

# Bristol Bay Sockeye Salmon

## UW-FRI

### Inseason Report #2

June 21, 2021

#### 1 Forecast Summary

The run size estimate from the inseason forecast model **does not** differ significantly from the preseason forecast (Table 1). This model weights the overall run size prediction based on the historical accuracy of the preseason forecast, and predictions based on standardized Port Moller test fishery catches and catch plus escapement through the current date.

Thus far in 2021, Port Moller test fishery indices are above what is expected for a run at the preseason forecast assuming average run-per-index (RPI) and travel time (TT); see (Figure 1, page 4). Early run timing, high catch efficiency, or a run size that is larger than the preseason forecast could all contribute to the observed pattern in test fishery catches. However, the pattern of daily Port Moller indices from June 17-20 indicate that the 2021 Bristol Bay run will arrive inshore earlier than 2018-2020.

At this point in the season, forecast weights are: 58% preseason forecast, 21% Port Moller catch per unit effort (CPUE), and 21% catch plus escapement. These weights indicate the preseason forecast has been the most reliable predictor of run size at this point in the season, in previous years.

Daily updates to many of the figures presented in this report are available as part of the UW-FRI online supplement:

<https://alaskasalmonprogram.org/bristol-bay-daily-updates/>

**Table 1: 2021 FRI in-season forecast (in thousands) summary.**

Forecast	Sockeye	Projected harvest
Preseason forecast	50,900	36,900
Weighted model	50,900	36,900

**Table 2: 2021 FRI pre-season sockeye salmon forecast (in thousands).**

DISTRICT	RIVER	AGES				TOTAL
		1.2	1.3	2.2	2.3	
Nak\Kvi		7,101	8,144	754	334	16,333
	Kvichak	2,768	2,223	307	61	5,359
	Naknek	2,864	3,920	426	214	7,424
	Alagnak	1,469	2,001	21	62	3,553
Egegik		6,224	2,317	1,994	1,098	11,633
Ugashik		4,117	1,704	293	90	6,204
Nushagak		6,784	8,672	93	36	15,661
	Wood	5,123	2,593	73	2	7,791
	Nushagak	1,144	5,048	10	20	6,298
	Igushik	517	1,031	10	14	1,572
Togiak		504	549	19	6	1,078
Totals		24,730	21,386	3,153	1,567	50,912

\*The Nushagak River total includes 76,000 0.3 and 1.4 age fish not included in the body of the table

## 2 Port Moller CPUE

The UW-FRI Port Moller index (stations 2-14) through June 20 is significantly ahead of what would be expected for a Bristol Bay sockeye run matching our preseason forecast of 50.9 million sockeye. This indicates either: (1) early run timing, and/or (2) catch efficiency at the Port Moller Test Fishery is higher than average. Patterns in catch and escapement will significantly increase over the next 7-9 days and allow us to better determine which of these alternatives is most likely.

Figure 1 (page 4) shows the 2021 daily UW-FRI Port Moller index (grey and black bars) compared with expected daily indices (red shaded region) for a run that is on track to meet the 2021 preseason forecast, in a year with average (1990-2020) run-per-index (RPI) and travel time (TT).

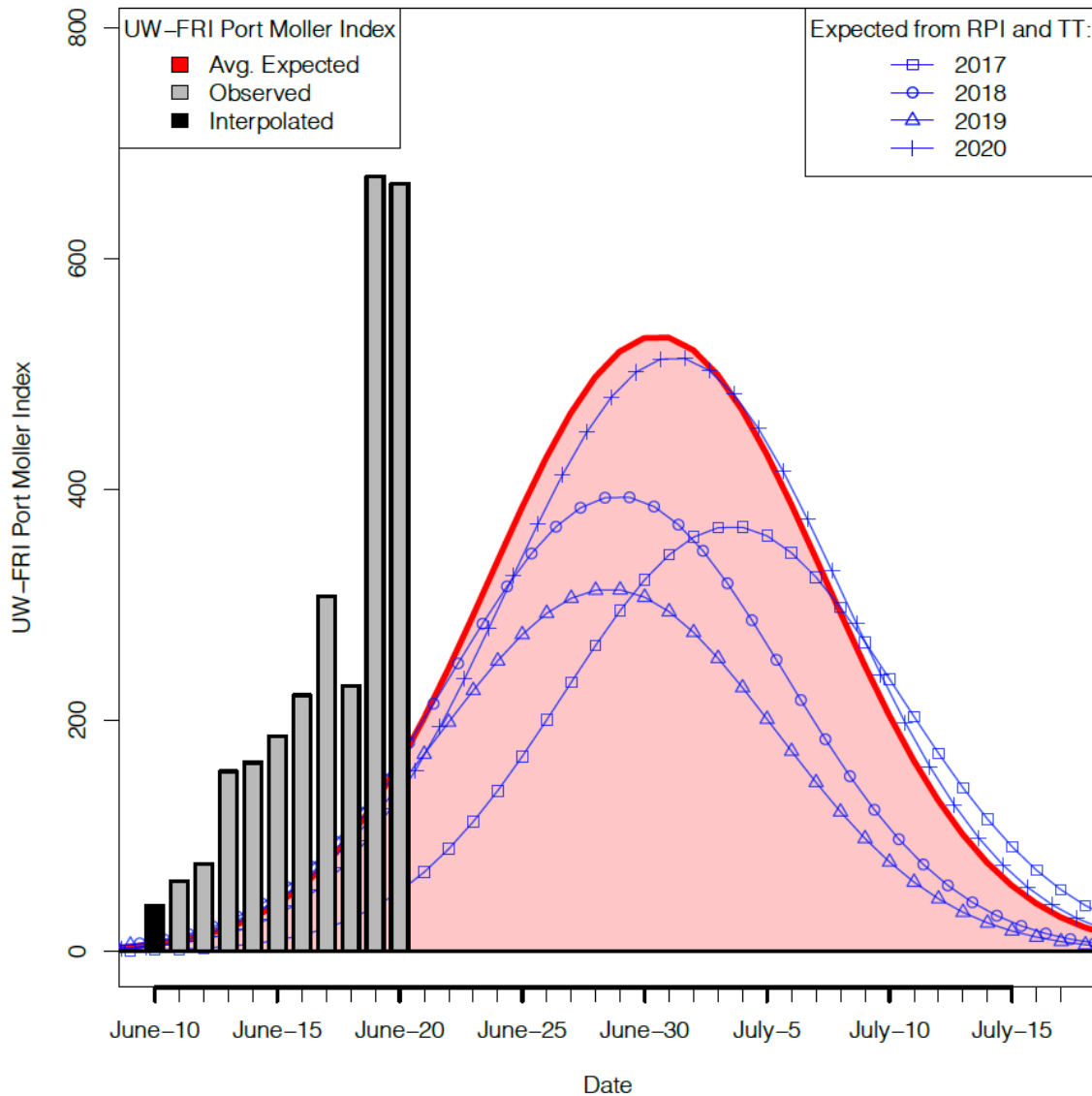
Run-per-index (RPI) is the number of fish that arrive inshore per fish caught in the Port Moller test fishery, and travel time (TT) is the number of days required for fish to travel between the Port Moller transect and fishing districts and counting towers. As examples, we have also included expected daily indices for a 2021 run equal to the preseason forecast but with the RPI and TT observed in years 2017-2020 (blue lines with symbols; Figure 1, page 4).

Expected daily Port Moller index values in Figure 1 (red shaded region) are generated by:

1. Calculating expected daily C+E for a 50.9 million fish run (preseason forecast) with *average* run timing and arrival distribution (i.e. run compression).
2. Scaling daily C+E predictions down to Port Moller index values by dividing by *average* RPI.
3. Lagging these values backward in time to when those fish should pass the Port Moller transect based on *average* travel time (TT).

The years 2017-2019 exhibited *higher* than average RPI, while 2020 had close to average RPI. This is why the expected index values (blue curves with symbols) for 2017-2019 are below the red curve describing the expected Port Moller index values. All of the curves shown in Figure 1 (page 4) represent the expected daily Port Moller indices for a run size equal to the 2021 preseason forecast with average inshore run timing, but have differing values for RPI and TT.

**Note:** The analysis described here continues to use the traditional UW-FRI test fishery transect (stations 2-14) to allow for comparison with prior years. Data from all fished stations is utilized for the overall inseason forecast estimate ('weighted model').



**Figure 1. Comparison of Expected & Observed Daily Port Moller Index:** 2021 observed and interpolated (gray and black bars) UW-FRI Port Moller Index is compared with expected daily index values (red line and shaded area) for a Bristol Bay run equal to the preseason forecast with average run timing, and exhibiting average Port Moller to inshore travel time (TT) and run-per-index (RPI). Expected daily index values for a run at the preseason forecast, with TT and RPI equal to those observed in 2017-2020 are plotted as blue lines and symbols.

## 4 Catch and Escapement

Run size predictions based on cumulative catch plus escapement (C+E) have poor accuracy this early in the season. This is largely due to inter-annual variation in run timing, differences in the start of escapement enumeration, and variation in early season fishing opportunity.

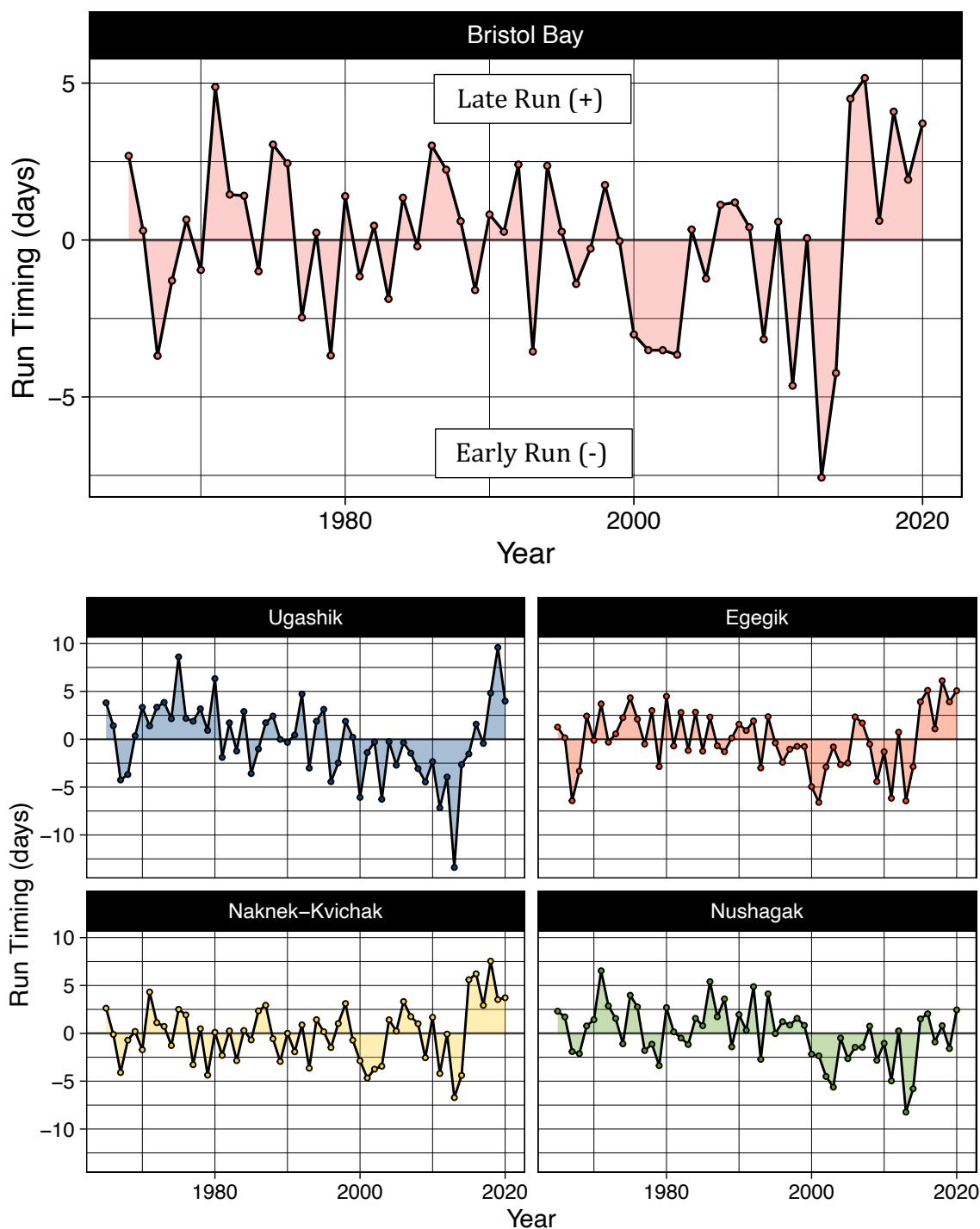
Figure 2 (page 6) shows the median inshore date (i.e. date at which 50% of each year's catch and escapement is observed) for each year 1965-2020, relative to the average (i.e. 0 on the vertical axis). From this we see:

1. Run timing for Bristol Bay as a whole exhibited some of the most extreme values on record in recent years: 7.6 days *early* in 2013 and 5.2 days *late* in 2016.
2. The 2020 run was *later* (+ 3.7 days) than the long-term average, and 5 out of the last 6 years (2015-2016, 2018-2020) have been *later* than the long-term average.
3. Late run timing for Bristol Bay as a whole in 2018-2020 primarily resulted from late inshore run timing to the Naknek-Kvichak, Egegik, and Ugashik districts.

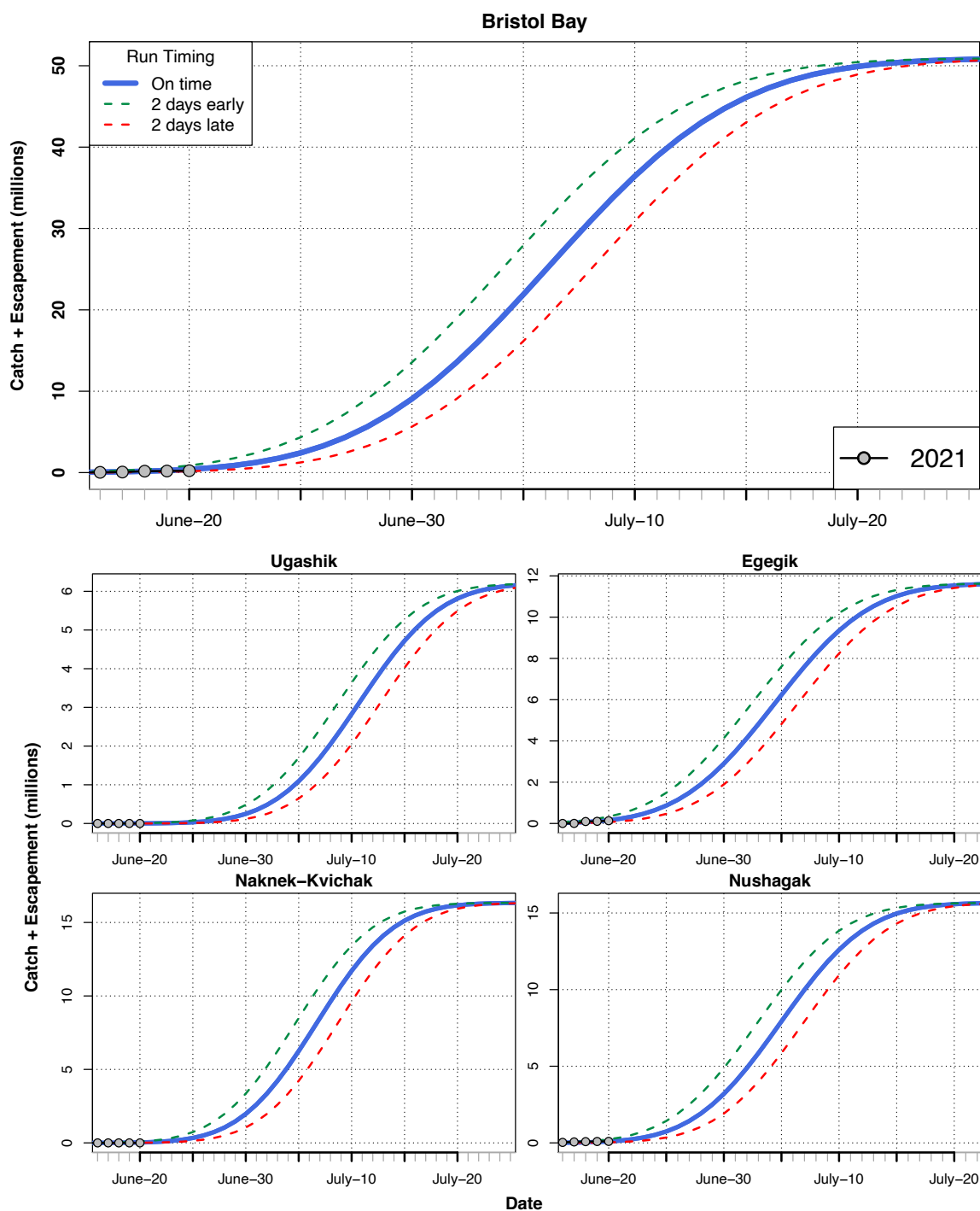
Figure 3 (page 7) displays a comparison of observed 2021 cumulative C+E (gray dots) with daily expectations given the preseason forecast and *average* arrival timing and run compression (blue line). In the coming days as more C+E data become available, we will be better able to assess whether the 2021 run is ahead, behind, or on track with expected inshore arrivals for a forecast of 50.9 million sockeye.

Figure 4 (page 8) displays daily catch and escapement compared with recent years (2017-2020). These figures indicate that very little C+E has been observed at this point in the season in recent years, or should be expected for a run size consistent with our preseason forecasts.

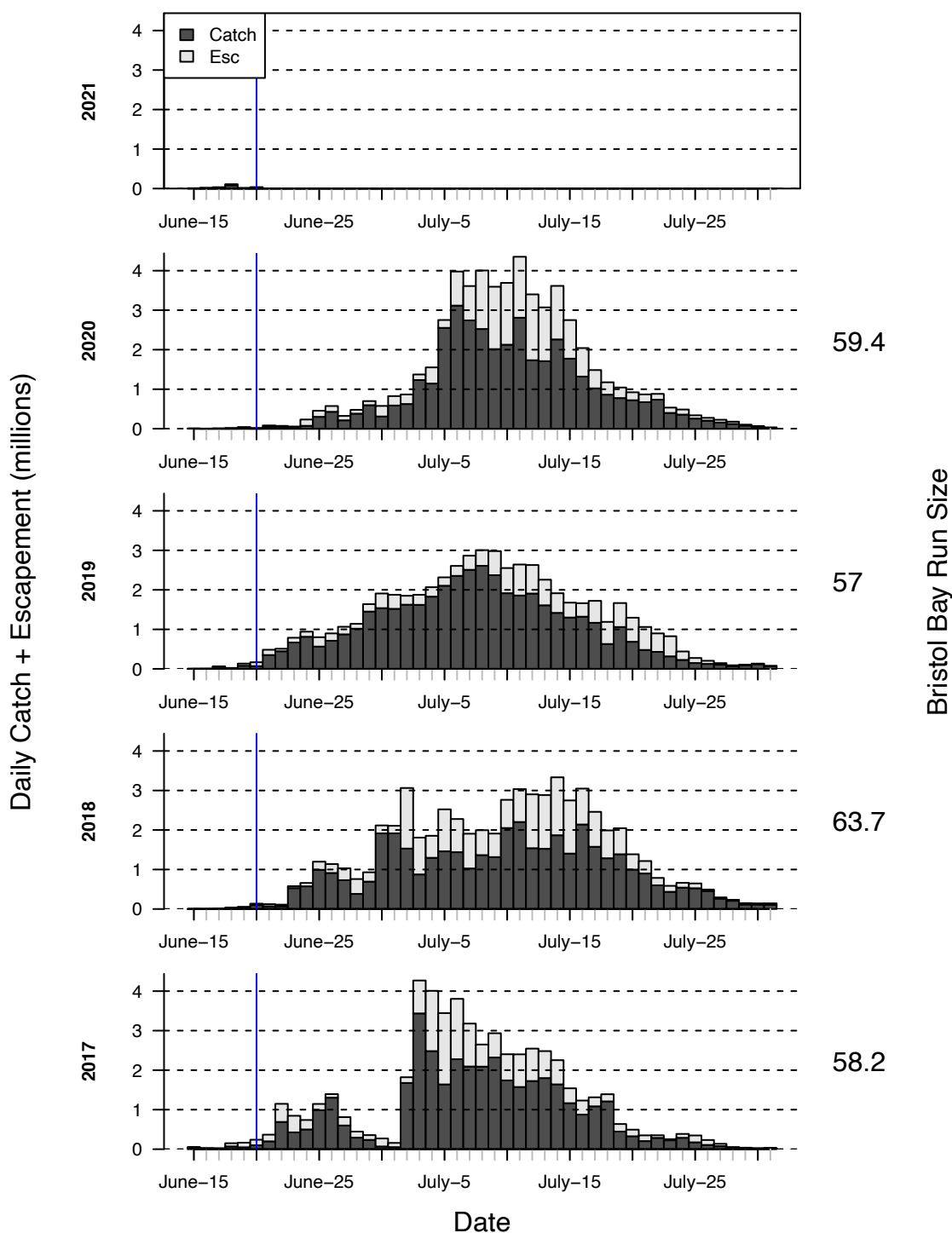
Both figures are updated daily as part of the UW-FRI online supplement:  
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**Figure 2. Historical Run Timing:** Annual differences in the median date for the inshore return (i.e. the date at which 50% of total catch and escapement is recorded), from the long-term average (1965-2020) in number of days. Negative values ( $< 0$ ) indicate years with early arrival timing, while positive values ( $> 0$ ) indicate late arrival timing, relative to the average.



**Figure 3. Cumulative C+E Comparison:** Comparison of daily cumulative C+E observed for Bristol Bay in 2021, and expected daily values (blue curve). Expected daily values are calculated relative to the 2021 preseason forecast and the average distribution of inshore arrivals (1980–2020). Connected gray dots show the 2021 observed daily cumulative C+E. Green dashed line represents expectations if the run is 2 days early, red dashed line if the run is 2 days late.



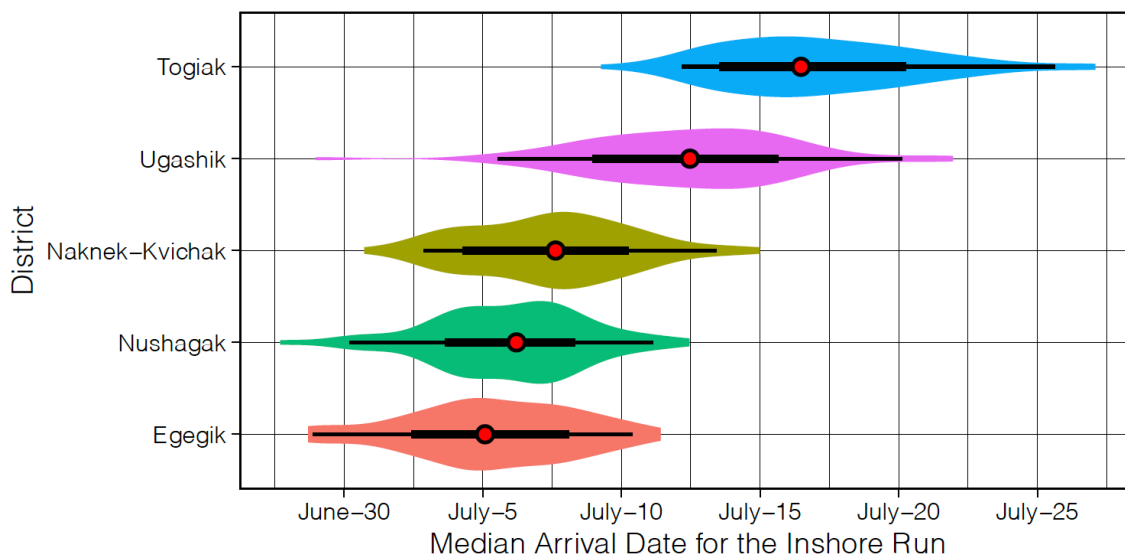
**Figure 4. Daily Catch and Escapement:** Observed catch and escapement for years 2017–2020 as stacked bars, compared with 2021 (top). Escapements are in light gray and catches in dark gray. The total Bristol Bay run size in millions of sockeye is listed on the right hand axis.



## 5 Port Moller Genetics

The first report on the genetic composition of sockeye passing the Port Moller test fishery transect was released by the Alaska Department of Fish and Game, Gene Conservation Laboratory, on June 19. Samples collected June 14-16 show the stocks that have historically exhibited the earliest inshore run timing (Nushagak, Egegik, and Wood) representing 87% of sockeye migrating past the test fishery transect.

We will provide a more detailed discussion of the inseason genetic data, and how predictions based on these data compare with preseason forecast proportions by district and observed catch and escapement by district, when the next set(s) of genetic stock composition estimates are available from the considerably larger indices June 17-20 .



**Figure 5. Median Return Date by District:** Caterpillar plots describe the distribution of median inshore return dates, across years by district. The median return date is the date on which 50% of the total annual catch + escapement is recorded in each district. The red dots display the median date of return for each district for the time series 1965-2020, the range of the thick lines encompass the centermost 50% median return dates, and the thin lines describe the centermost 95% of median return dates for each district across years. The shaded areas illustrate the distribution of median return dates across years for each district.

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## Acknowledgements

The Alaska Department of Fish and Game collects the catch, escapement, and age composition data integral to these analyses. The Bristol Bay Science and Research Institute (BBSRI) operates the Port Moller test fishery, data from which becomes a substantial part of the analysis included in UW-FRI inseason reports. The Alaska Department of Fish and Game Gene Conservation Laboratory analyzes genetic samples collected during the Port Moller test fishery. We thank both BBSRI and ADF&G for making these data available to us prior to and during the Bristol Bay season. We appreciate all of the hard work by individuals collecting data at counting towers, dockside, and on the test fishery boat.

## Appendices

**A1. GOA Sockeye Escapement:** 2015-2021 cumulative sockeye escapements to select Gulf of Alaska river systems.

