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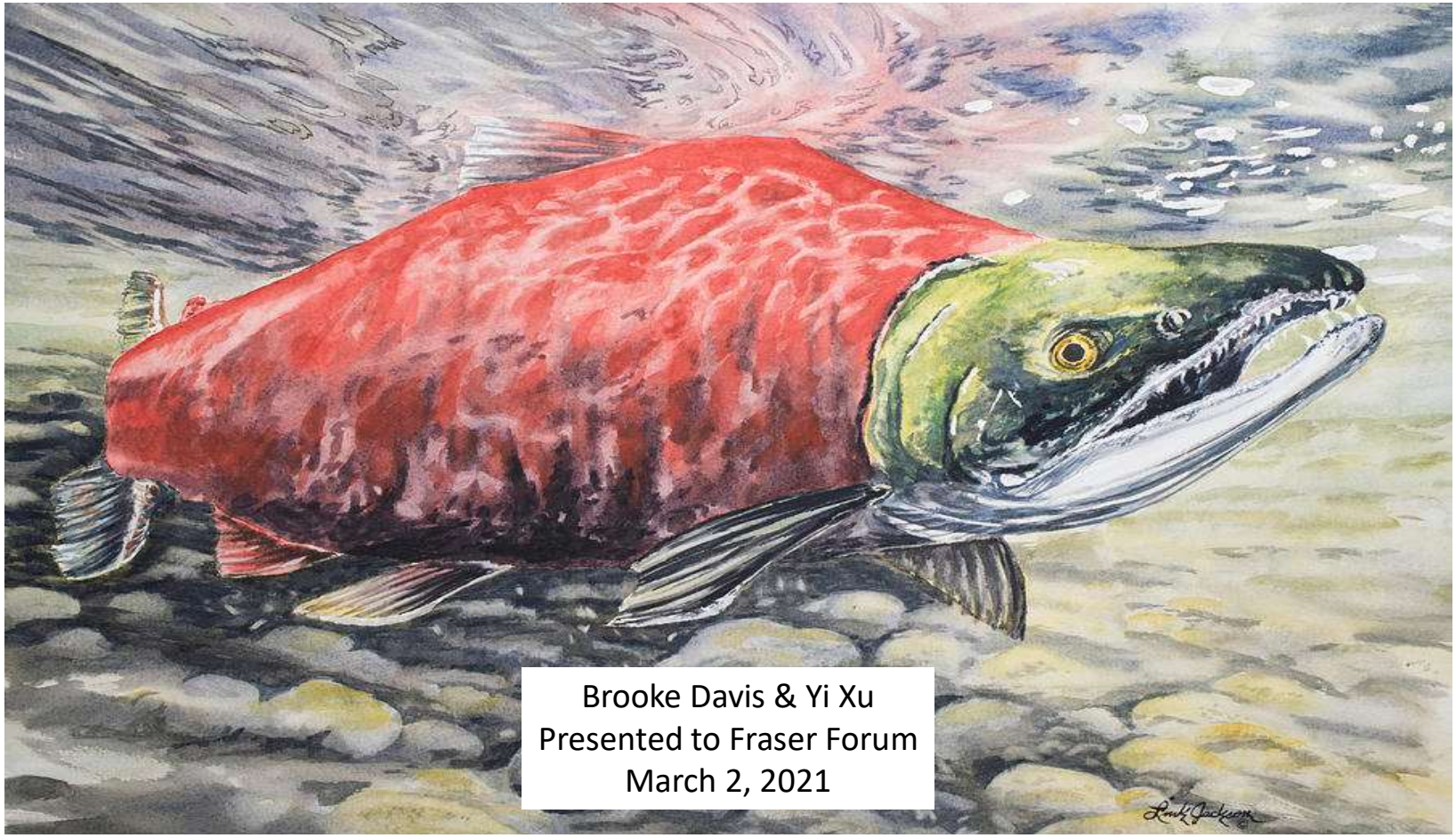
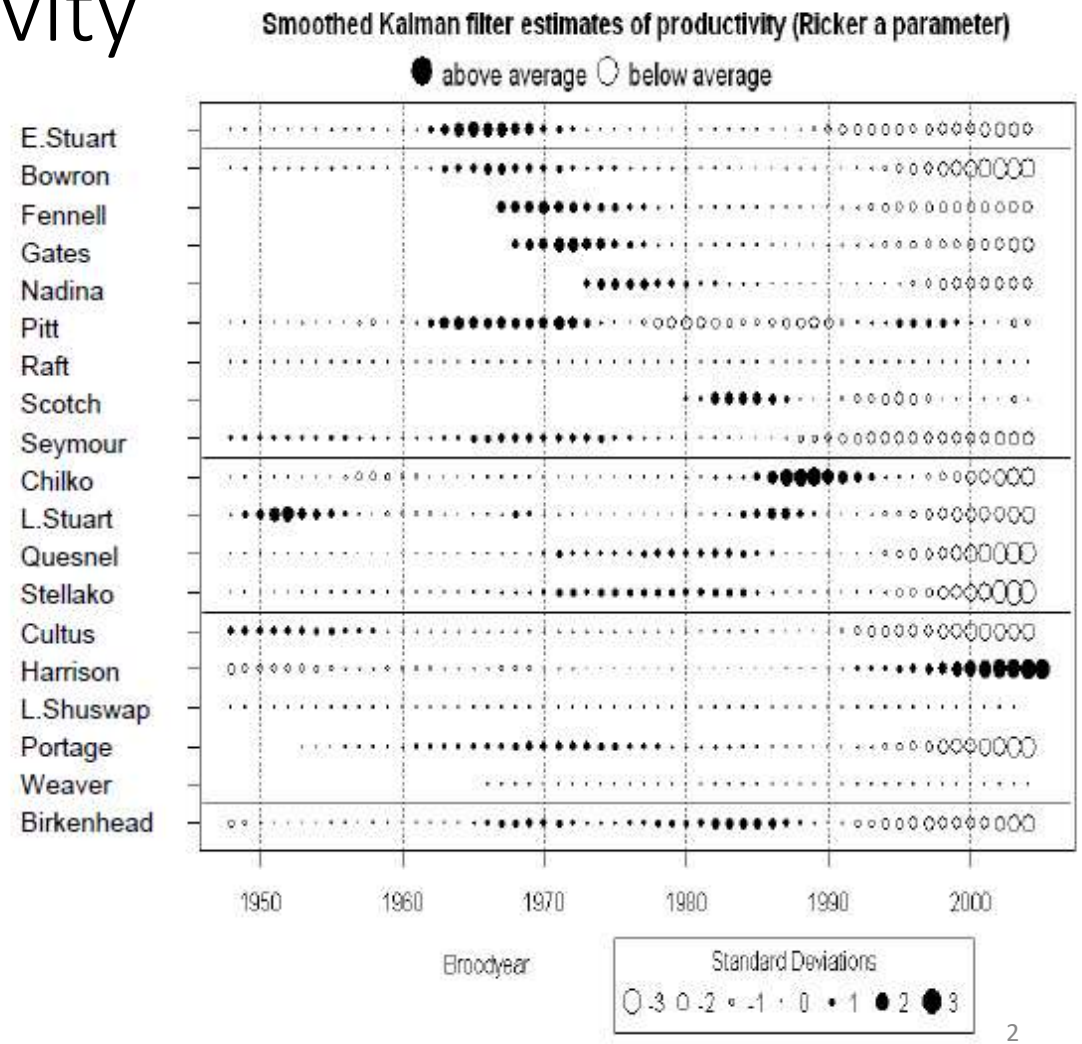
2021 Sockeye and Pink Forecasts



Brooke Davis & Yi Xu
Presented to Fraser Forum
March 2, 2021

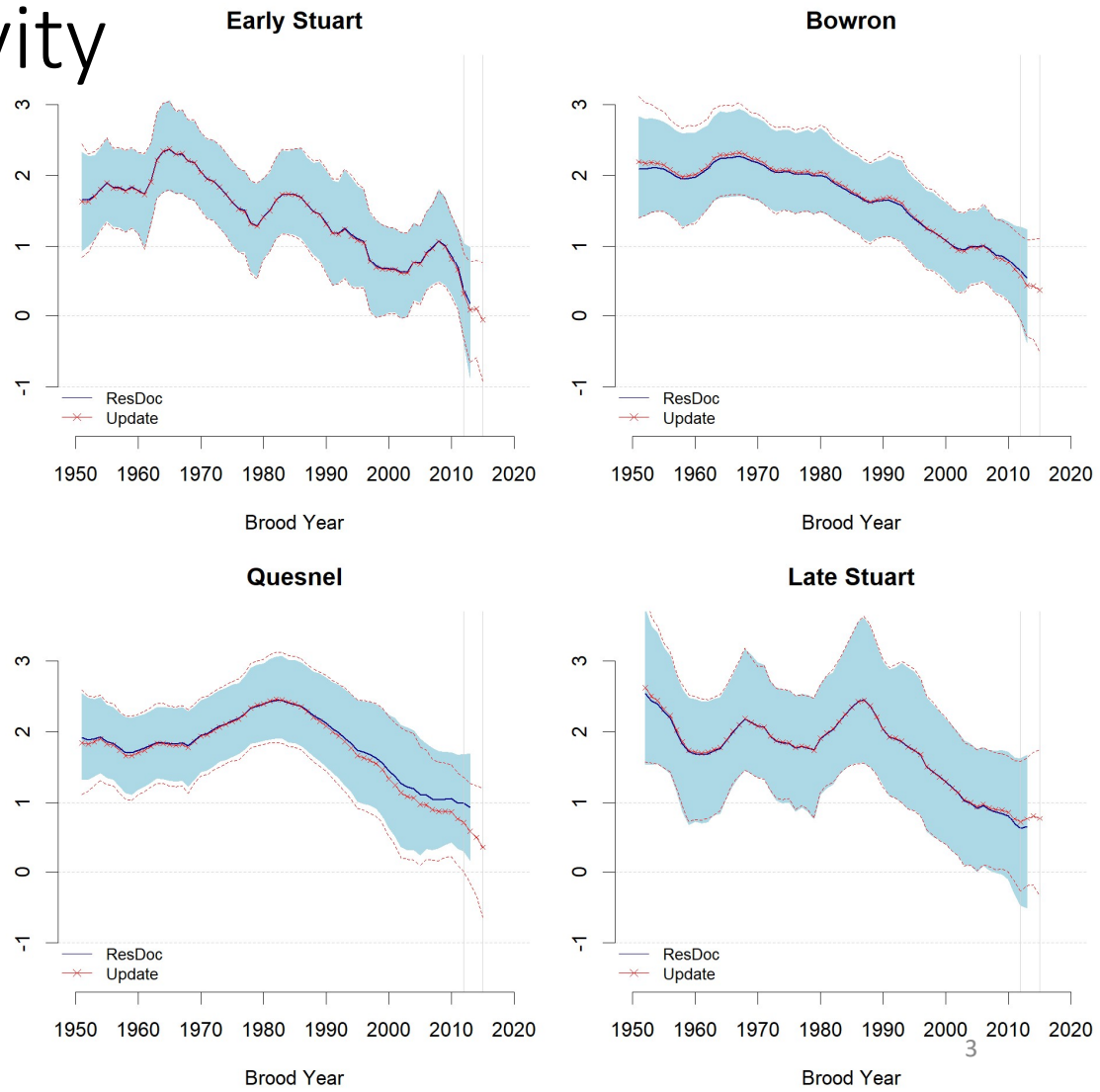
Declines in productivity

- Dorner et al. (2008) and Peterman and Dorner (2012) found widespread declines in productivity in Fraser Sockeye stocks
- Have these patterns persisted?



Declines in productivity

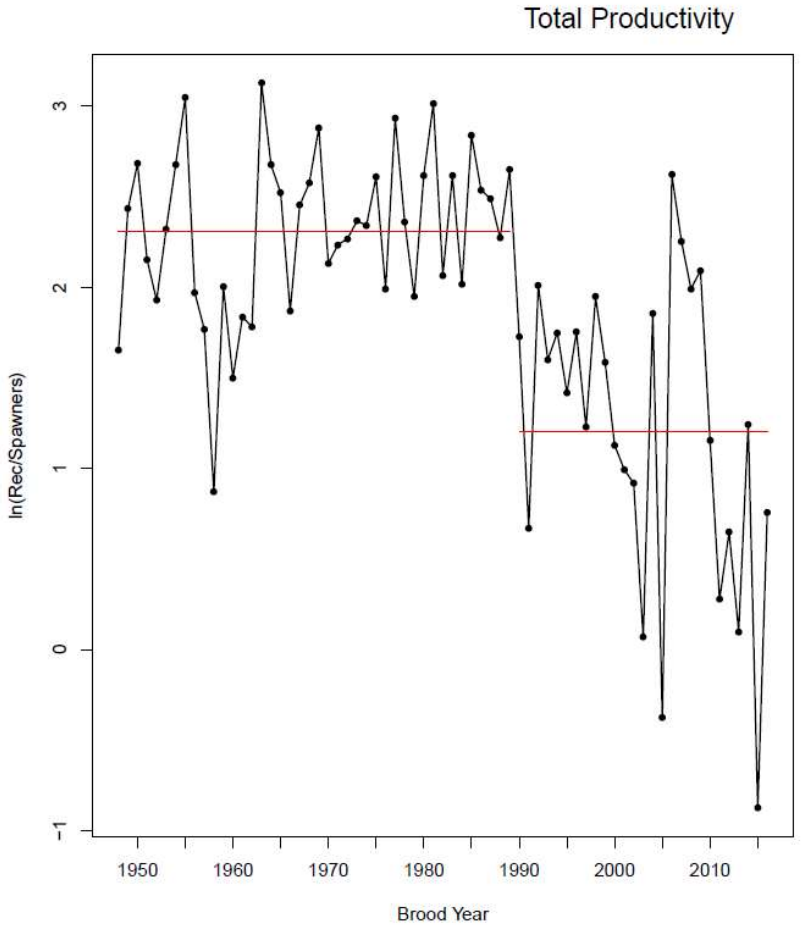
- Short answer: YES
- 2019 Fraser Sockeye RPA found that 10 Endangered/Threatened/ Special Concern stocks showed evidence of declines in productivity
- Analysis is currently being updated, and for many stocks, shows continued declines in productivity

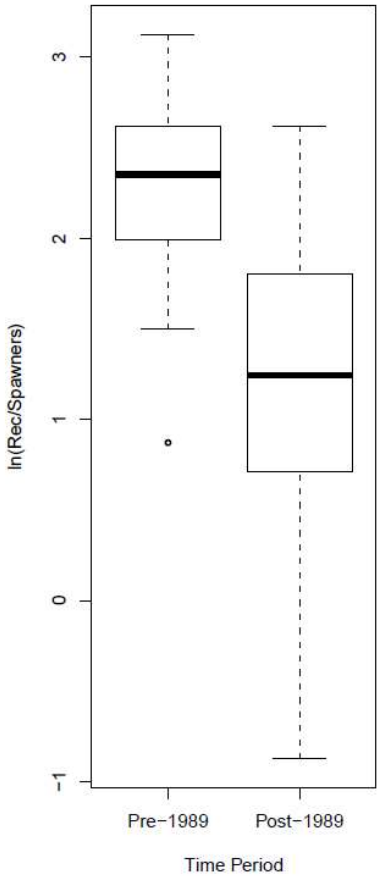


Figures courtesy of Ann-Marie Huang, 2020

Possible Regime Shift?

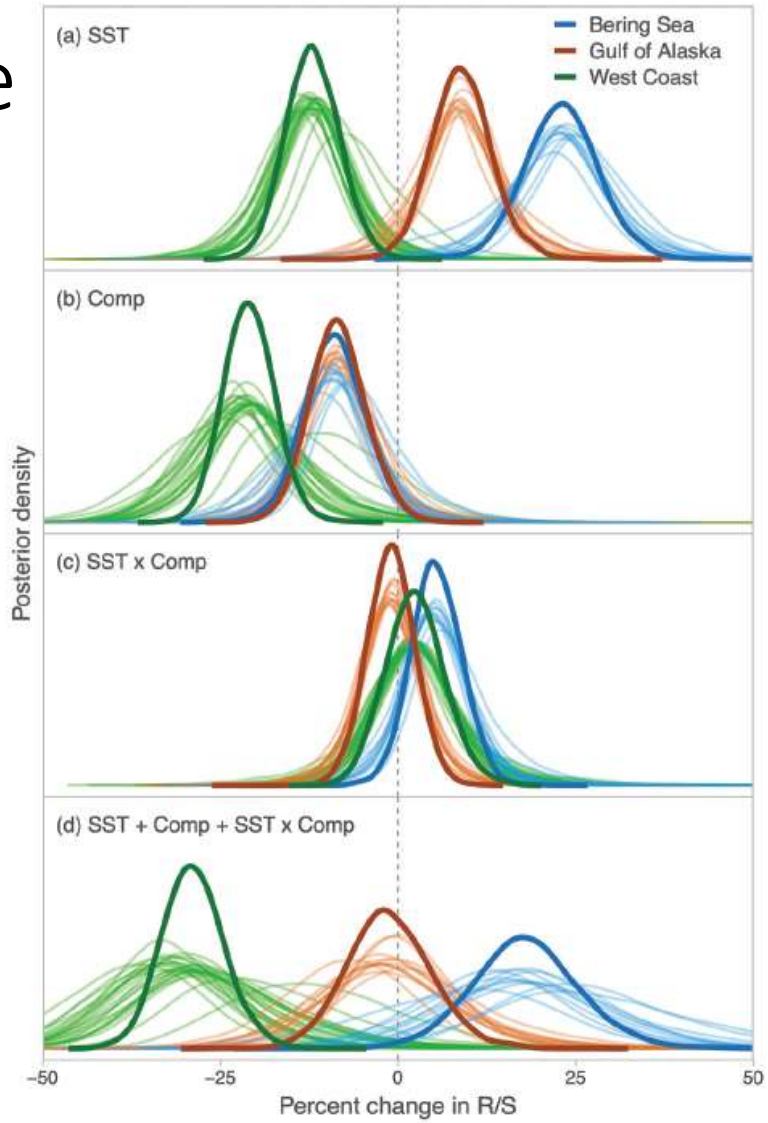
- A very straightforward analysis finds evidence of a statistically significant shift in mean productivity around 1989.
- We have seen evidence of regime shifts in Alaskan Sockeye (Ruggerone et al. 2004), possibly due to changes in ocean condition and Pink Salmon density (which began increasing significantly in the 1970's)





Potential Drivers of Decline

- Connors et al. (2020) found that West Coast Sockeye suffered lower productivity due to warm ocean conditions, and were also negatively affected by Pink salmon densities



2020 Returns Were the Lowest on Record

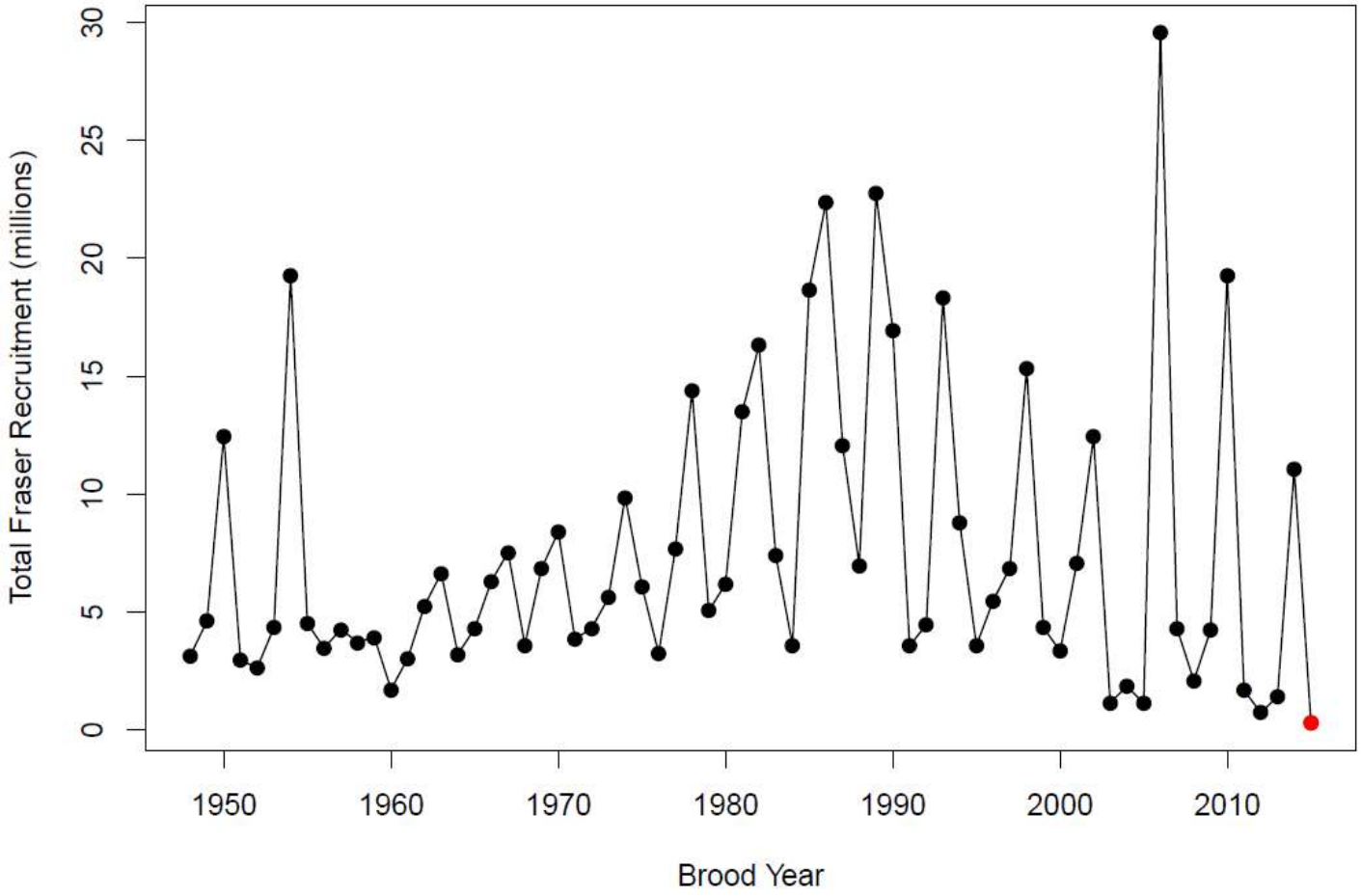
Stock Group	Pre-season p50 Run Size	In-season Run Size	Difference
Early Stuart	**13,000**	**16,000**	+23%
Early Summer Run	**218,000**	**69,000**	**-68%**
Chilliwack	57,000	25,000	-56%
Pitt/Alouette/Coquitlam	41,000	9,000	-78%
Nadina/Bowron/Gates/ Nahatlatch/Taseko	98,000	31,000	-68%
Early Thompson/North Barriere	22,000	3,000	-86%
Summer Run	**611,000**	**187,000**	**-69%**
Harrison/Widgeon	169,000	59,000	-65%
Late Stuart/Stellako	128,000	55,000	-57%
Chilko	256,000	68,000	-73%
Quesnel	2,000	1,000	-50%
Raft/North Thompson	56,000	4,000	-93%
Late Run	**99,000**	**16,000**	**-84%**
Birkenhead group	96,000	12,000	-88%
L.Shuswap/Portage	1,000	100	-90%
Weaver/Cultus	2,000	4,000	+100%
Total Accounted Run	**941,000**	**288,000**	**-69%**

Slide 6

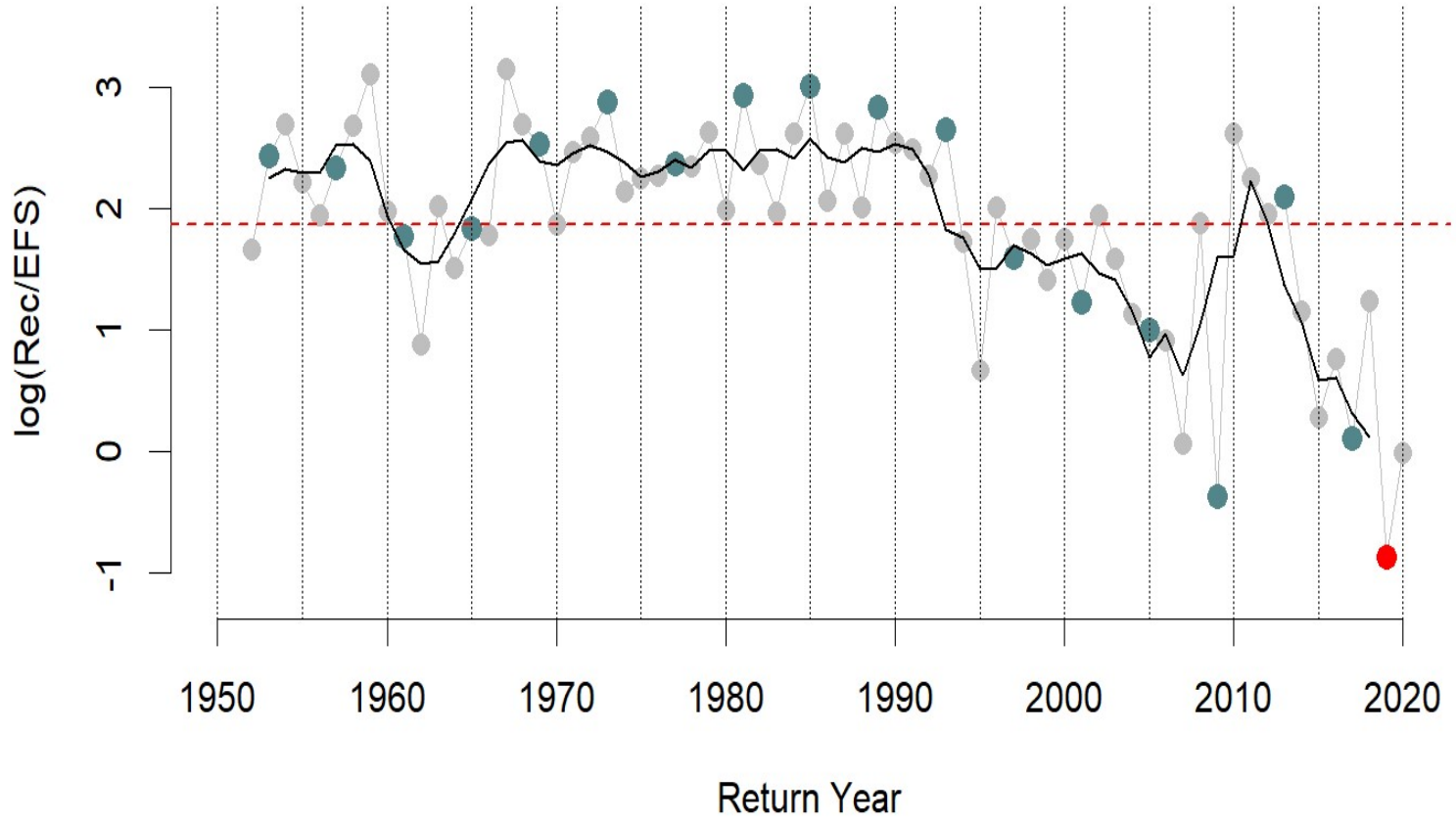
DB1 Make my own table with Return values we are using?

Davis, Brooke, 12/11/2020

2020 Returns Were the Lowest on Record



2019 and 2020 Productivity were about as low as 2009



2021 Context: How did we attempt to capture recent productivity?

1) Included 2020 return data, attempting to account for uncertainty, in order to capture recent low productivity

2) Changes to model selection process:

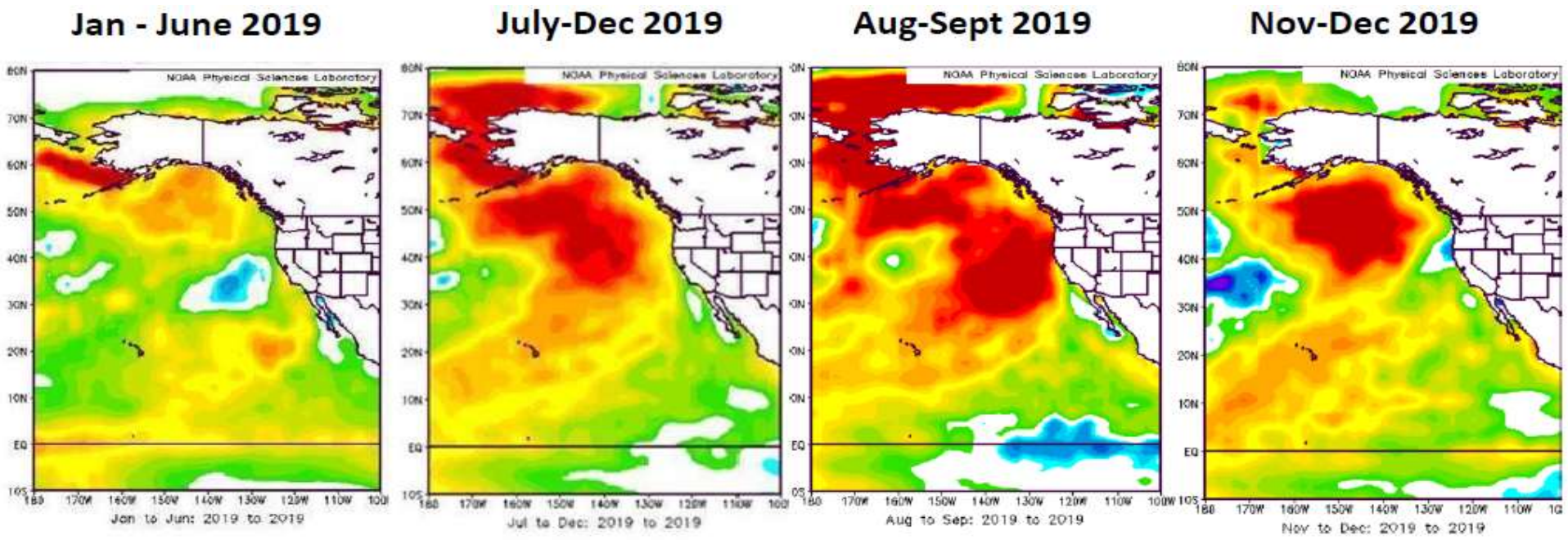
- Favouring models with environmental (especially temperature) covariates, when they provided forecast values more consistent with recent productivity
- Opting for a “recent productivity” naïve model (RS8) only in extreme cases of recent low productivity, that could not be captured by any biological forecast model
- Using sibling models for older age-classes to capture poor productivity seen in 2020 return

Model selection outcome:

- 13/19 major stocks modelled using environmental covariate
- 9 major stocks have older age-class modelled using sibling model
- 5 major stocks modelled using RS8 model (including Chilko)

Other changes for 2021

- New section to be included in forecast document to try and capture some material usually presented in the “Supplement” process
  - Help provide context to managers and others using the forecast



Run timing group Stocks	Forecast Model [a]	Probability that Return will be at/or Below Specified Run Size 10%	25%	50%	75%	90%
Early Stuart	*Ricker (Pi)*	8,000	12,000	18,000	30,000	47,000
Early Summer Total		33,000	59,000	108,000	207,000	375,000
Total excluding misc. stocks		26,000	46,000	83,000	158,000	280,000
Bowron [h]	*Ricker (Pi)*	100	200	400	700	1,000
Upper Barriere (Fennell) [h]	*Ricker (Pi)4/Sibling5*	300	500	1,000	3,000	5,000
Gates	*RS8yr*	2,000	4,000	9,000	19,000	39,000
Nadina	*PowerJuvFrD-peak4 /Sibling5*	6,000	10,000	19,000	37,000	68,000
Pitt	*Ricker(Ei)4 /Sibling5*	14,000	23,000	40,000	69,000	108,000
Scotch	*Ricker(Pi)4 /Sibling5*	1,000	3,000	6,000	13,000	28,000
Seymour	*Ricker(Ei)*	3,000	5,000	8,000	16,000	31,000
Misc (EShu) [b]	*R/S*	1,000	3,000	6,000	11,000	19,000
Misc (Taseko) [c & h]	*R/S*	30	60	100	200	300
Misc (Chilliwack)	*Power4/Sibling5*	4,000	6,000	10,000	21,000	44,000
Misc (Nahatlatch) [d]	*R/S*	2,000	4,000	8,000	17,000	32,000
Summer Total		232,000	474,000	1,046,000	2,225,000	4,502,000
Total excluding misc. stocks		228,000	464,000	1,024,000	2,181,000	4,412,000
Chilko	*RS8yr*	71,000	142,000	311,000	677,000	1,366,000
Late Stuart	*Power (Pi)*	62,000	128,000	285,000	600,000	1,241,000
Quesnel	*Ricker(Ei)*	69,000	147,000	331,000	708,000	1,425,000
Stellako	*Larkin4/Sibling5*	21,000	35,000	68,000	128,000	229,000
Harrison [e]	*Ricker(Ei)Odd3/Sibling4*	3,000	8,000	21,000	52,000	120,000
Raft [e]	*Ricker(Pi)4/Sibling5*	2,000	4,000	8,000	16,000	31,000
Misc (N. Thomp. Tribs) [e,f,h]	*R/S*	800	2,000	4,000	9,000	18,000
Misc (N. Thomp River) [e & f]	*R/S*	3,000	8,000	17,000	34,000	70,000
Misc (Widgeon) [g & h]	*R/S*	90	300	700	1,000	2,000
Late Total		40,000	79,000	159,000	313,000	572,000
Total excluding misc. stocks		37,000	67,000	134,000	267,000	492,000
Cultus [h]	*PowerJuv (Pi)4/Sibling5*	200	500	900	2,000	4,000
Late Shuswap	*Ricker(Ei)*	8,000	16,000	35,000	78,000	149,000
Portage [h]	*RS8yr*	400	800	2,000	4,000	9,000
Weaver	*RS8yr*	23,000	40,000	74,000	136,000	235,000
Birkenhead	*RS8yr*	5,000	10,000	22,000	47,000	95,000
Misc Harrison/Lillooet [g]	*R/S*	3,000	12,000	25,000	46,000	80,000
TOTAL SOCKEYE SALMON		313,000	624,000	1,330,000	2,775,000	5,496,000
Total sockeye excluding misc. stocks		299,000	589,000	1,259,000	2,636,000	5,231,000
TOTAL PINK SALMON	*Ricker(FrD-peak _MayPi_JulSepSSS)*	1,701,000	2,229,000	3,009,000	4,051,000	5,375,000

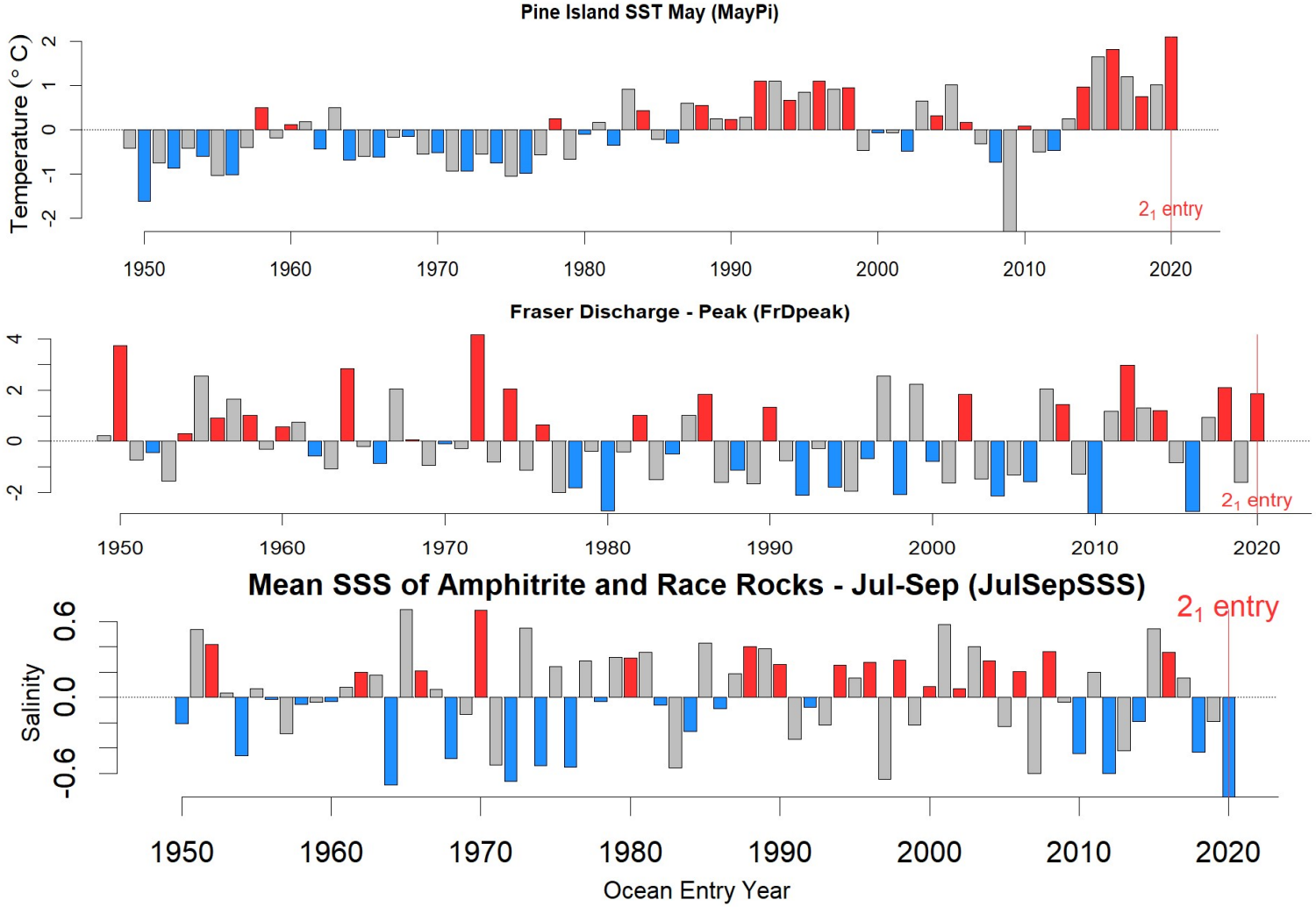
Sockeye stock/timing group	2021 Fraser Sockeye Forecasts				
	Four-year-old return 50%[a]	Five-year-old Return 50%[a]	Total Return 50%	Four-Year-Old Proportion	Five-Year-Old Proportion
Early Stuart	16,000	2,000	18,000	89%	11%
Early Summer					
Bowron	300	100	400	75%	25%
Upper Barriere (Fennell)	600	400	1,000	60%	40%
Gates	6,000	3,000	9,000	67%	33%
Nadina	13,000	6,000	19,000	68%	32%
Pitt	11,000	29,000	40,000	28%	73%
Scotch	5,800	200	6,000	97%	3%
Seymour	7,900	100	8,000	99%	1%
Misc (EShu)	5,940	60	6,000	99%	1%
Misc (Taseko)	40	60	100	40%	60%
Misc (Chilliwack)	5,000	5,000	10,000	50%	50%
Misc (Nahatlatch)	7,000	1,000	8,000	88%	13%
Summer					
Chilko	285,000	26,000	311,000	92%	8%
Late Stuart	274,000	11,000	285,000	96%	4%
Quesnel	330,800	200	331,000	100%	0%
Stellako	53,000	15,000	68,000	78%	22%
Harrison[a]	20,000	1,000	21,000	95%	5%
Raft	5,000	3,000	8,000	63%	38%
Misc (N. Thomp. Tribs)	3,500	500	4,000	88%	13%
Misc (N. Thomp River)	13,000	4,000	17,000	76%	24%
Misc (Widgeon)	400	300	700	57%	43%
Late					
Cultus	890	10	900	99%	1%
Late Shuswap	35,000	0	35,000	100%	0%
Portage	2,000	0	2,000	100%	0%
Weaver	73,900	100	74,000	100%	0%
Birkenhead	13,000	9,000	22,000	59%	41%
Misc(Non-Shuswap)	19,000	6,000	25,000	76%	24%
Total	1,207,000	123,000	1,330,000	91%	9%

Key Takeaways for 2021 (Sockeye)

- Total brood in 2017 was higher than 2016 (91% of returns are expected to be age-4)
- Poor marine conditions experienced by 2020 return have persisted
- Freshwater conditions were likely better for the 2017 cohort, compared to 2020 (more details in document)
  - Although, evidence from Chilko suggests “marine survival” as the main driver of productivity (downstream migration + marine)
- We have likely done a better job of capturing recent productivity in the 2021 forecast, compared to 2020
  - Based on recent average productivity, compared to implied productivity in the forecast models, it is not surprising that returns came in around P10 last year
  - **BUT** the 2021 P25 forecast level is most consistent with recent generational average productivity

Fraser Pink Forecast 2021

2021 Pink Returns: Environmental Context



Pink Salmon Data Challenges

- Current method for forecasting Fraser Pink's uses juvenile estimates from Mission smolt program
  - Program did not run in 2020, no juvenile estimate available
- In the past, Juvenile estimates favoured over escapement, because escapement estimation method has changed significantly over time; juvenile methodology deemed more trustworthy and consistent over time
  - 1957-1991: stream-specific estimates
  - 1993-2001: system-wide mark-recapture
  - 2003-2007: system-wide indirectly-derived test fishery index
  - 2009-present: system-wide hydroacoustic estimate

Pink Salmon Data Challenges

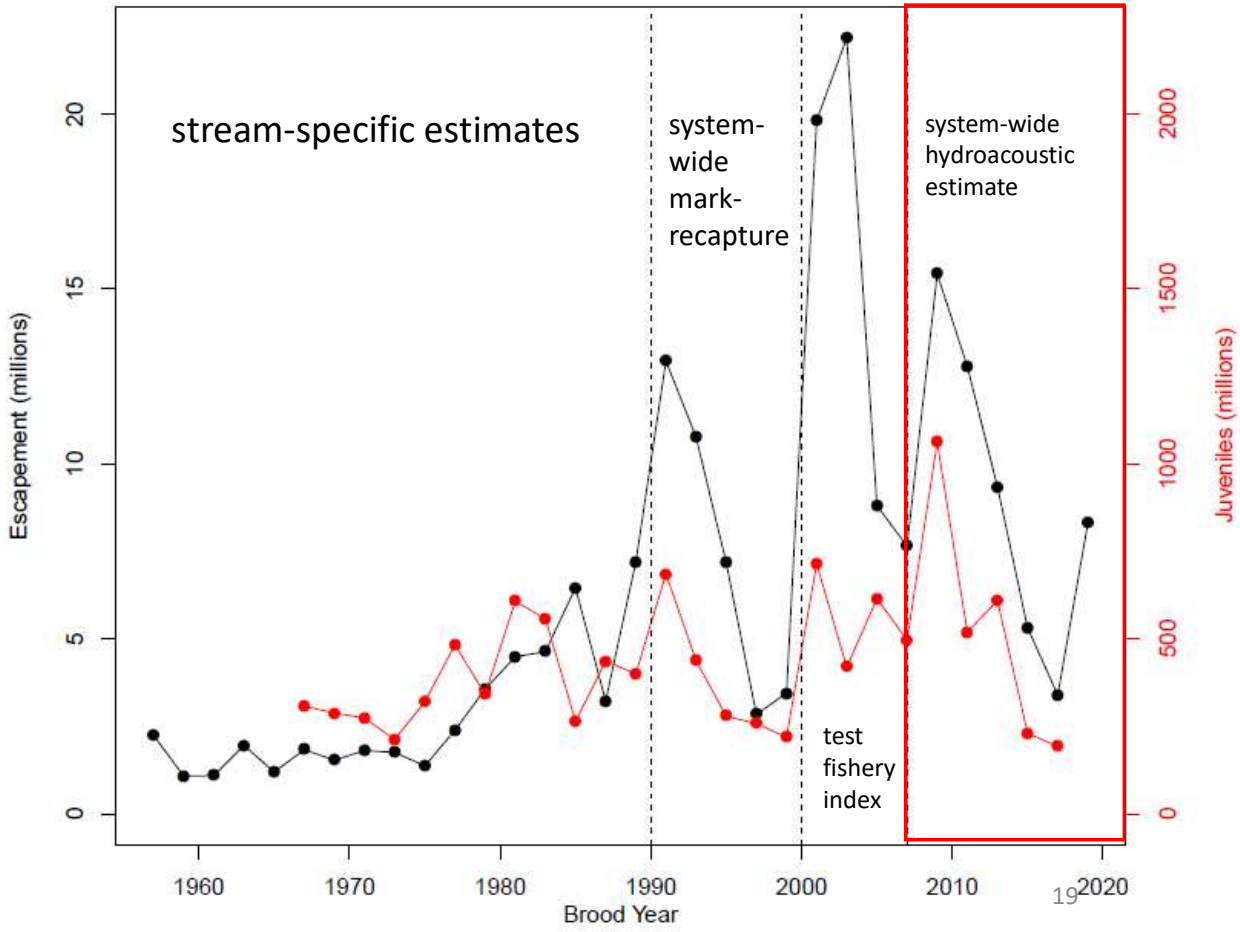
- Our only option for enumerating 2019 brood, and forecasting 2021 returns, was using the highly uncertain escapement estimates
- In order to choose an appropriate model, we needed to identify candidate models and run a retrospective analysis to guide our model selection

Approach for Pink Retrospectives

1) Set of candidate spawner recruit models identified using sequential linear regression on Ricker and Power models
   - Ricker and Power model forms considered
   - Environmental covariates from our current library used (SST, PDO, Fr Discharge)
   - Following first forecast meeting, some additional models requested by the group were ran as well
2) Model performance was compared using retrospective analysis
   - One-step-ahead retrospective
   - Assessed using 6 metrics of forecast performance (3 old + 3 new)
     1. Mean absolute error (MAE)
     2. Mean Percent error (MPE)
     3. Root-mean-square error (RMSE)
     4. Mean absolute percent error (MAPE)
     5. Mean arctangent absolute error (MAAPE)
     6. Mean absolute scaled error (MASE)

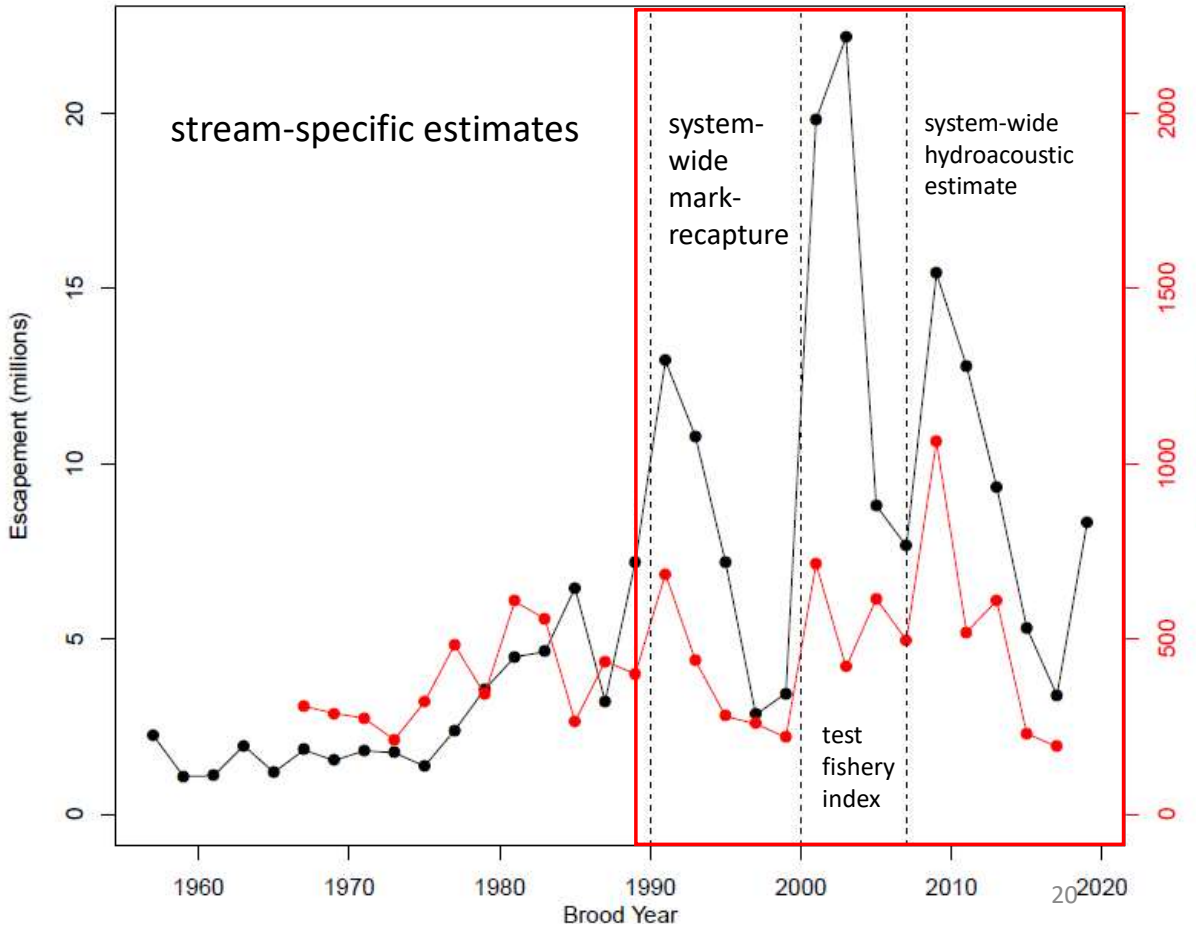
Pink Salmon Retrospective

- Retrospective approach #1: only assess performance during recent estimation regime
  - 5-year retrospective for brood years 2009-2017



Pink Salmon Retr

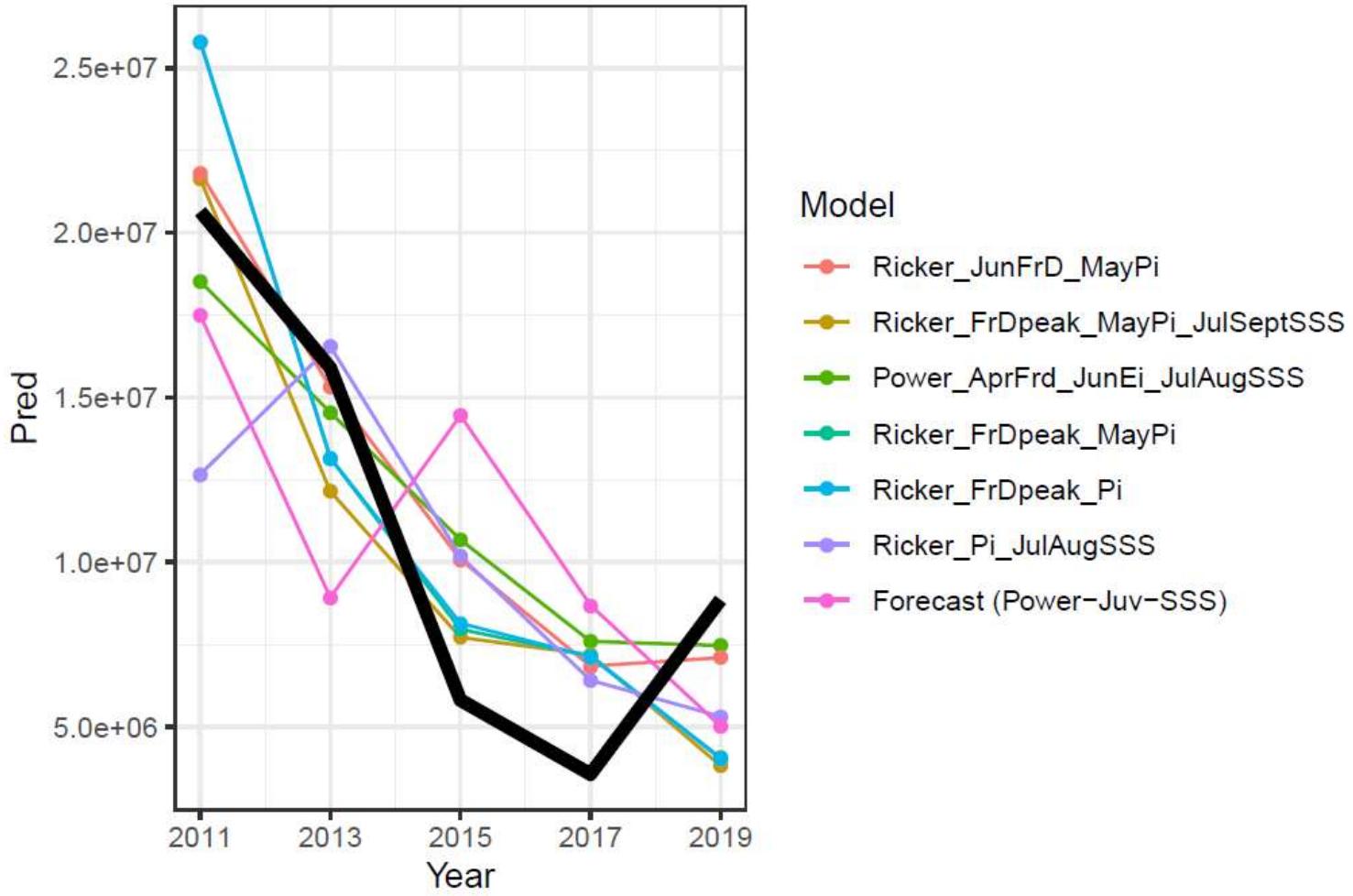
- Following feedback from initial reviewers, we also decided to stretch out the retrospective window:
  - 15-year retrospective for brood years 1989-2017



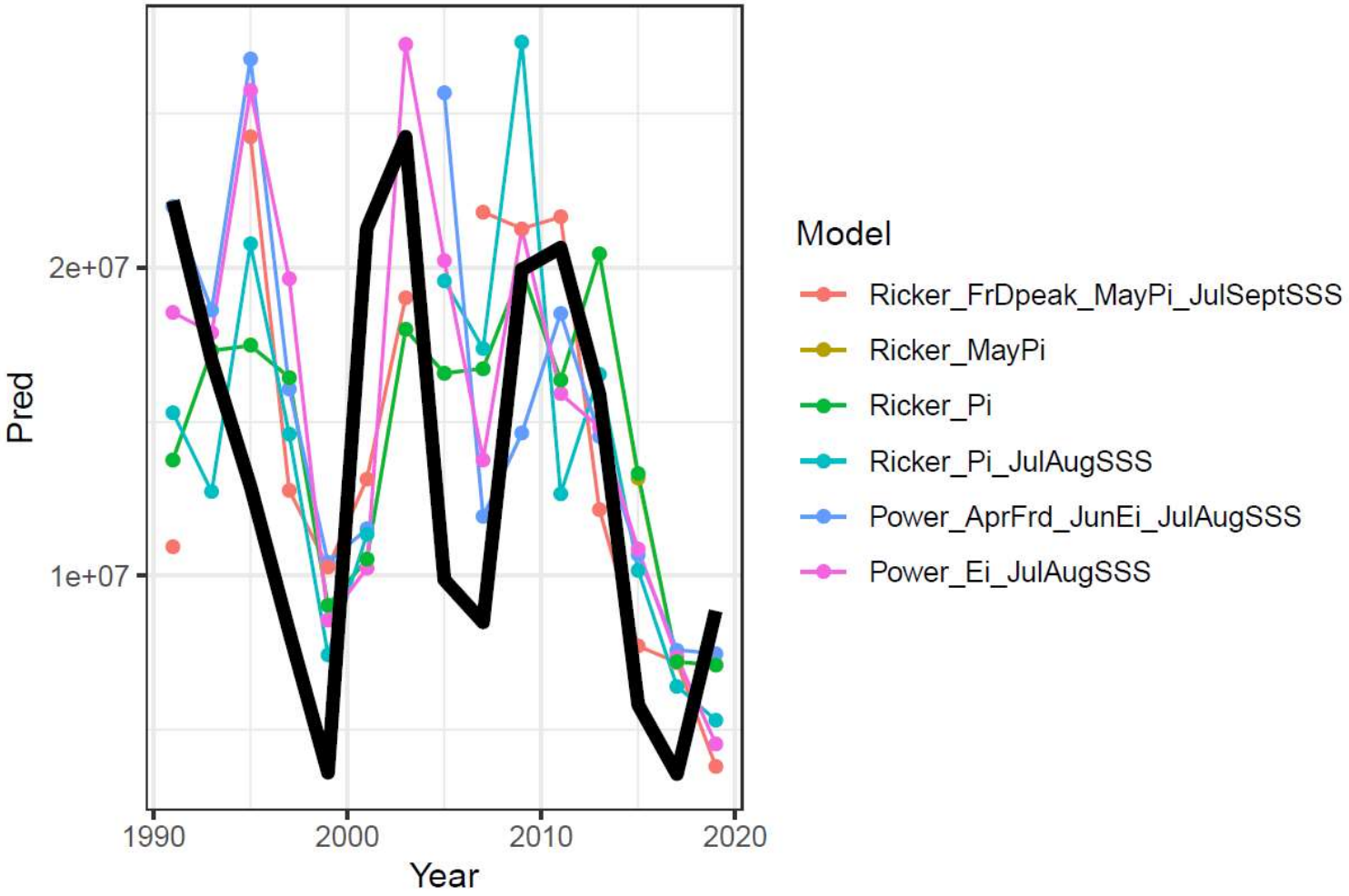
Pink Retrospective – Results

Model	MAE	MPE	RMSE	MAPE	MAAPE	MASE	Rank
Ricker_JunFrD_MayPi	2,215,329	0.2952	2,600,350	0.3895	0.3335	0.3959	1
Ricker_FrDpeak_MayPi_JulSeptSSS	3,062,383	0.1175	3,382,807	0.4395	0.3815	0.5473	2
Power_AprFrd_JunEi_JulAugSSS	2,754,914	0.3247	3,106,507	0.4629	0.3776	0.4924	3
Ricker_FrDpeak_MayPi	3,685,655	0.1822	3,863,152	0.4679	0.4109	0.6587	4
Ricker_FrDpeak_Pi	3,721,972	0.1869	3,885,342	0.4735	0.4161	0.6652	5
Ricker_Pi_JulAugSSS	3,878,908	0.1610	4,558,768	0.4757	0.4219	0.6933	6
Power_Ei_JulAugSSS	3,793,279	0.2298	4,050,493	0.5433	0.4555	0.6779	7
Ricker_MayPi	4,319,675	0.4328	4,682,326	0.5957	0.4755	0.7720	8
Power	3,910,529	0.6635	5,165,574	0.7356	0.4577	0.6989	9
Ricker_Pi	4,351,807	0.4388	4,730,363	0.6017	0.4778	0.7778	9
Forecast (Power-Juv-SSS)	5,547,643	0.3804	5,904,444	0.7903	0.5833	0.9915	11
Ricker_JunPi	5,343,577	0.5910	5,988,671	0.7931	0.5589	0.9550	12
RS1	6,684,374	0.2414	9,603,573	0.5676	0.4661	1.1947	12
RS2	6,104,493	0.3268	6,630,572	0.6278	0.5384	1.0910	12
Power_JulAugSSS	6,100,027	0.5587	6,704,758	0.9128	0.5783	1.0902	15
Ricker	5,692,290	0.9298	7,115,179	1.0309	0.5501	1.0173	16
Ricker_JulAugSSS	5,981,619	0.9022	7,445,716	1.0637	0.5548	1.0691	17
Ricker_JulPi	6,157,355	0.6438	6,869,699	0.8602	0.6101	1.1005	18
MRS_Log	12,412,767	1.4355	14,025,967	1.4935	0.8208	2.2184	19
MRS	19,156,877	2.2236	21,918,110	2.2236	0.9615	3.4238	20

Pink Retrospective – Results (Top 6 models)



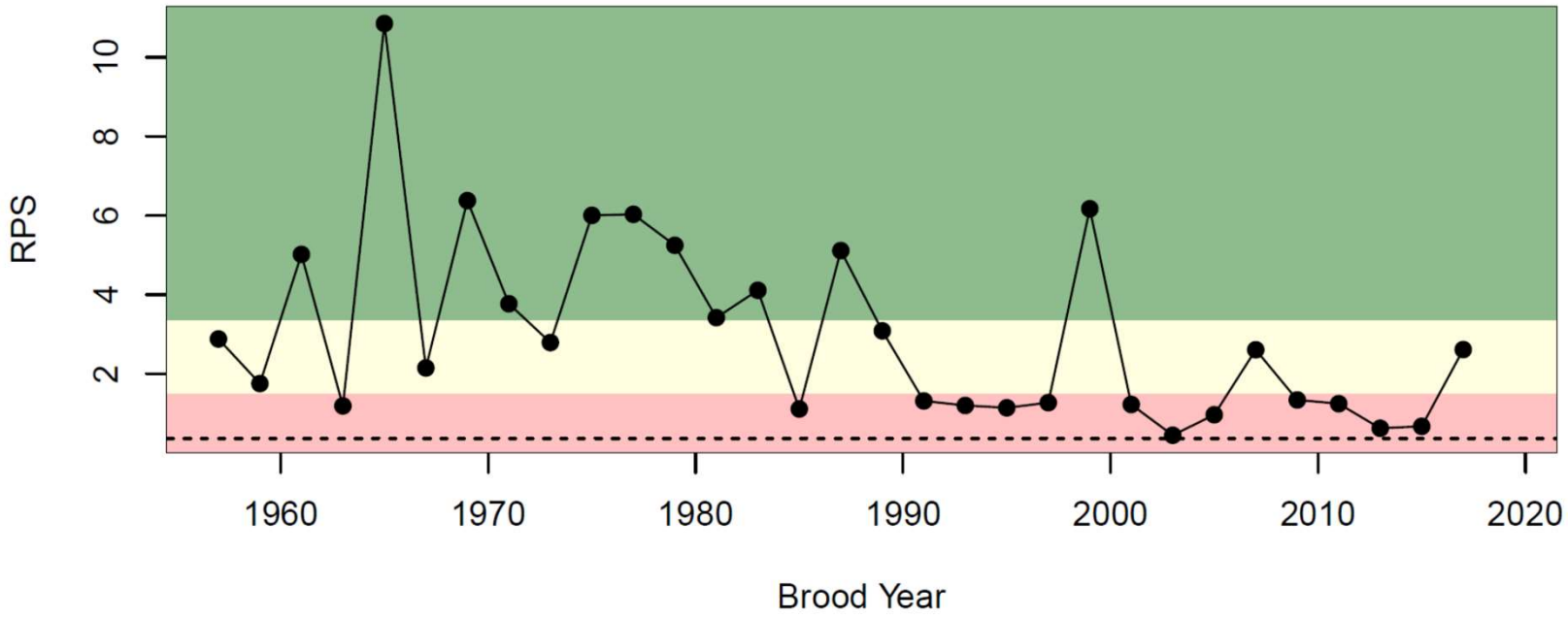
Pink Retrospective – 15-yr Results



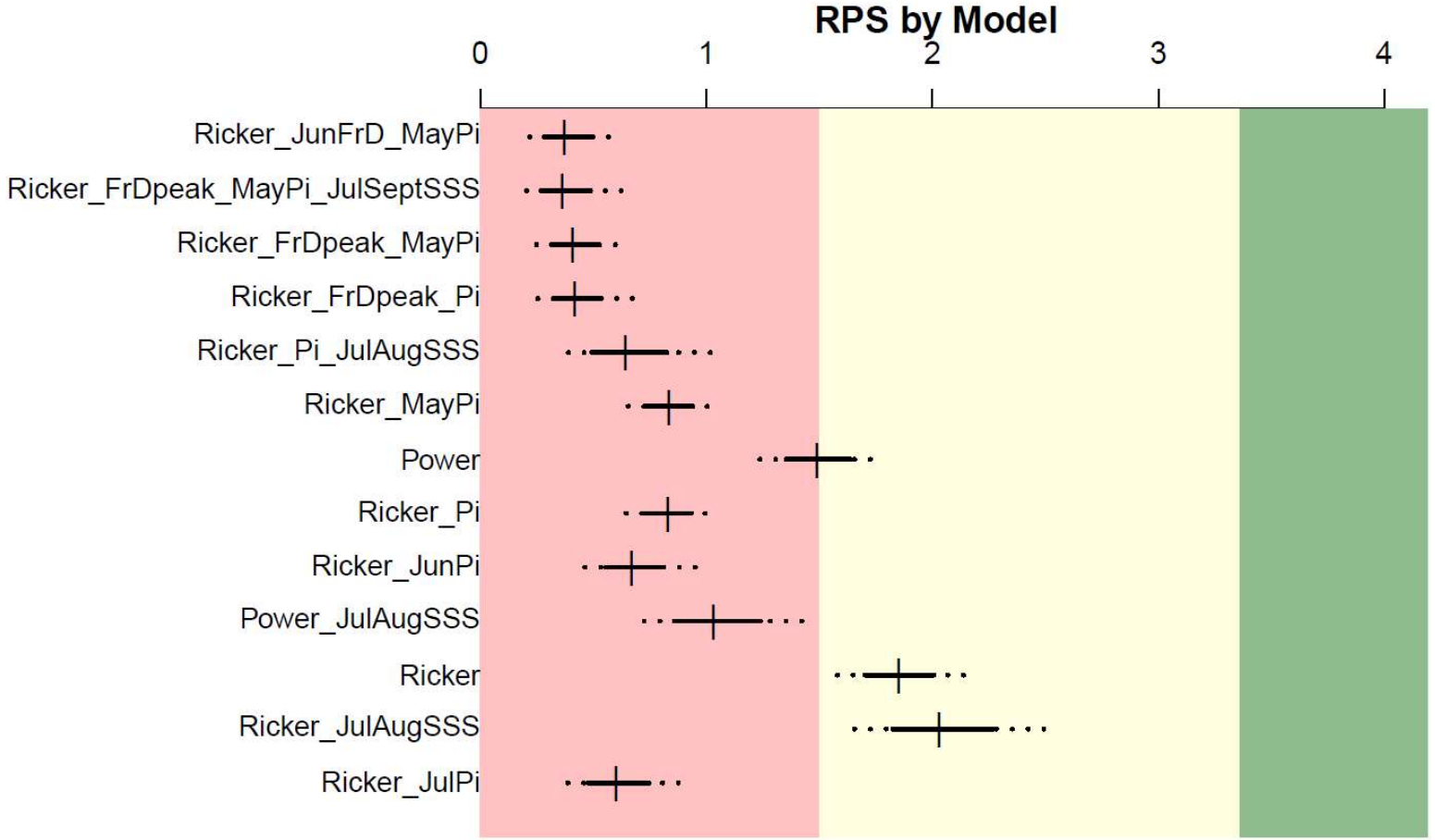
Pink Retrospective – 2021 Predictions

Model	P10	P25	P50	P75	P90	5-year Rank	15-year Rank	R^2
Ricker_JunFrD_MayPi	1,813,750	2,341,050	3,072,791	4,032,889	5,221,185	1	12	0.36
Ricker_FrDpeak_MayPi_JulSeptSSS	1,701,366	2,228,876	3,009,002	4,050,516	5,374,877	2	1	0.42
Ricker_FrDpeak_MayPi	2,062,315	2,620,661	3,393,834	4,365,215	5,485,414	4	12	0.42
Ricker_FrDpeak_Pi	2,109,988	2,676,259	3,454,490	4,441,571	5,599,103	5	15	0.32
Ricker_Pi_JulAugSSS	3,232,279	4,102,581	5,303,810	6,858,239	8,864,516	6	4	0.37
Ricker_MayPi	5,434,465	6,107,042	6,909,518	7,811,357	8,733,293	8	2	0.35
Power	10,275,696	11,236,281	12,375,142	13,609,317	14,768,093	9	10	0.23
Ricker_Pi	5,358,338	6,075,844	6,875,717	7,749,926	8,646,419	9	3	0.35
Ricker_JunPi	3,840,674	4,603,712	5,564,406	6,720,132	7,955,593	12	7	0.29
Power_JulAugSSS	6,022,042	7,124,191	8,565,230	10,288,742	12,145,423	15	14	0.25
Ricker	13,119,704	14,133,119	15,358,942	16,663,795	17,971,440	16	9	0.21
Ricker_JulAugSSS	13,754,998	15,156,485	16,866,995	18,871,862	20,807,950	17	11	0.20
Ricker_JulPi	3,216,768	3,963,836	4,994,308	6,191,920	7,590,645	18	8	0.26

Pink Retrospective – Historical Productivity



Pink Retrospective – Recent Productivity

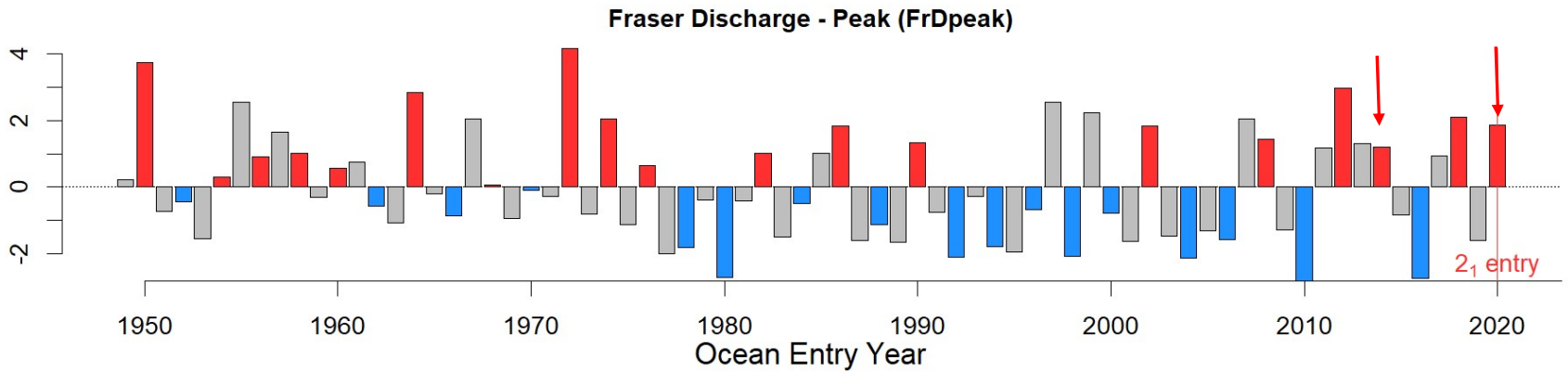


Pink Retrospective – Additional Diagnostic

- As an additional diagnostic, we wanted to go back and look how each candidate model performed in a year with similar environmental conditions
- Brood years with most similar ocean entry year conditions were 1973, 2013, 1985, 1957
- Decided to check BY 2013, since it is most recent, and model fit would most closely resemble model fit used in 2021

Pink Retrospective – Additional Diagnostic

2013 Brood / 2015 Return Comparison:



Pink Retrospective – Additional Diagnostic

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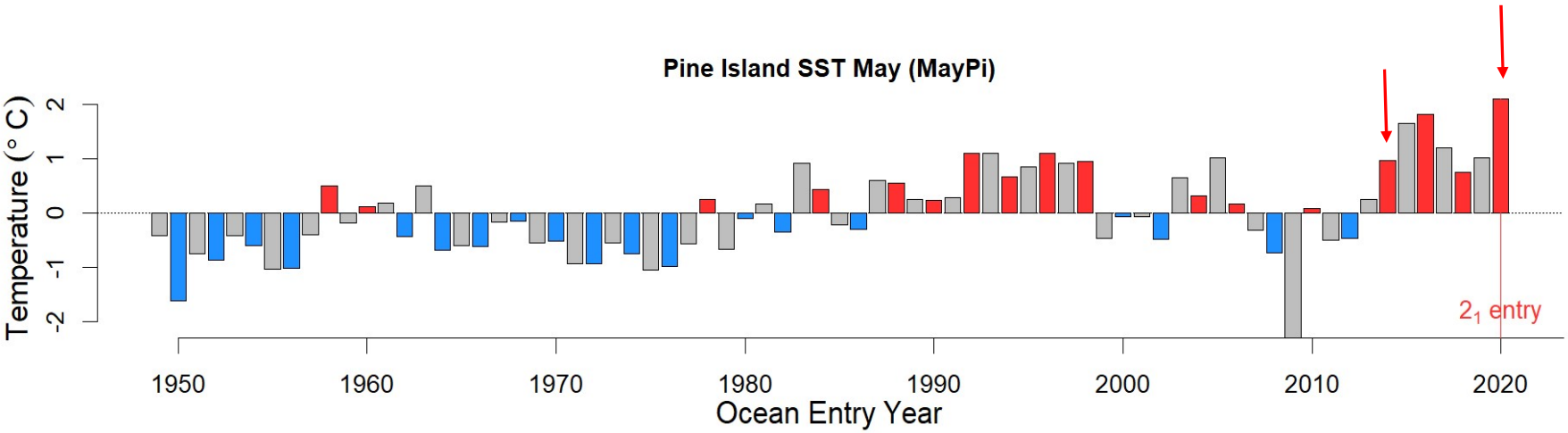

Pink Retrospective – Additional Diagnostic

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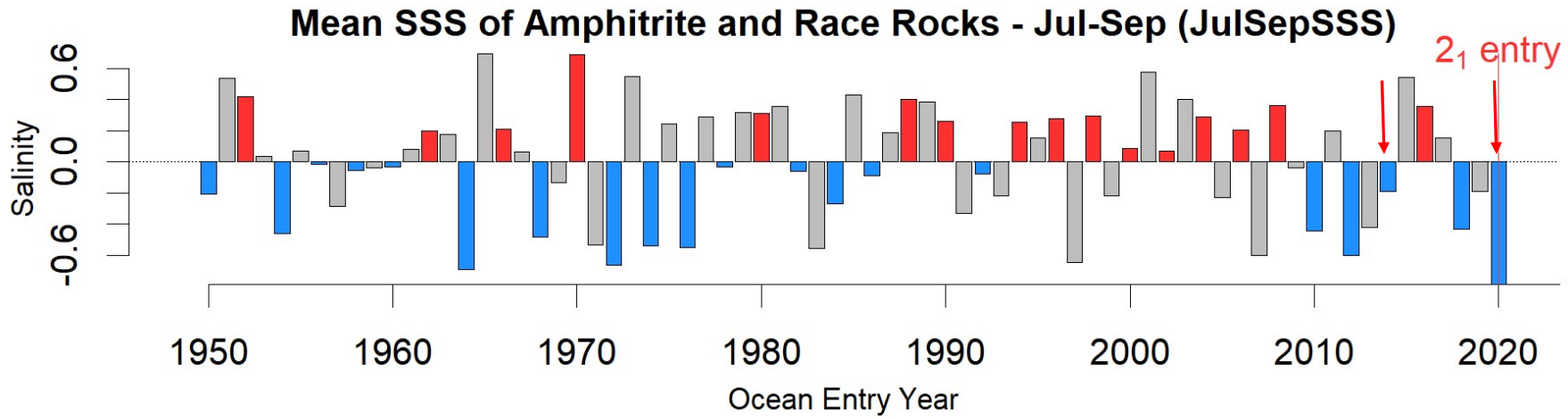
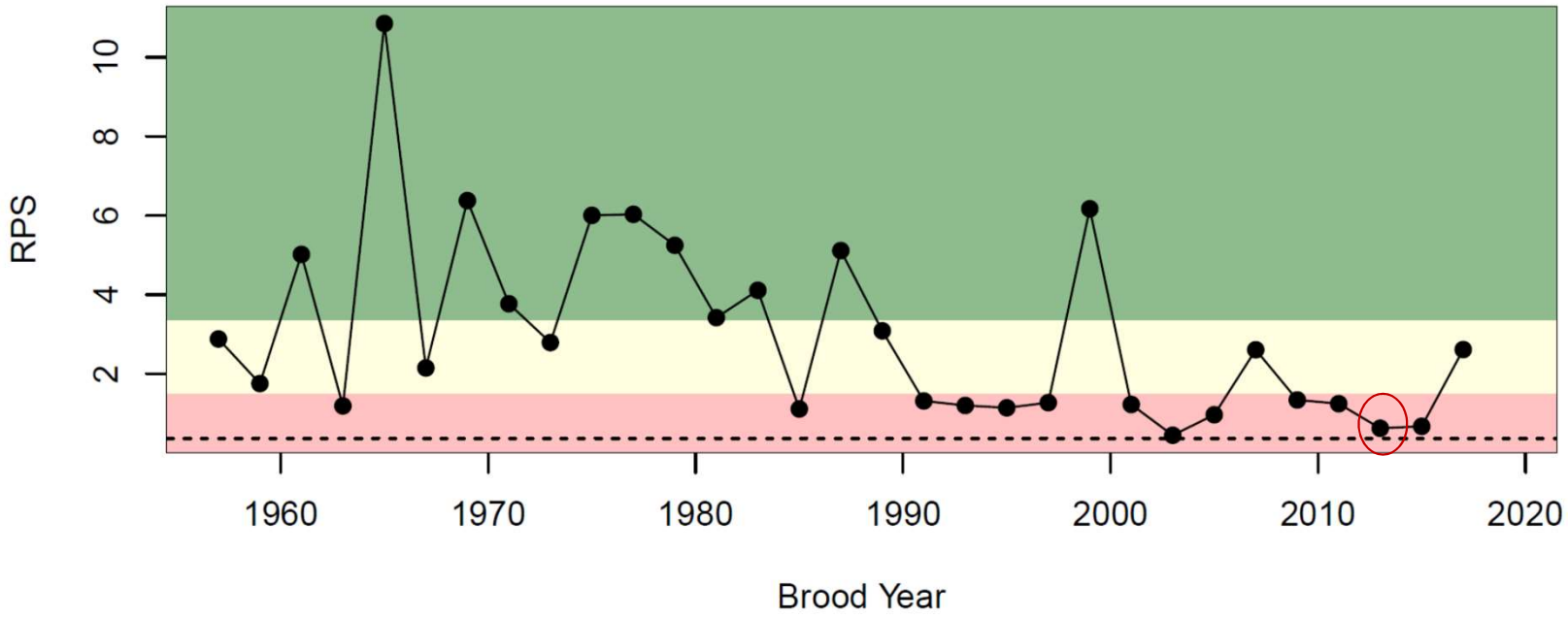


Pink Retrospective – Recent Productivity



Pink Retrospective – Additional Diagnostic

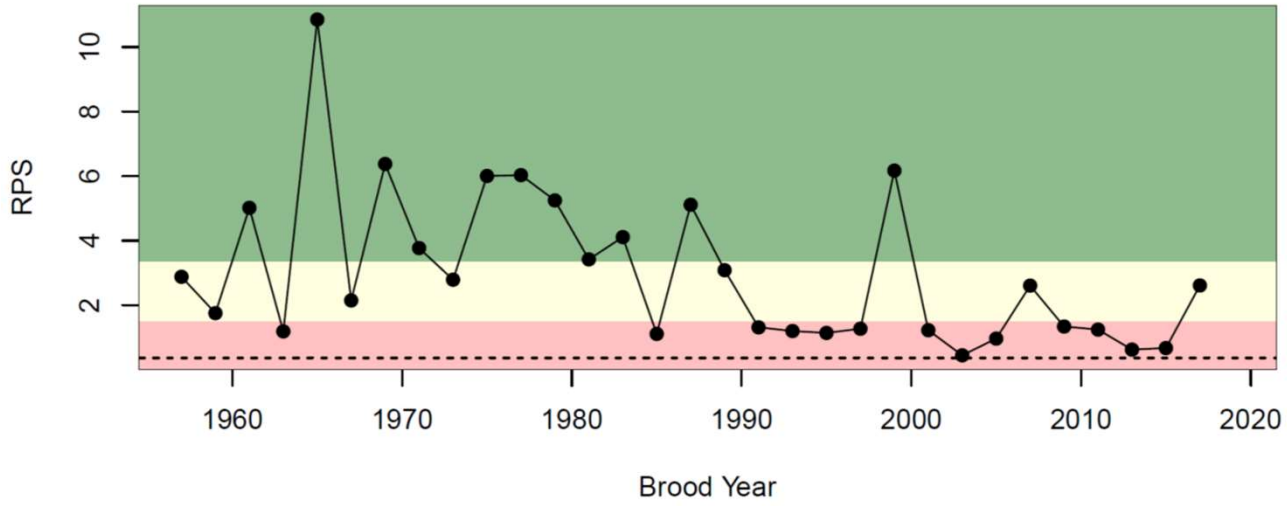
Model	Pred	Return	5-year Rank	15-year Rank	R^2
Ricker_JunFrD_MayPi	10,081,281	5,812,085	1	12	0.36
Ricker_FrDpeak_MayPi_JulSeptSSS	7,715,430	5,812,085	2	1	0.42
Power_AprFrD_JunEi_JulAugSSS	10,680,401	5,812,085	3	5	0.56
Ricker_FrDpeak_MayPi	7,960,467	5,812,085	4	12	0.42
Ricker_FrDpeak_Pi	8,143,136	5,812,085	5	15	0.32
Ricker_Pi_JulAugSSS	10,177,072	5,812,085	6	4	0.37
Power_Ei_JulAugSSS	10,854,518	5,812,085	7	6	0.49
Ricker_MayPi	13,173,288	5,812,085	8	2	0.35
Power	14,262,558	5,812,085	9	10	0.23
Ricker_Pi	13,316,455	5,812,085	9	3	0.35
Ricker_JunPi	16,321,999	5,812,085	12	7	0.29

Pink Retrospective – 2021 Predictions

Model	P10	P25	P50	P75	P90	5-year Rank	15-year Rank	R^2
Ricker_JunFrD_MayPi	1,813,750	2,341,050	3,072,791	4,032,889	5,221,185	1	12	0.36
Ricker_FrDpeak_MayPi_JulSeptSSS	1,701,366	2,228,876	3,009,002	4,050,516	5,374,877	2	1	0.42
Ricker_FrDpeak_MayPi	2,062,315	2,620,661	3,393,834	4,365,215	5,485,414	4	12	0.42
Ricker_FrDpeak_Pi	2,109,988	2,676,259	3,454,490	4,441,571	5,599,103	5	15	0.32
Ricker_Pi_JulAugSSS	3,232,279	4,102,581	5,303,810	6,858,239	8,864,516	6	4	0.37
Ricker_MayPi	5,434,465	6,107,042	6,909,518	7,811,357	8,733,293	8	2	0.35
Power	10,275,696	11,236,281	12,375,142	13,609,317	14,768,093	9	10	0.23
Ricker_Pi	5,358,338	6,075,844	6,875,717	7,749,926	8,646,419	9	3	0.35
Ricker_JunPi	3,840,674	4,603,712	5,564,406	6,720,132	7,955,593	12	7	0.29
Power_JulAugSSS	6,022,042	7,124,191	8,565,230	10,288,742	12,145,423	15	14	0.25
Ricker	13,119,704	14,133,119	15,358,942	16,663,795	17,971,440	16	9	0.21
Ricker_JulAugSSS	13,754,998	15,156,485	16,866,995	18,871,862	20,807,950	17	11	0.20
Ricker_JulPi	3,216,768	3,963,836	4,994,308	6,191,920	7,590,645	18	8	0.26

Key Takeaways for 2021 (Pink)

- Despite fairly narrow confidence bounds, this year's forecast should be approached with caution, due to highly uncertain escapement time series
- All environmental signals are indicating poor survival for 2019 cohort, which our chosen model is picking up on
- When comparing the chosen forecast model to historical productivity, it can be viewed as quite precautionary
  - productivity implied by the forecast is near historical lows, reflecting historically poor environmental conditions faced by 2019 cohort



Acknowledgements

Data Contributors

- Biological Data: Steve Latham, Scott Decker, Tanya Vivian, Tracy Cone, Brian Leaf, Lucas Pon, Dan Selbie, Jennifer Sandher, Doug Lofthouse, Katie Davidson

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Model Contributors

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Other Support

- Timber Whitehouse, Jamie Scroggie, Karen Richards, Judy Maunsell, Matthew Townsend, Matthew Parslow, Les Jantz, Fiona Martens, Yunbo Xie

+ The FRP Technical Committee!

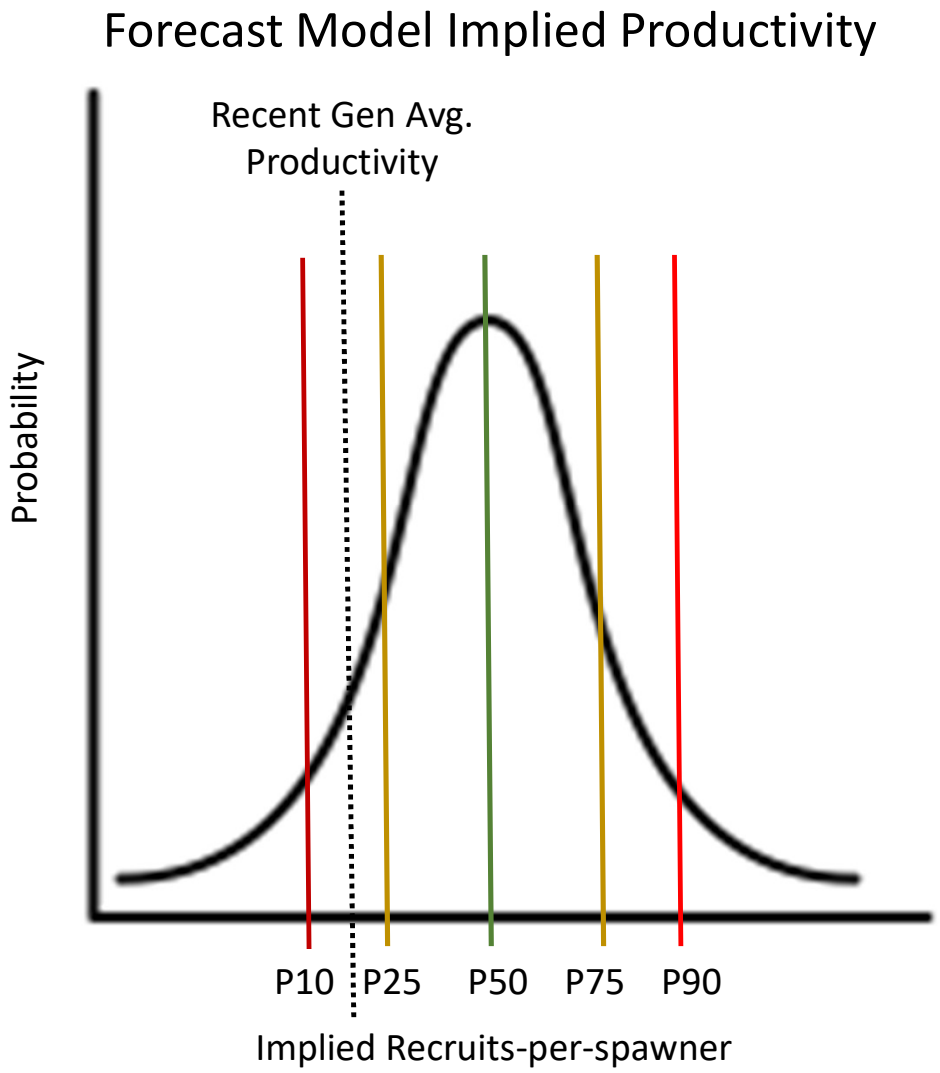
Questions?

Extra Slides

Additional Diagnostic

- Where in the forecast model's posterior distribution does recent generational average productivity fall?
- Also provide for run-timing groups, and total

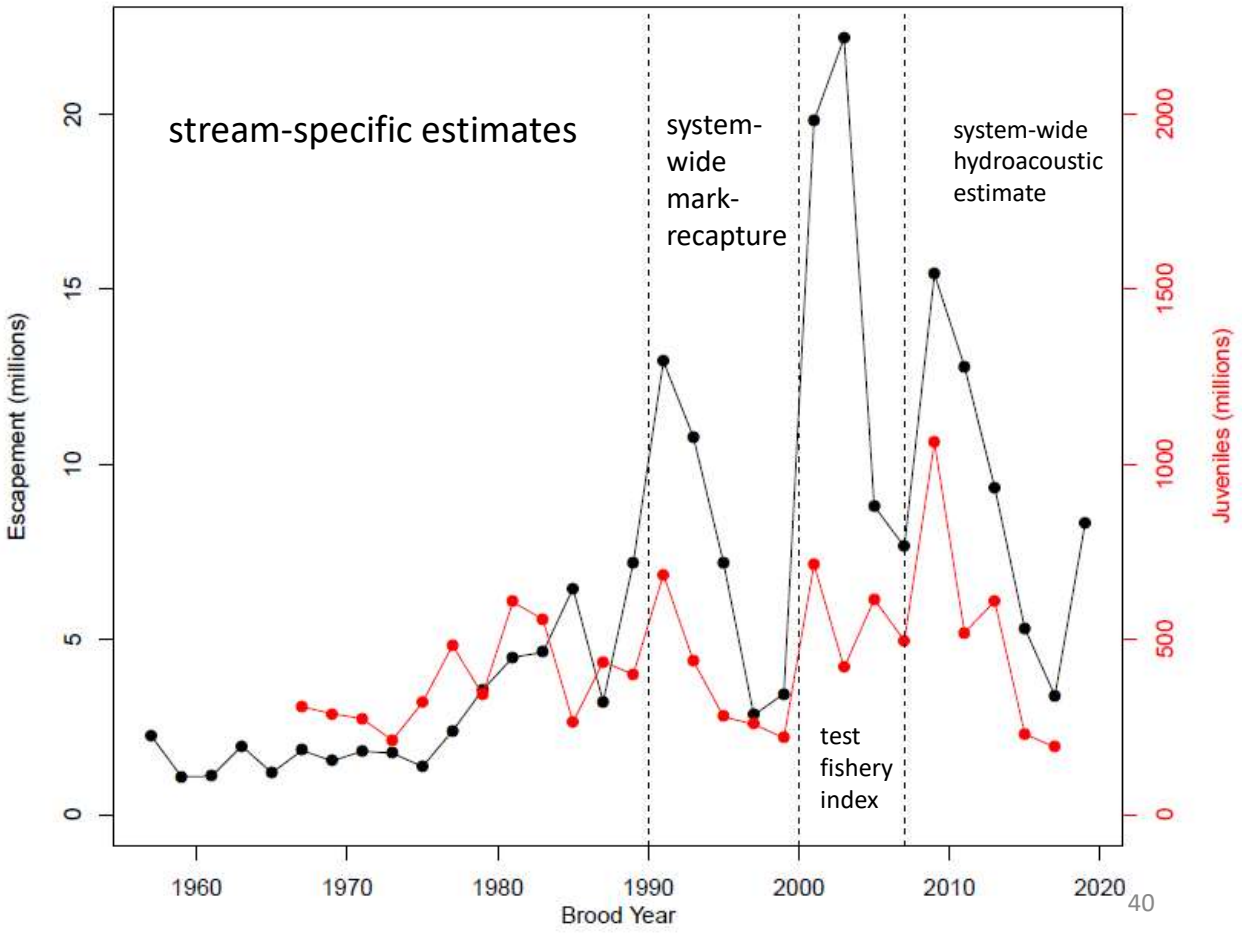
Provides further context to forecast users



Stock	Age	Forecast Age Prop.	Geo. Average R/EFS	Peak Geo. Avg. R/EFS	Min Geo. Avg. R/EFS	Recent Gen. R/EFS	Posterior Quantile of Recent Gen. R/EFS	2021 Forecast R/EFS by Probability Level				
								0.10	0.25	0.50	0.75	0.90
Early Stuart	**4**	**93%**	**5.81**	**24.47**	**1.39**	**1.55**	**0.29**	**0.92**	**1.40**	**2.31**	**3.95**	**6.33**
Early Summer	**4**	**55%**				**0.90**	**0.27**	**0.48**	**0.84**	**1.62**	**3.18**	**5.93**
	5	**45%**				**0.29**	**0.25**	**0.17**	**0.29**	**0.51**	**0.95**	**1.70**
Bowron	4	86%	5.91	20.42	0.80	1.13	0.25	0.56	1.14	2.36	4.75	8.68
Upper Barriere	4	67%	5.28	53.49	0.65	0.66	0.21	0.37	0.92	2.24	4.76	10.24
	5	33%	0.40	2.10	0.04	0.04	0.05	0.20	0.35	0.68	1.35	2.46
Gates	4	70%	8.12	41.01	0.99	0.99	0.27	0.43	0.88	1.93	4.25	8.64
	5	30%	0.37	3.71	0.06	0.12	0.08	0.17	0.34	0.74	1.63	3.32
Nadina	4	71%	5.36	13.47	1.35	1.35	0.08	1.69	2.98	5.73	11.59	21.56
	5	29%	0.47	2.65	0.02	0.44	0.59	0.11	0.19	0.34	0.63	1.12
Pitt	4	28%	1.08	7.32	0.08	0.08	0.07	0.15	0.29	0.59	1.16	1.90
	5	72%	3.04	10.38	0.49	0.49	0.21	0.36	0.56	0.91	1.51	2.33
Scotch	4	97%	5.42	21.50	1.16	1.18	0.27	0.49	1.04	2.38	5.26	11.80
Seymour	4	100%	6.64	29.24	1.13	1.71	0.11	1.50	2.62	4.89	9.43	18.52
Chilliwack	4	52%	1.59	5.29	0.75	0.77	0.04	1.15	1.57	2.11	2.79	3.63
	5	48%	0.38	1.64	0.16	0.16	0.49	0.02	0.06	0.17	0.45	1.16
Summer	**4**	**96%**				**1.02**	**0.25**	0.48	1.00	2.23	4.79	9.75
Chilko	4	92%	5.87	25.28	0.67	0.67	0.27	0.30	0.61	1.34	2.91	5.88
Late Stuart	4	99%	8.05	57.25	2.07	4.63	0.58	0.67	1.49	3.42	7.32	15.42
Quesnel	4	100%	7.45	31.38	0.57	1.35	0.11	1.14	2.44	5.55	11.87	23.90
Stellako	4	79%	6.05	16.32	0.71	1.40	0.59	0.32	0.54	1.08	2.07	3.79
	5	21%	0.71	3.32	0.03	0.15	0.05	0.32	0.54	0.92	1.61	2.67
Harrison	4	93%	2.96	19.69	0.45	0.45	0.36	0.11	0.25	0.65	1.64	3.75
Raft	4	66%	4.84	14.31	0.30	0.30	0.07	0.55	1.10	2.20	4.70	9.03
	5	34%	1.21	6.78	0.20	0.20	0.12	0.16	0.33	0.68	1.40	2.76
Late	**4**	**93%**				**0.77**	**0.08**	**1.02**	**1.87**	**3.69**	**7.39**	**13.55**
Cultus (R/smolt)	4	99%	0.033	0.059	0.009	0.009	0.31	0.003	0.007	0.015	0.033	0.066
Late Shuswap	4	100%	4.52	21.23	0.21	1.06	0.11	0.91	1.86	4.09	9.21	17.66
Portage	4	100%	9.52	69.07	0.62	0.62	0.09	0.80	1.72	4.01	9.35	20.02
Weaver	4	100%	9.58	41.81	0.82	4.44	0.42	1.60	2.77	5.10	9.41	16.33
Birkenhead	4	59%	4.11	21.53	0.16	0.16	0.07	0.29	0.58	1.28	2.80	5.66
	5	41%	1.48	6.39	0.37	0.37	0.29	0.15	0.30	0.66	1.45	2.93
Total	**4**	**92%**				**1.04**	**0.25**	**0.52**	**1.05**	**2.29**	**4.85**	**9.72**

Pink Salmon Data

- Escapement estimates appear to be higher compared to juveniles since elimination of stream-specific estimates
- But is confounded with freshwater productivity



Pink Retrospective – Results