological Escapement Goal, SEG = Sustainable Escapement Goal.

[a] Total run includes all age classes.

[b] Goals listed here are as follows, Kenai River: Inriver; Kasilof River: BEG; Susitna River: SEG (weir goals); and Fish Creek: SEG.

[c] This is the inriver sockeye salmon goal for runs less than 2.3 million measured using sonar at river mile 19 on the Kenai River.

[d] Susitna sockeye salmon are managed to achieve escapement goals at Larson, Chelatna and Judd lakes weirs. Current escapement goals for these lakes are: Larson (15,000–35,000), Chelatna (20,000–45,000) and Judd (15,000–40,000).

OTHER SALMON SPECIES

The forecast of the 2020 Upper Cook Inlet commercial harvest of other salmon species is as follows:

	Commercial harvest forecasts
Pink salmon	74,000
Chum salmon	175,000
Coho salmon	203,000
Chinook salmon	6,900

Forecast Methods

The recent 5-year average commercial harvest was used to forecast the harvest of chum, coho, and Chinook salmon in 2020. The forecast for pink salmon is based upon the average harvest during the previous 5 even-numbered years.

Forecast Discussion

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

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