Bristol Bay Sockeye Salmon

UW-FRI

Inseason Report #3

June 27, 2020

1 Forecast Summary

The inseason run size estimate from the integrated Bayesian model remains within 1% of the preseason forecast. At this point in the season, the preseason forecast still receives the majority of weight (65.2%) in our overall forecast, indicating that historically it has been the most reliable source of information about run size through this date. Forecasts based on Port Moller indices receive and catch and escapement (C+E) to date will both have progressively more influence on the overall forecast as these sources of information become more reliable in the first days of July.

Currently, cumulative Bristol Bay catch and escapement (C+E) is behind expectations for this date given the preseason forecast (Figure 1, page 3), but it's increasing at a rate consistent with a run 2 days late.

Table 1: 2020 UW-FRI inseason forecast (in thousands) summary.

Forecast	Sockeye	Projected harvest
Preseason forecast	48,920	36,220
Inseason model	48,920	36,220

The UW-FRI online supplement is updated daily and available at:

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

Table 2: 2020 UW-FRI preseason sockeye salmon forecast (in thousands).

DISTRICT	RIVER	AGES 1.2	1.3	2.2	2.3	TOTAL
Nak\Kvi		4,495	8,387	1,132	497	14,511
	Kvichak	2,624	2,773	470	106	5,973
	Naknek	959	4,070	600	367	5,996
	Alagnak	912	1,544	62	24	2,542
Egegik		1,554	6,076	1,366	1,189	10,185
Ugashik		2,437	1,383	359	44	4,223
Nushagak		11,985	6,696	241	80	19,118
	Wood	10,690	3,147	215	45	14,097
	Nushagak	984	2,903	14	27	4,044
	Igushik	311	646	12	8	977
Togiak		145	716	19	3	883
Totals		20,616	23,258	3,117	1,813	48,920

*The Nushagak River total includes 116,000 0.3 and 1.4 age fish not included in the body of the table

2 Catch and Escapement

Cumulative catch plus escapement (C+E) through June 26 is 1.6 million sockeye, lower than the historical average (1980-2019) through this date of 2.6 million sockeye, for run sizes ranging from 17.9 - 67.1 million. Through this date cumulative C+E was 4.8 million sockeye in 2019 (run size: 56.9 million), 4.0 million in 2018 (run size: 63.7 million), and 6.3 million in 2017 (run size: 58.2 million). Currently, cumulative C+E is consistent with expectations for a run within 1% of the preseason forecast (48.9 million sockeye) but with 2-day late run timing (Figure 1, page 3).

Figure 2 (page 4) displays a comparison of daily catch and escapement for 2016-2020. We have added the daily UW-FRI Port Moller indices to this figure, allowing a comparison of both the relative magnitude and distribution of Port Moller test fishery catches across years. From this we observe that in years with late arrival timing (e.g. 2016) Port Moller indices continued to increase in magnitude beyond June 29, through July 8-9.

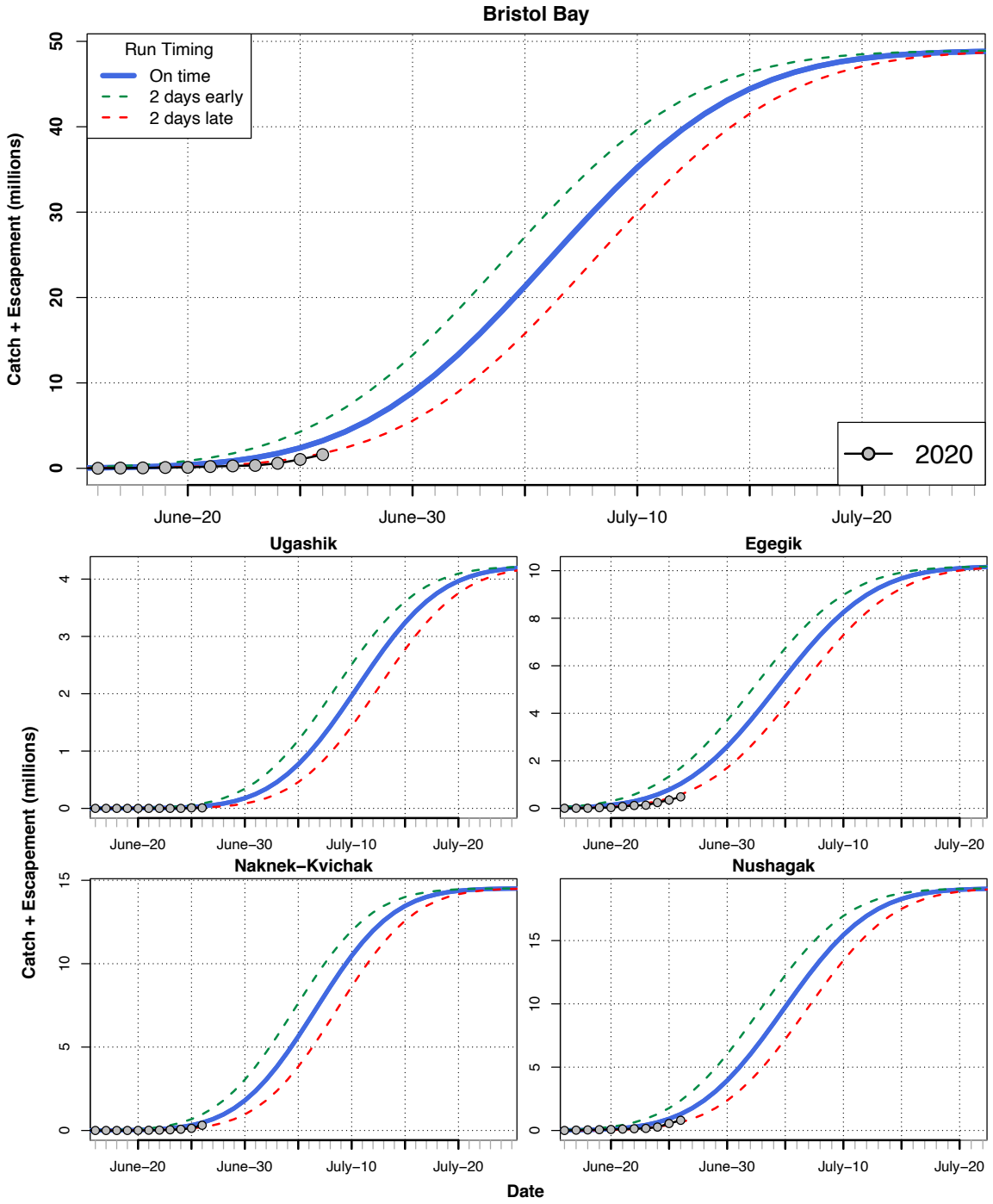

Figure 1. Cumulative C+E Comparison: Comparison of daily cumulative C+E observed for Bristol Bay in 2020, and expected daily values (blue curve). Expected daily values are calculated relative to the 2020 preseason forecast and the average distribution of inshore arrivals (1980–2019). Connected gray dots show the 2020 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.

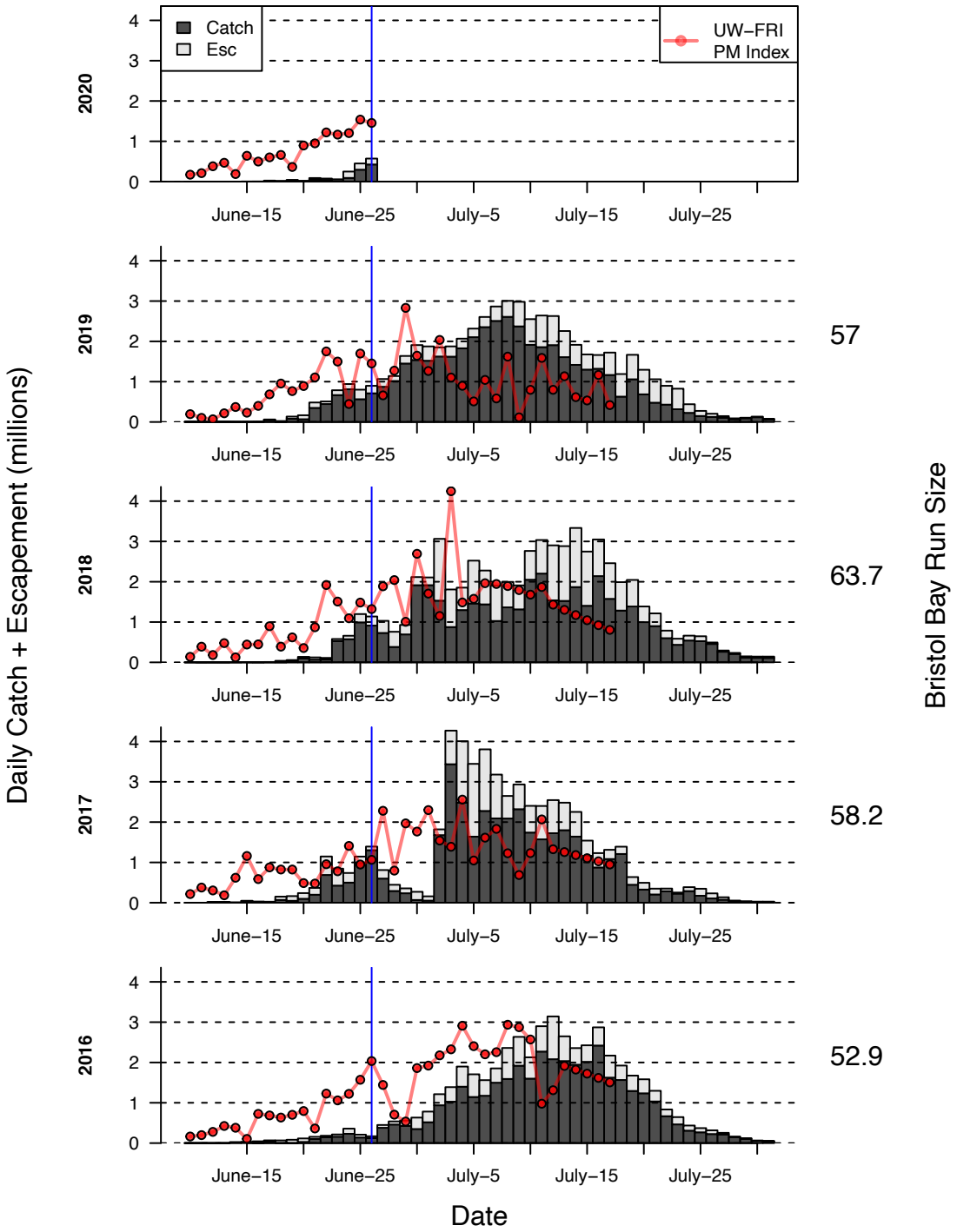

Figure 2. Daily C+E and Port Moller Index: Observed catch and escapement for years 2016 to 2019 as stacked bars and the daily UW-FRI Port Moller Index (observed and interpolated) as a red dotted line, compared with 2020 values. Escapements are in light gray and catches in dark gray. Total Bristol Bay run size in millions of sockeye is shown at the right. Daily UW-FRI Port Moller Index values (red) are scaled relative to maximum across these years.

3 Port Moller CPUE

The **cumulative** UW-FRI Port Moller index through June 25 is 2,149, 23% lower than the (1990-2019) average of 2,789 for this date. However, the current cumulative index is similar to those observed through this date in 2019 (2,186), 2018 (2,157), 2017 (2,060), and 2016 (2,142), which resulted in run sizes of 52.9-63.7 million sockeye (Appendix A1, page 12).

Daily UW-FRI Port Moller indices since June 17-20 have been slightly below expectations (Figure 3, page 6; red line) for a run in the range of the preseason forecast with **average**: 1) inshore arrival timing, 2) run-per-index (RPI), and 3) travel time (TT) of 6-7 days. However, RPI over the last 3 years (2017-2019) has been **above** average due in part to the offshore distribution of migrating sockeye past Port Moller in recent years and the fact that the UW-FRI Port Moller index is calculated as the sum of catch per unit effort (CPUE) for stations 2-14, to maintain the ability to compare indices among seasons.

UW-FRI Port Moller indices are increasing and remain consistent with expectations for a Bristol Bay run size equal to the 2020 preseason forecast, if RPI is **above** average and similar to 2019 (Figure 3, page 6, blue curve marked with a "+" symbol), or if inshore run timing is later than average. In either case, we would expect to see increasing Port Moller test fishery indices at least through July 1-2, and likely through July 4-5. Assuming the average travel time TT (test fishery transect to inshore districts) of 6-7 days, the increased number of fish passing the transect after June 20 (Figure 3, page 6) are beginning to arrive inshore.

As the 2020 season progresses, we begin to compare the pattern in Port Moller test fishery CPUE with inshore arrivals to inform inseason estimates of RPI and TT for the 2020 season. However, inseason estimates of RPI and TT are **very uncertain** until distinctive patterns in CPUE are mirrored in inshore C+E. As such, we rely on average estimates of RPI and TT from prior seasons, until we have sufficient information to estimate these values in real time. We will also be closely monitoring the pattern in Port Moller test fishery catches across time, as the "peak" in test fishery CPUE is **a key indicator** of run timing for Bristol Bay as a whole and by fishing district, which can be used to updated inseason forecasts based on observed C+E through a given date.

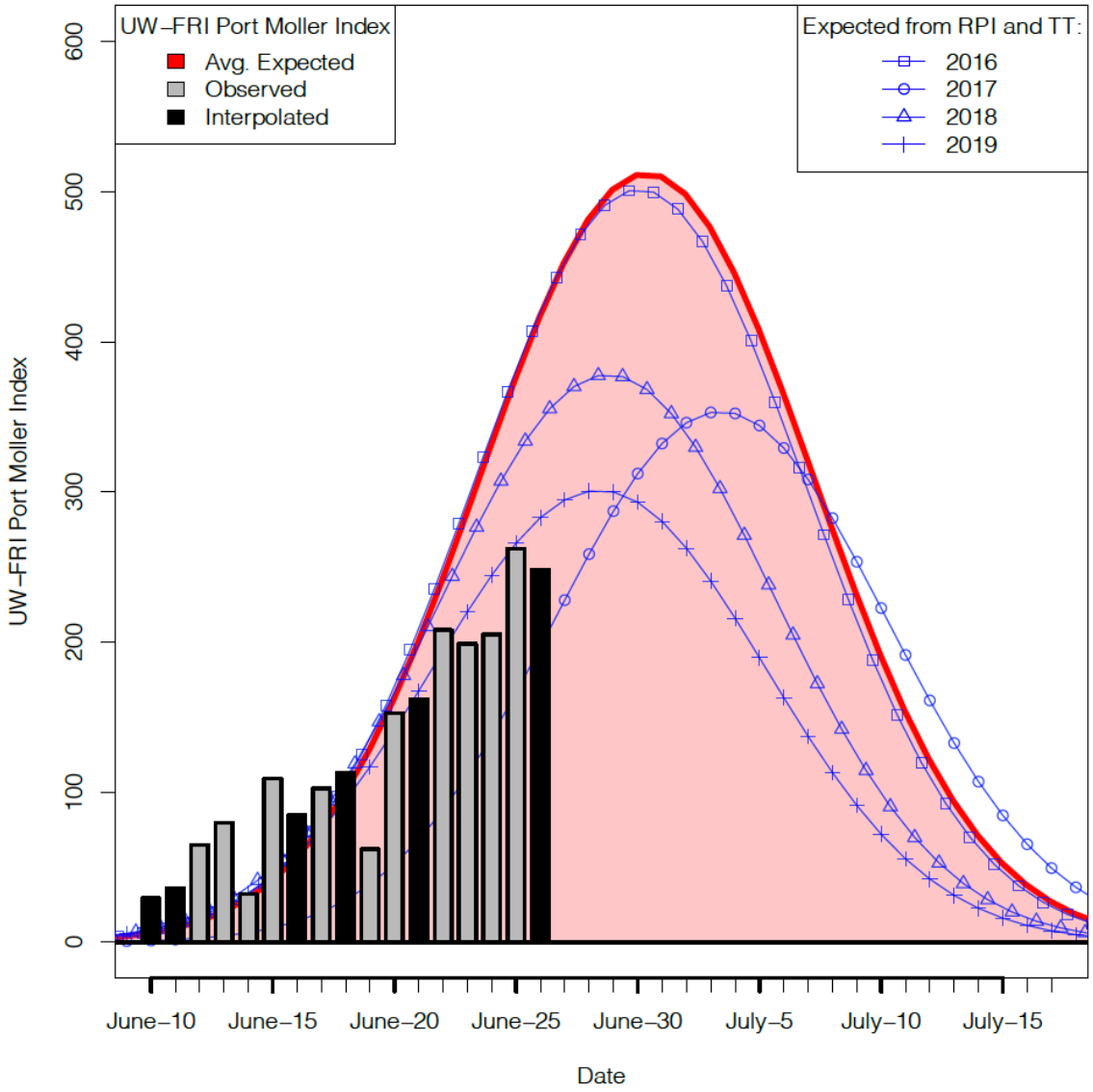

Figure 3. Comparison of Expected & Observed Daily Port Moller Index: 2020 observed and interpolated (gray and black bars) UW-FRI Port Moller Index is compared with expected daily index values (red line and shaded area) for a Bristol Bay run equal to the preseason forecast with average run timing, and 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 2016-2019 are plotted with blue lines and symbols.

4 Port Moller Genetics

Through June 25 the genetic stock composition of Port Moller test fishery catches has been similar to preseason forecast proportions by district. Figure 4 (page 8) compares preseason expectations for the proportion of the Bristol Bay run by district, sockeye caught in the test fishery and those arriving inshore (C+E), and resulting predictions for 2020 season total proportions by district.

Specifically, Figure 4 (page 8) compares district proportions of the 2020 Bristol Bay run from:

1. The 2020 UW-FRI Preseason Forecast (black columns).
2. 'Cumulative Port Moller Genetic Samples' or the sum of daily Port Moller indices partitioned by applicable genetic stock composition data, and representing the relative number of sockeye bound for each district to have passed the Port Moller transect to date (yellow columns).
3. ***Predicted*** end of season proportions (Adjusted Port Moller Genetic Estimate) based on cumulative genetic samples (above) and the average difference between these and season total C+E proportions in previous years (blue columns).
4. ***Observed*** proportions of C+E through June 26 (green columns).

Egegik representation in test fishery genetic stock composition estimates has consistently increased across the 2020 season. This increase was expected, given the magnitude of Egegik's preseason forecast. If the current cumulative Port Moller genetic composition (Figure 4, yellow bars) are adjusted for average differences between the proportion of test fishery catches by district and season total proportions of C+E in past years (Figure 4, blue columns), the predicted Egegik proportion of the 2020 run is very close to that in the preseason forecast.

Nushagak District representation in the cumulative test fishery stock composition (yellow column) is consistent with the preseason forecast proportion (black column), however the adjusted Port Moller genetic estimate (blue column) is lower than the preseason forecast proportion. Increased representation of the Wood River stock in subsequent genetic samples from the Port Moller test fishery would cause the adjusted genetic estimate (blue column) for the Nushagak District to align with its preseason forecast proportion (black column).

The Naknek-Kvichak District has shown strong representation in Port Moller test fishery stock composition samples, for this early point in the season. Given its typical under representation (relative to end-of-season run proportions) in June genetic samples, the adjusted Port Moller genetic estimate currently predicts a higher than forecasted proportion of the 2020 run is bound for this district. However, additional genetic stock composition data will better inform this prediction.

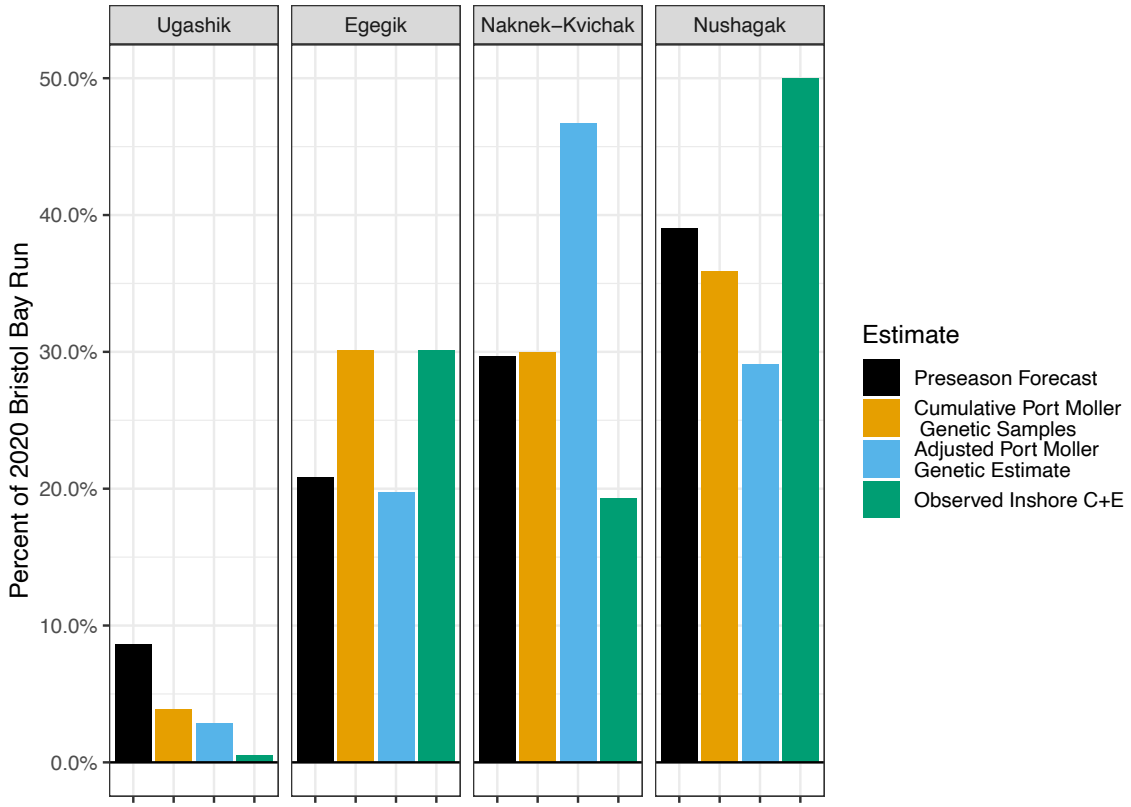

Figure 4. Bristol Bay Proportions by District: Comparison of predictions for 2020 Bristol Bay run proportions by district with cumulative genetic samples collected in the Port Moller test fishery through June 24-25, and the adjusted Port Moller genetic estimate. Current predictions (Adjusted Port Moller Genetic Estimate) are based on the cumulative genetic samples collected in the Port Moller test fishery, adjusted for historical over/under-representations by district relative to season total proportions, through the current date.

5 Port Moller Age Composition

The age composition of sockeye caught in the Port Moller test fishery throughout the 2020 season has been fairly consistent with the preseason forecast. Figure 5 (page 10) shows the preseason forecast proportions for the major age classes (bars), compared with the cumulative inseason age composition of Port Moller test fishery catches (diamonds). Cumulative age composition is calculated by: (1) apportioning daily Port Moller indices by the observed age composition, (2) summing age-specific indices across days, and (3) calculating the proportions represented by cumulative age-specific indices through the current date.

If all preseason predictions for returning age classes were accurate, we would expect these Port Moller age proportions (diamonds) to move toward preseason forecast proportions as the season progresses. If cumulative Port Moller age composition proportions do not agree with preseason forecast proportions, this provides an indication of whether certain age classes are returning in higher or lower abundance than predicted.

Within the UW-FRI preseason forecast the 1.3 age class represents the largest portion (47.5%) of the 2020 Bristol Bay run, followed closely by the 1.2 age class (42.1%). The 2.2 and 2.3 age classes were predicted to represent relatively small portions of the 2020 run at 6.4% and 3.7% respectively (Figure 5, page 10). Thus far, the age composition of sockeye passing the Port Moller transect has been **very similar** to preseason expectations, with a slightly higher proportion of 1.3's and slightly lower proportion of 1.2's and 2.2's than expected. This is consistent with the observed inshore returns to the Egegik, Naknek, and Nushagak rivers, which are expected to be comprised of mostly 1.3's.

Over the course of the season, the proportion of the 1.2 age class has increased in test fishery samples. Given the large forecasted run to the Wood River (14.1 million) which is comprised primarily of the 1.2 age class (75.8%), we would expect continued increases in the proportion of 1.2's in subsequent Port Moller Test Fishery age composition samples.

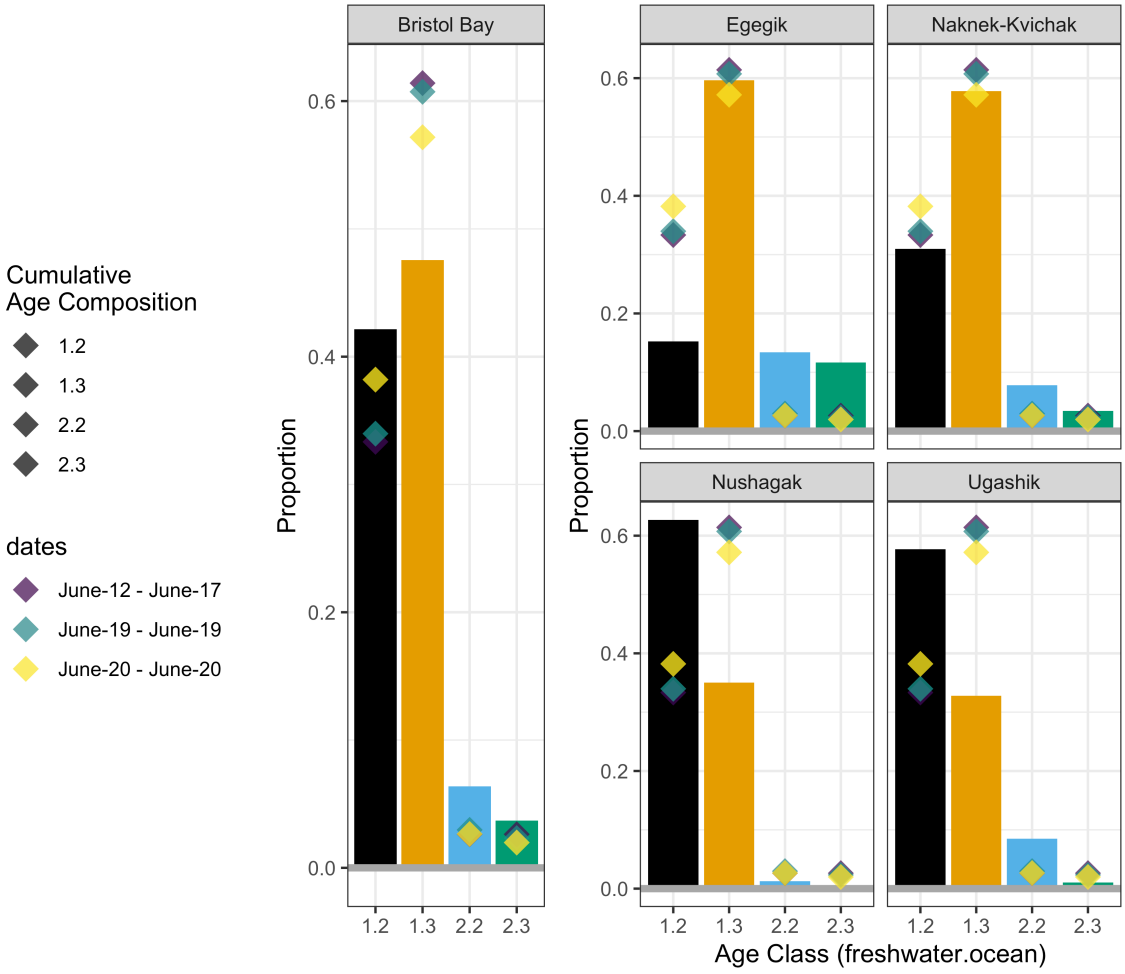

Figure 5. Age Composition from Port Moller and Preseason Forecast: Comparison of expected age class proportions of the 2020 run to each district from the preseason forecast (bars) with the cumulative Port Moller age composition through June 20 (diamonds).

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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. Cumulative UW-FRI Port Moller index: Comparison of cumulative daily indices (sum of the sockeye catch per hour fished for stations 2-14, with interpolations for missing stations and days) 2001-2020 and total run size in millions of sockeye.

Date	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
June 10	23	34	15	32	38	13	16	11	20	3	45	2	34	63	47	28	37	23	33	**29**
June 11	52	100	24	67	71	43	40	17	40	36	112	28	69	104	110	62	101	90	51	**65**
June 12	80	169	44	103	109	53	63	59	105	39	176	48	145	137	148	109	153	121	62	**130**
June 13	126	229	75	193	130	77	89	116	184	81	289	86	299	193	182	181	184	202	99	**210**
June 14	168	430	155	292	205	140	134	156	253	131	408	107	553	267	280	246	290	223	162	**242**
June 15	219	631	256	427	285	217	161	259	340	165	624	128	704	292	360	264	487	298	201	**351**
June 16	338	813	509	593	420	332	234	325	549	249	809	187	857	376	465	387	587	374	270	**436**
June 17	503	961	601	796	531	476	304	485	843	279	1,057	257	1,069	476	676	504	737	527	387	**538**
June 18	596	1,090	689	933	660	657	421	807	1,032	432	1,241	293	1,217	588	927	612	877	594	549	**651**
June 19	775	1,248	742	1,155	810	979	485	1,061	1,319	521	1,449	412	1,407	711	1,179	732	1,017	699	680	**713**
June 20	897	1,500	884	1,314	906	1,226	559	1,455	1,596	742	1,781	507	1,642	823	1,424	867	1,100	760	832	**865**
June 21	1,030	1,707	1,049	1,640	1,068	1,541	735	1,782	1,930	985	2,057	682	1,917	1,059	1,600	929	1,181	908	1,020	**1,027**
June 22	1,222	1,974	1,186	1,906	1,277	1,799	883	2,255	2,242	1,359	2,528	805	2,145	1,202	1,901	1,138	1,344	1,235	1,318	**1,235**
June 23	1,322	2,302	1,379	2,047	1,469	2,233	1,056	2,619	2,522	1,629	2,833	1,282	2,358	1,477	2,106	1,319	1,477	1,492	1,574	**1,434**
June 24	1,444	2,645	1,506	2,354	1,697	2,703	1,235	3,101	2,726	1,854	3,208	1,496	2,559	1,730	2,463	1,527	1,717	1,679	1,650	**1,639**
June 25	1,600	2,948	1,710	2,832	1,952	3,231	1,314	3,616	2,983	1,975	3,526	1,724	2,791	1,841	2,791	1,795	1,879	1,931	1,939	**1,901**
June 26	1,726	3,242	1,842	3,278	2,283	3,760	1,683	4,049	3,719	2,134	3,932	1,885	2,932	1,995	3,333	2,142	2,060	2,157	2,186	**2,149**
June 27	1,896	3,513	2,276	3,924	2,707	4,131	1,907	4,798	4,283	2,399	4,151	2,022	3,064	2,211	3,709	2,388	2,449	2,478	2,299	-
June 28	2,043	3,816	2,643	4,356	3,014	4,800	2,145	5,338	4,937	2,545	4,455	2,180	3,287	2,420	4,124	2,508	2,584	2,826	2,516	-
June 29	2,150	4,093	2,997	4,749	3,353	5,409	2,404	5,740	5,600	2,668	4,738	2,374	3,438	2,674	4,420	2,599	2,920	2,998	2,999	-
June 30	2,260	4,243	3,073	5,075	3,555	5,693	2,732	6,328	6,249	2,804	4,936	2,572	3,572	2,906	4,883	2,916	3,221	3,457	3,279	-
July 1	2,360	4,398	3,179	5,231	3,898	5,937	2,893	6,877	6,893	3,176	5,221	2,846	3,688	3,085	5,246	3,244	3,613	3,747	3,494	-
July 2	2,473	4,548	3,343	5,518	4,117	6,355	3,094	7,392	7,411	3,449	5,411	3,042	3,787	3,311	5,542	3,615	3,875	3,943	3,841	-
July 3	2,595	4,696	3,528	5,763	4,265	6,912	3,287	7,696	7,902	3,806	5,516	3,293	3,881	3,547	5,968	4,011	4,112	4,667	4,029	-
July 4	2,663	4,885	3,726	5,933	4,432	7,164	3,504	8,072	8,271	4,016	5,692	3,423	3,924	3,790	6,480	4,508	4,548	4,920	4,182	-
July 5	2,724	4,981	3,954	6,310	4,658	7,496	3,693	8,538	8,608	4,209	5,815	3,515	4,010	4,033	6,991	4,917	4,727	5,189	4,269	-
July 6	2,783	5,055	4,108	6,488	4,849	7,965	4,195	9,070	8,986	4,383	5,915	3,588	4,053	4,243	7,507	5,293	5,002	5,524	4,447	-
July 7	2,818	5,079	4,246	6,602	5,060	8,274	4,410	9,361	9,321	4,600	6,032	3,611	4,087	4,485	8,077	5,677	5,314	5,855	4,546	-
July 8	2,851	5,121	4,367	6,715	5,205	8,613	4,645	9,561	9,613	4,754	6,095	3,682	4,114	4,766	8,667	6,178	5,523	6,177	4,823	-
July 9	2,877	5,157	4,474	6,811	5,330	8,826	4,791	9,761	9,864	4,890	6,143	3,723	4,134	4,940	9,281	6,667	5,640	6,483	4,842	-
July 10	2,898	5,185	4,565	6,889	5,436	9,003	4,980	9,923	10,076	5,007	6,181	3,753	4,149	5,117	9,733	7,105	5,850	6,769	4,978	-
July 11	2,913	5,205	4,643	6,950	5,524	9,148	5,152	10,051	10,252	5,108	6,208	3,775	4,160	5,298	10,230	7,272	6,202	7,087	5,249	-
July 12	2,925	5,219	4,708	6,997	5,597	9,264	5,308	10,151	10,396	5,193	6,229	3,790	4,168	5,466	10,714	7,496	6,428	7,331	5,385	-
Total run	**23.1**	**17.9**	**26.8**	**44.8**	**40.3**	**43.8**	**46.3**	**42.1**	**41.6**	**41.3**	**31.8**	**31.8**	**25.7**	**41.5**	**59.9**	**52.9**	**58.2**	**63.7**	**57.0**	-

A2. GOA Sockeye Escapement: 2014-2020 cumulative sockeye escapements to select Gulf of Alaska river systems.