

# Bristol Bay Sockeye Salmon

## UW-FRI

### Inseason Report #1

*June 17, 2023*

#### 1 Introduction

In this first UW-FRI Inseason Report we provide an overview of the methods and data used to generate inseason run size forecasts, the structure of future reports, and links to the online resources we provide.

During the 2023 season, UW-FRI inseason forecast methods will use four primary sources of information to generate run size estimates:

- 1) The UW-FRI preseason forecast (50 million; Table 2, page 4),
- 2) Port Moller catch per unit effort (CPUE) and associated age and genetic composition information
- 3) Catch + escapement to date (C+E)
- 4) The size at age of incoming Bristol Bay sockeye (i.e. the smaller size at age is associated with larger run size)

Given the sensitivity of inseason predictions based on these data to variation in run timing, we also use the distribution of Port Moller catches across time to inform estimates of inshore run timing by fishing district, and update forecasts accordingly.

To generate inseason forecasts for Bristol Bay and district-specific run size we use a “Bayesian updating” model that: (1) weights forecasts based on past performance on a given date, and (2) updates those weights across the season as different types of data become more informative. This approach estimates the relative probability of different run sizes for 2023 conditional on current observations of salmon abundance, size and age composition, and timing, our “prior” prediction of run size (preseason forecast), and the uncertainty in predictions based on the different sources of information (past prediction

error). This method provides a better estimate of forecast uncertainty, and also allows us to ask probabilistic questions regarding predicted run size throughout the season, for example: “What is the probability, given the data, of a 2023 run size above/below 50 million sockeye?”.

In addition to our inseason forecast reports:

<https://alaskasalmonprogram.org/inseason-reports/>

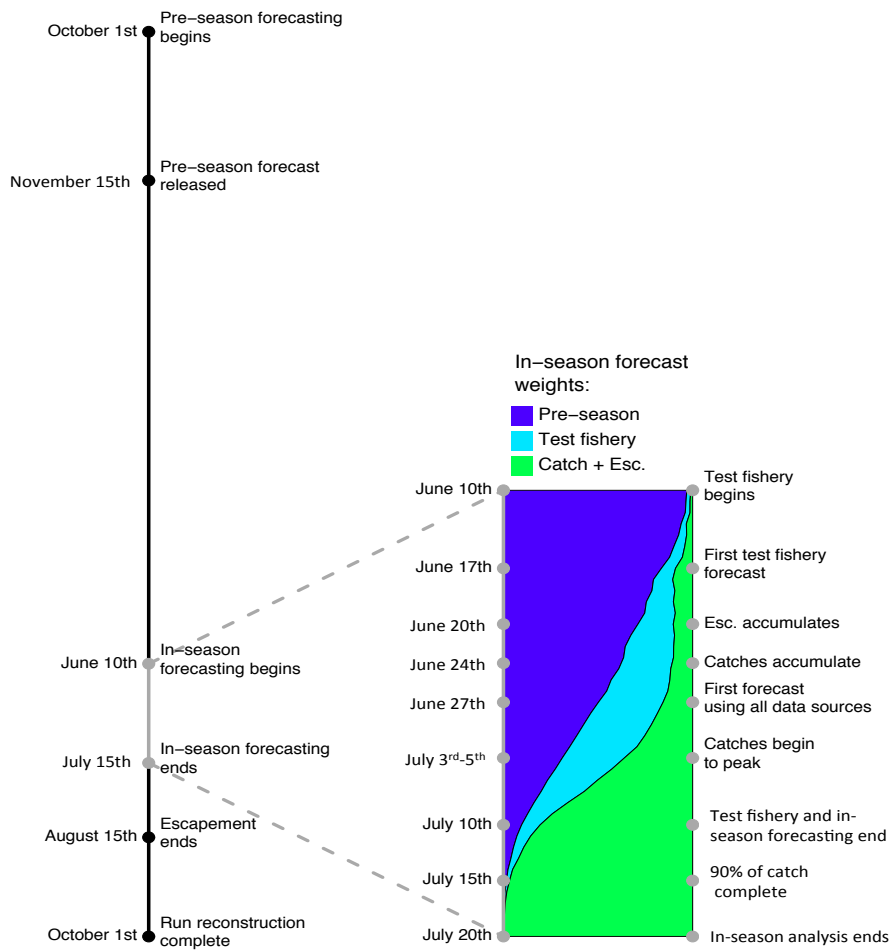
we will provide an online supplement with up-to-date versions of several standard graphs often included in our reports. This webpage displays C+E and Port Moller test fishery data, and is intended to track the daily progression of the 2023 season compared with the preseason forecast and recent years. The online supplement provides a quick reference on the progress of the Bristol Bay run compared to expectations and will be updated whenever new data become available, as opposed to the 4 to 6-day cycle for inseason reports. The online supplement is available at the following link (updated for 2023 when daily C+E are available):

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

Figure 1 (page 3) shows an **approximate** timeline of the UW-FRI forecasting process and accompanying data sources. The vertical line on the left of the figure is the entire year beginning with preseason forecasting in October, through run reconstruction at the end of September. The expansion of the inseason portion of the timeline generally illustrates how different inseason data types are weighted in our overall forecast methods, as they become available and more reliable across the season.

On any particular day, run size estimates based on a single type of data will differ from those based on other sources of information. In addition, the accuracy of forecasts based on Catch + Escapement and Port Moller test fishery data change (become more reliable) as the season progresses. The run size forecast generated from each data type contributes to our overall Bristol Bay forecast in proportion to how well it has performed historically, on the current date. The width of the shaded area for a particular forecast type in the expanded portion of the inseason forecasting timeline (Figure 1, page 3) indicates the relative reliability (i.e. past performance) of forecasts based on this type of data at a given point in the season, and the **approximate** weight it receives in the overall forecast.

For instance, at the beginning of the season the preseason forecast is the most reliable source of information, as indicated by the width of the dark blue area on June 10-20. This is due to the fact that the Port Moller test fishery has just started and there is very little or no catch and escapement information through that date. However, by the middle of the season, July 3-5, all three sources of information are equally reliable. Late in the season, when a large proportion of sockeye have returned, catch and escapement data are the best predictor of total run size.



**Figure 1. Data and forecasting time-line:** The area plot for the inseason forecasting portion of the year describes the relative weight given to each source of information in the overall weighted UW-FRI forecast.

## 2 Forecast summary

The *Forecast summary* section will include our inseason run size estimate and the preseason forecast for reference. Figure 2 (page 5) compares the 2023 preseason forecast with reconstructed Bristol Bay run sizes 1970-2022. After this first report the *Forecast summary* will become Section 1.

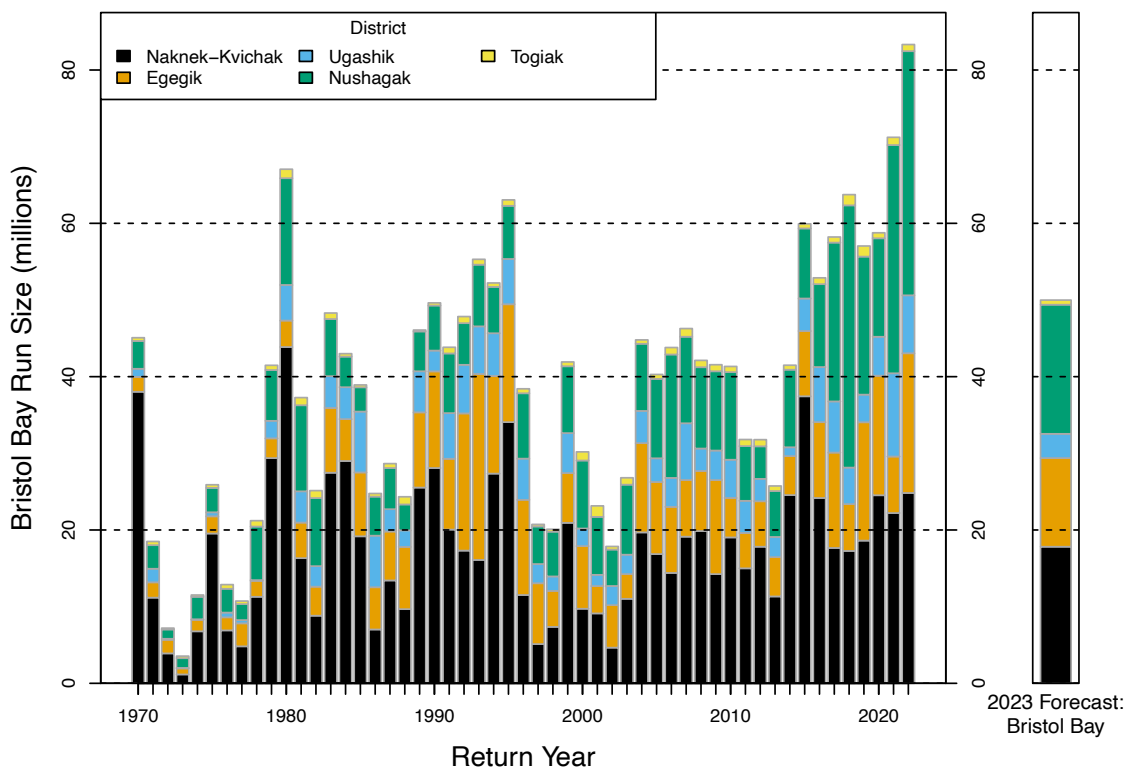
**Table 1: 2023 UW-FRI inseason forecast summary (in thousands).**

Forecast	Sockeye	Projected harvest
<b>Preseason forecast</b>	49,984	34,950
<b>Weighted model</b>	49,984	34,950

**Table 2: 2023 UW-FRI preseason sockeye salmon forecast (in thousands).**

DISTRICT	RIVER	AGES				TOTAL
		1.2	1.3	2.2	2.3	
Nak\Kvi		6,115	9,324	1,242	1,136	17,817
	Kvichak	1,901	5,497	566	498	8,462
	Naknek	2,686	2,249	559	423	5,917
	Alagnak	1,528	1,578	117	215	3,438
	Egegik	2,003	6,199	1,530	1,829	11,561
	Ugashik	1,181	1,302	403	282	3,168
	Nushagak	6,655	9,364	160	445	16,838
	Wood	5,244	2,703	80	279	8,306
	Nushagak	800	5,403	71	159	6,647
	Igushik	611	1,258	9	7	1,885
	Togiak	114	472	11	3	600
<b>Totals</b>		16,068	26,661	3,346	3,695	49,984

\*The Nushagak River total includes 214,128 0.3 and 1.4 age fish not included in the body of the table



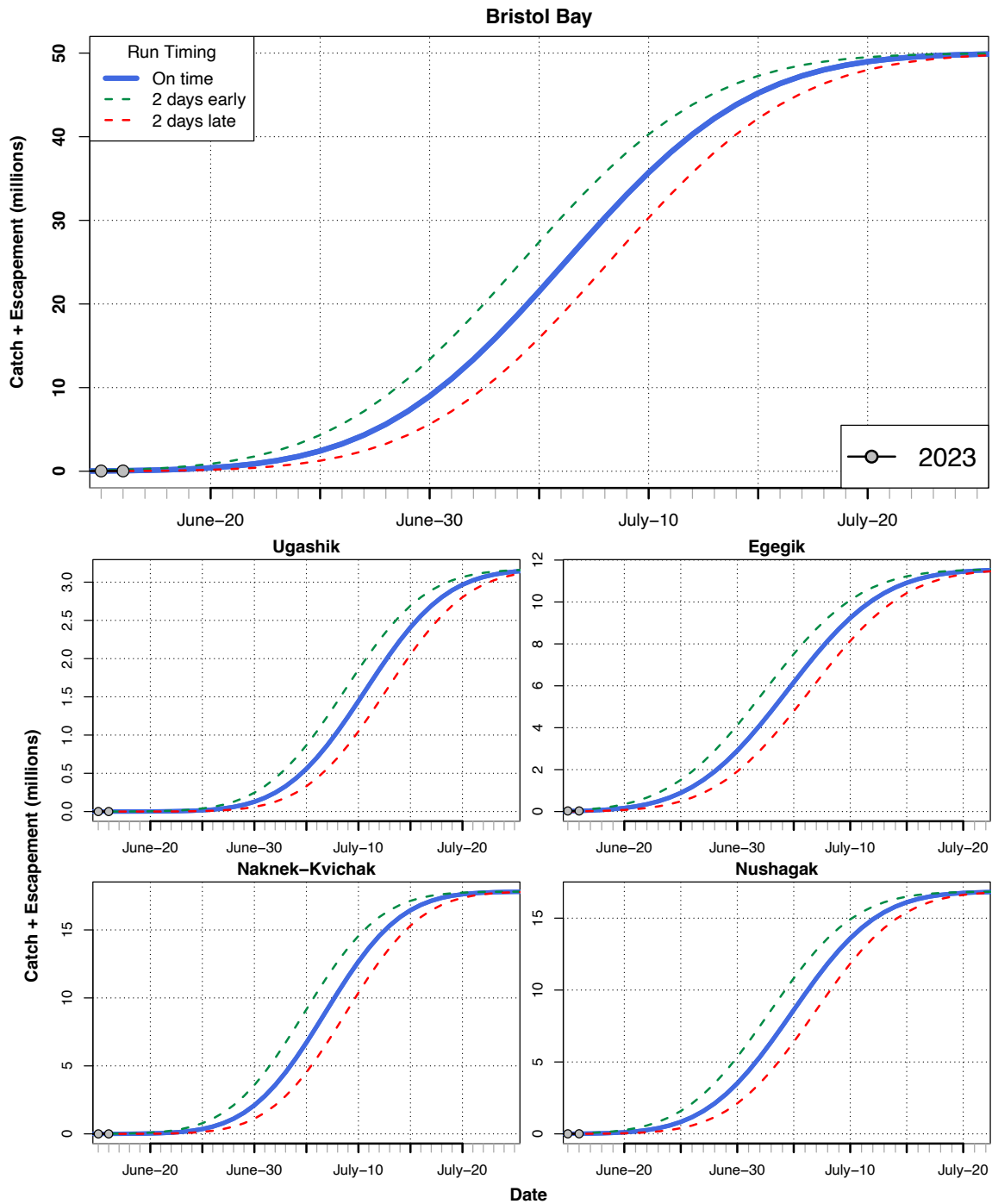
**Figure 2. 2023 Bristol Bay Preseason Forecast:** Comparison of the 2023 UW-FRI preseason forecast with run sizes 1970-2022.

### 3 Catch and escapement

The *Catch and escapement* section will include tables and figures that compare current catch and escapement (C+E) data with what is expected (preseason forecast) and C+E to date in previous years.

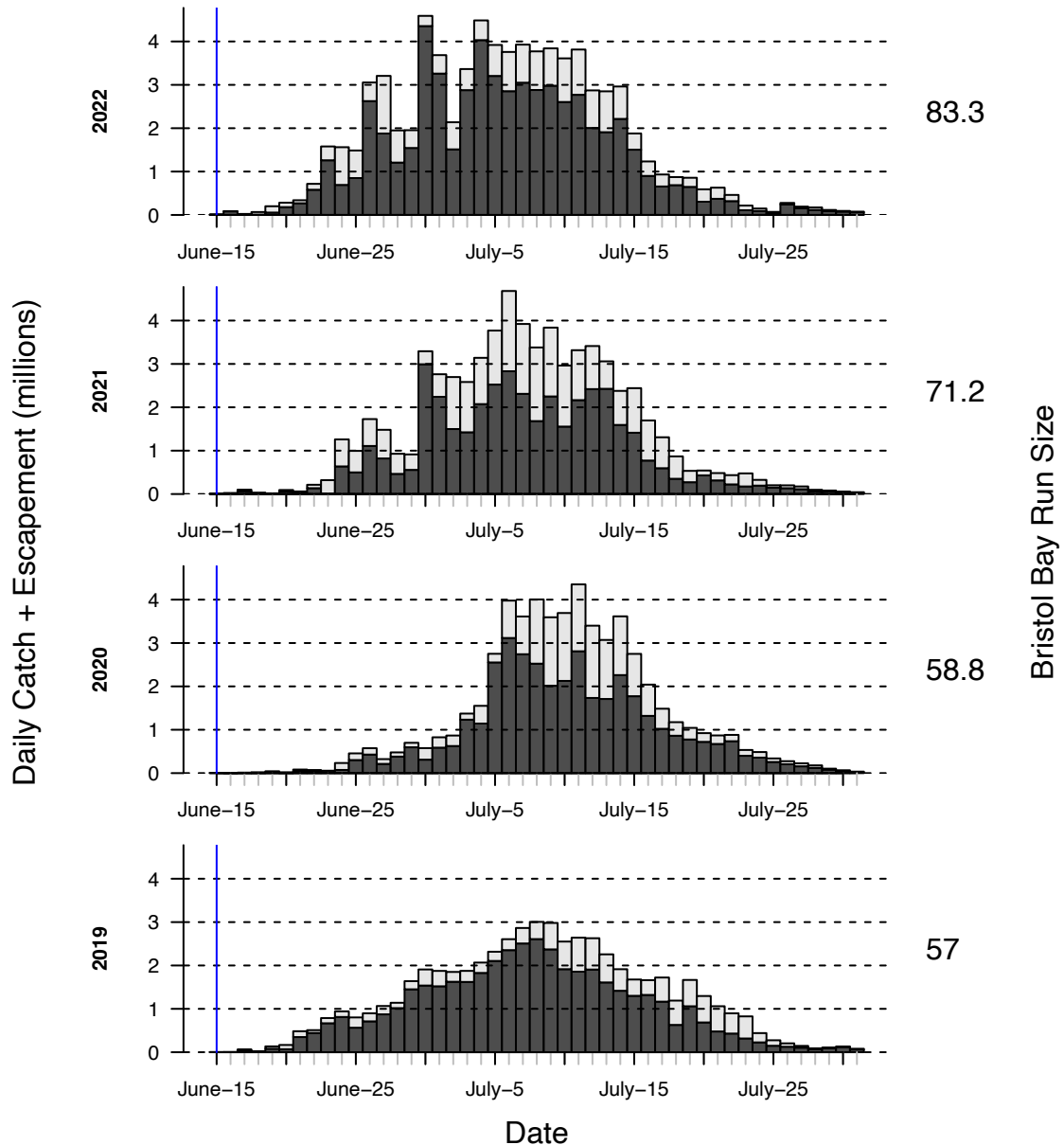
Figure 3 (page 6) displays cumulative C+E to date in 2023 (grey dots), relative to a Bristol Bay run that aligns with the preseason forecast (blue curve), with average run timing and run compression. Figure 3 also shows expected cumulative C+E for runs arriving inshore 2 days early (green dashed line) or 2 days late (red dashed line). The four panels below display this same information for the Ugashik, Egegik, Naknek-Kvichak, and Nushagak districts. Figure 3 indicates that for a Bristol Bay run totaling 50 million sockeye, with average run timing, we should expect to have 9.0 million sockeye inshore (as catch and escapement) by June 30, 21.5 million by July 5, and 35.7 million by July 10. This figure will be updated daily as part of the online supplement at:

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



**Figure 3. Cumulative C+E Comparison:** Comparison of daily cumulative C+E observed for Bristol Bay in 2023, and expected daily values (blue curve). Expected daily values are calculated relative to the 2023 preseason forecast and the average distribution of inshore arrivals (1980–2022). Connected gray dots show the 2023 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.

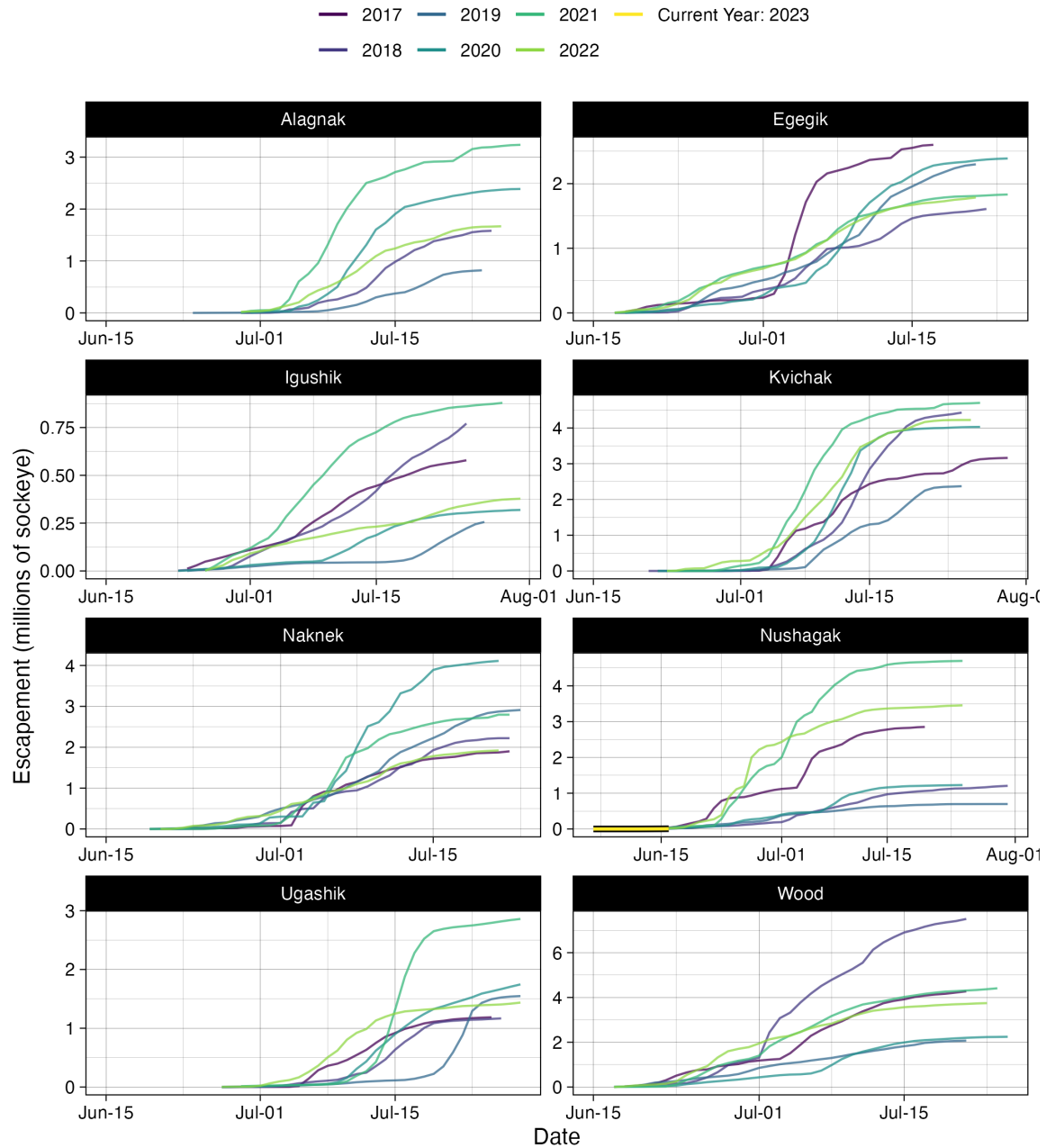
Figure 4 (page 7), illustrates daily catch and escapement (non-cumulative) for Bristol Bay 2019–2022. These graphs are a conventional way to look at the distribution of the Bristol Bay sockeye run across seasons, and compare run timing and run compression with previous years. This figure will be updated with a top panel showing 2023 for comparison purposes as daily catch and escapement data become available, and included with the online supplement.



**Figure 4. Daily Catch and Escapement:** Observed catch and escapement for years 2019–2022 as stacked bars. Escapements are in light gray and catches in dark gray. Total run for Bristol Bay is shown in millions of sockeye on the right hand axis.

## 4 Bristol Bay sockeye escapement

As part of these reports and our inseason website we visualize current sockeye salmon escapement counts collected by ADF&G for 8 of the 9 Bristol Bay river systems, compared with recent years. Figure 5 (page 8) shows cumulative sockeye salmon escapement to each river in 2023 compared with 2017-2022.



**Figure 5. Bristol Bay Sockeye Escapement:** 2017-2023 cumulative sockeye salmon escapements to Bristol Bay river systems.



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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.