TRENDS IN SIZE-AT-AGE, SEX RATIOS, AND AGE-AT-RETURN IN HATCHERY AND WILD CHINOOK SALMON ACROSS BC

SUPPLEMENTARY INFORMATION

Photo credit: Eiko Jones

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Photo credit: Nicole Christiansen

AUTHOR'S NOTE

The following figures and tables are provided a supplementary information to the report "An assessment of trends in size-at-age, sex ratios, and age-at-return in Chinook salmon across BC", a component of the BCSRIF funded PSF Hatchery Effectiveness Review. They provide supplemental figures and tables that add additional details to the analysis.

FIGURES

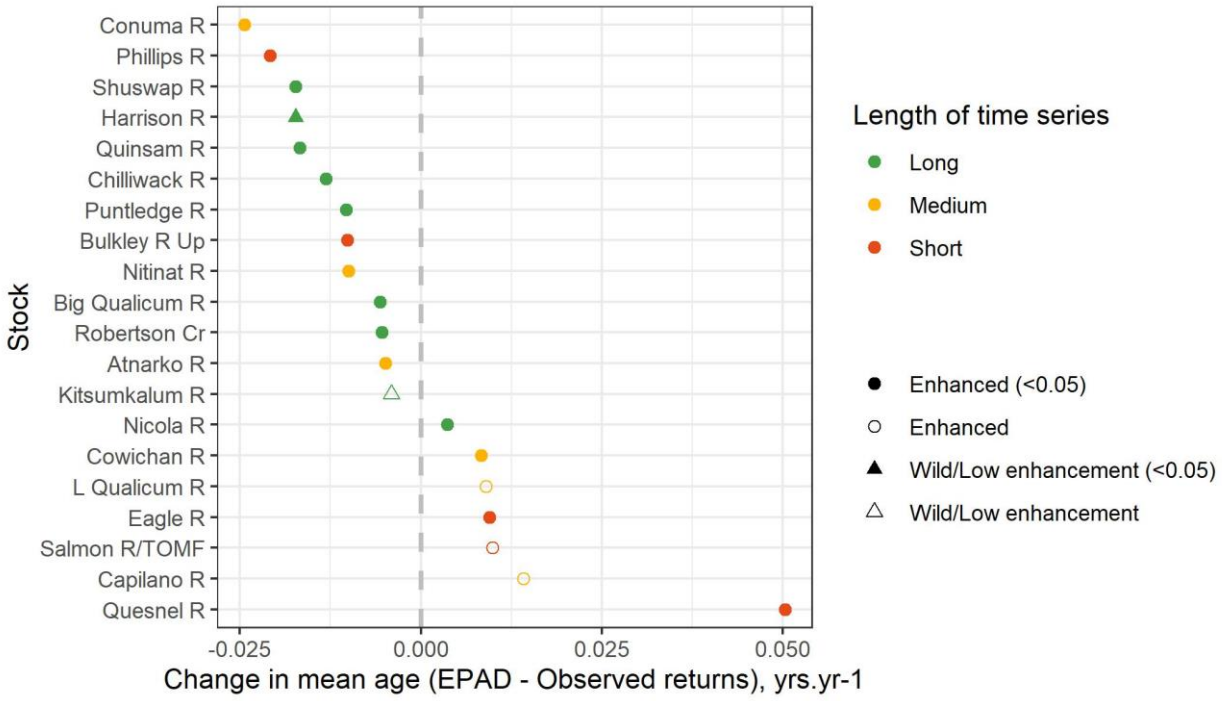

Figure SI 1. Rate plot showing change in mean age from EPADS Observed returns. The length of the time series from which trends were calculated is given by point colour. Statistically significant trends are represented by filled points.

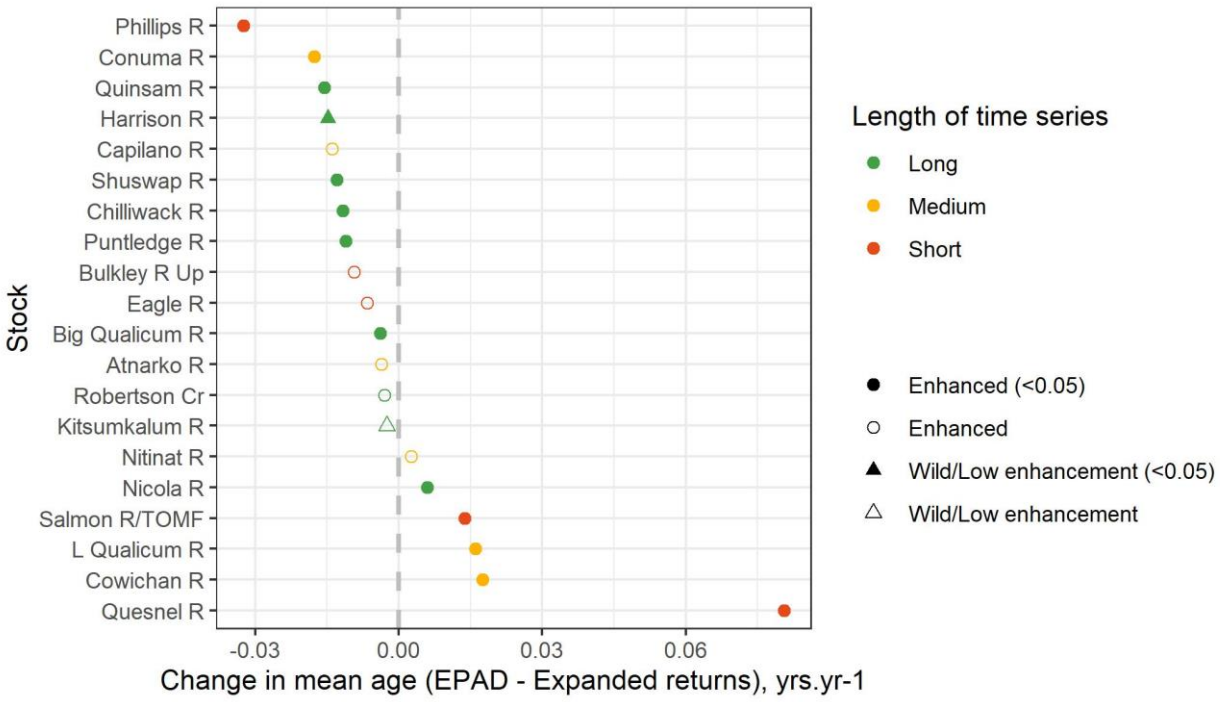

Figure SI 2. Rate plot showing change in mean age from EPADS Expanded returns. The length of the time series from which trends were calculated is given by point color. Statistically significant trends are represented by filled points.

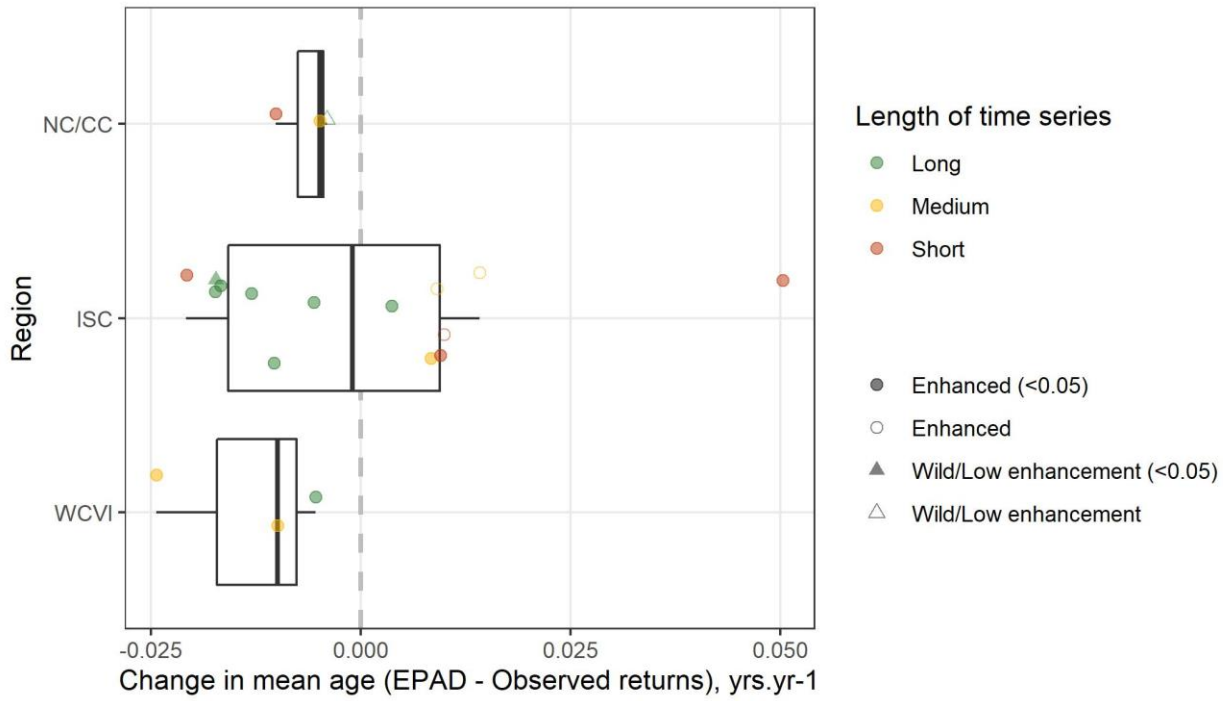

Figure SI 3. Boxplot of change in mean age (Observed returns) grouped by region. The length of the time series from which trends were calculated is given by point colour. Statistically significant trends are represented by filled points.

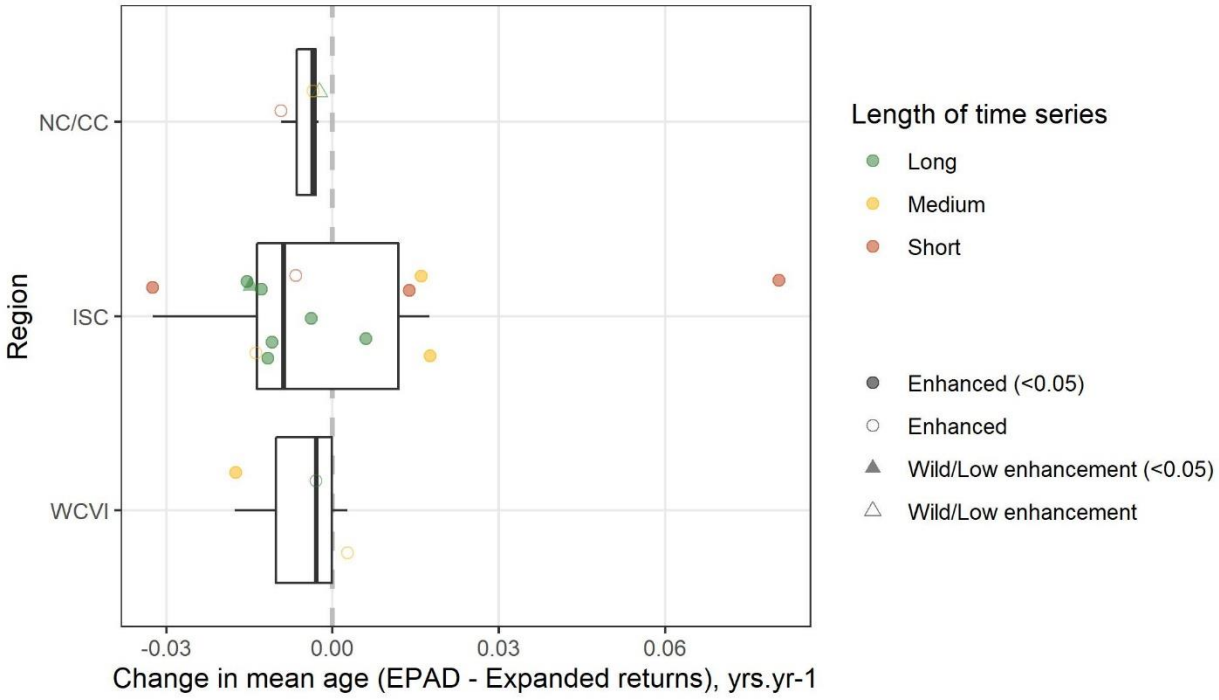

Figure SI 4. Boxplot of change in mean age (Expanded returns) grouped by region. The length of the time series from which trends were calculated is given by point colour. Statistically significant trends are represented by filled points.

Figure SI 5. Time series of mean age calculated from EPADS Observed returns. Annual mean age is shown in black dots, while the number of returns per age class is given by size of colored bubbles. The length of the time series from which trends were calculated is given by point color.

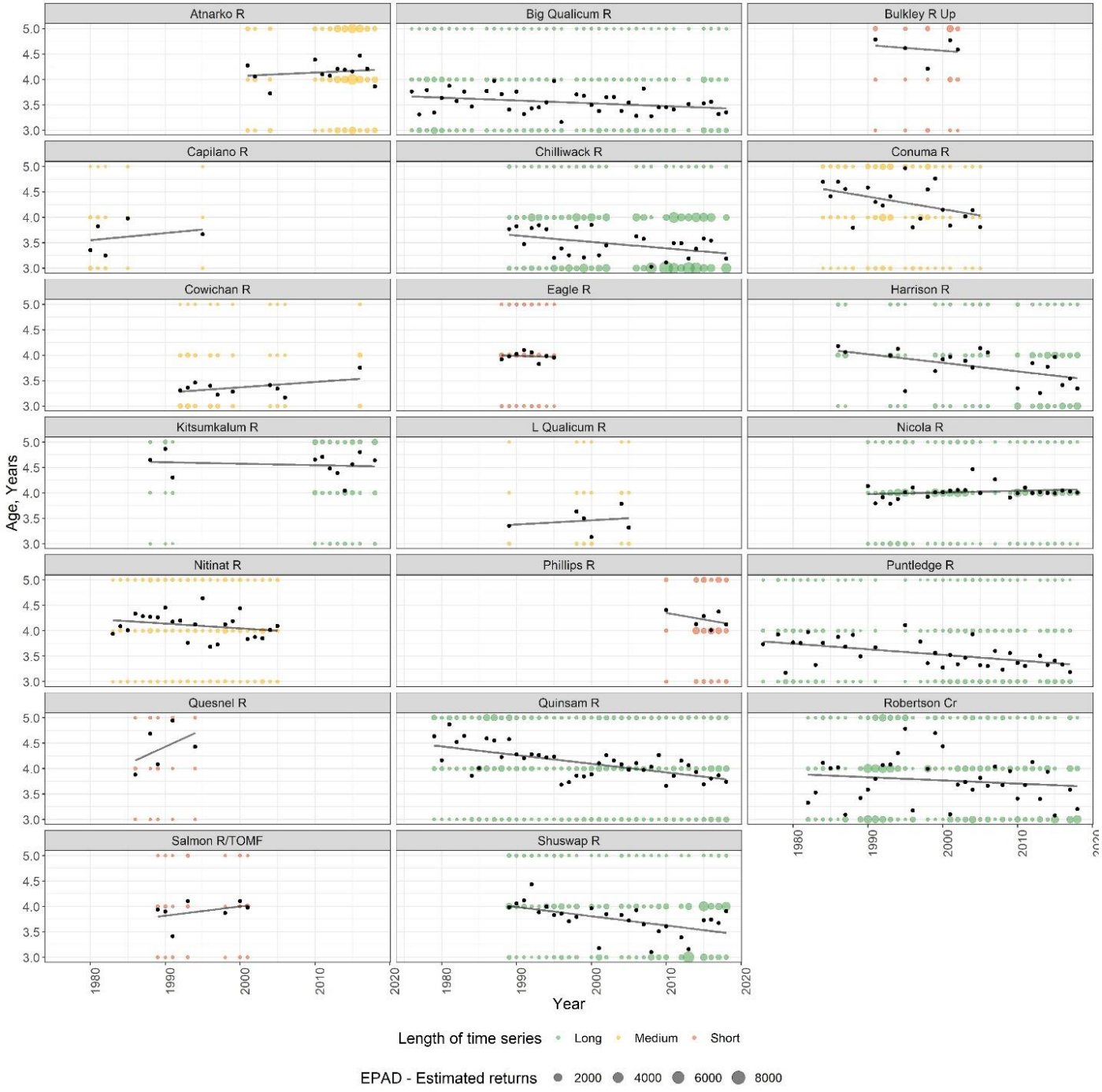

Figure SI 6. Time series of mean age calculated from EPADS Estimated returns. Annual mean age is shown in black dots, while the number of returns per age class is given by size of colored bubbles. The length of the time series from which trends were calculated is given by point color.

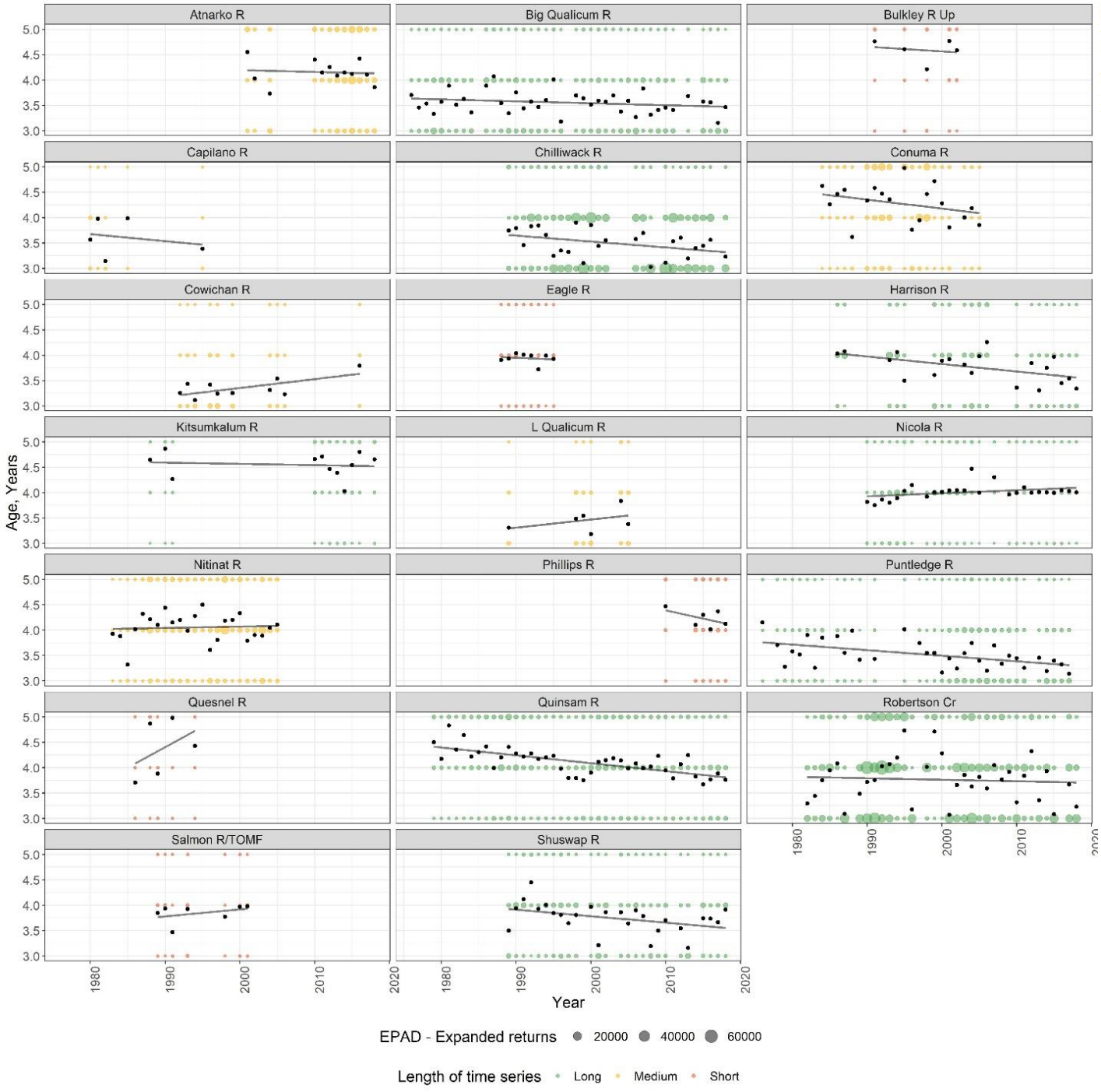

Figure SI 7. Time series of mean age calculated from EPADS Expanded returns. Annual mean age is shown in black dots, while the number of returns per age class is given by size of colored bubbles. The length of the time series from which trends were calculated is given by point color.

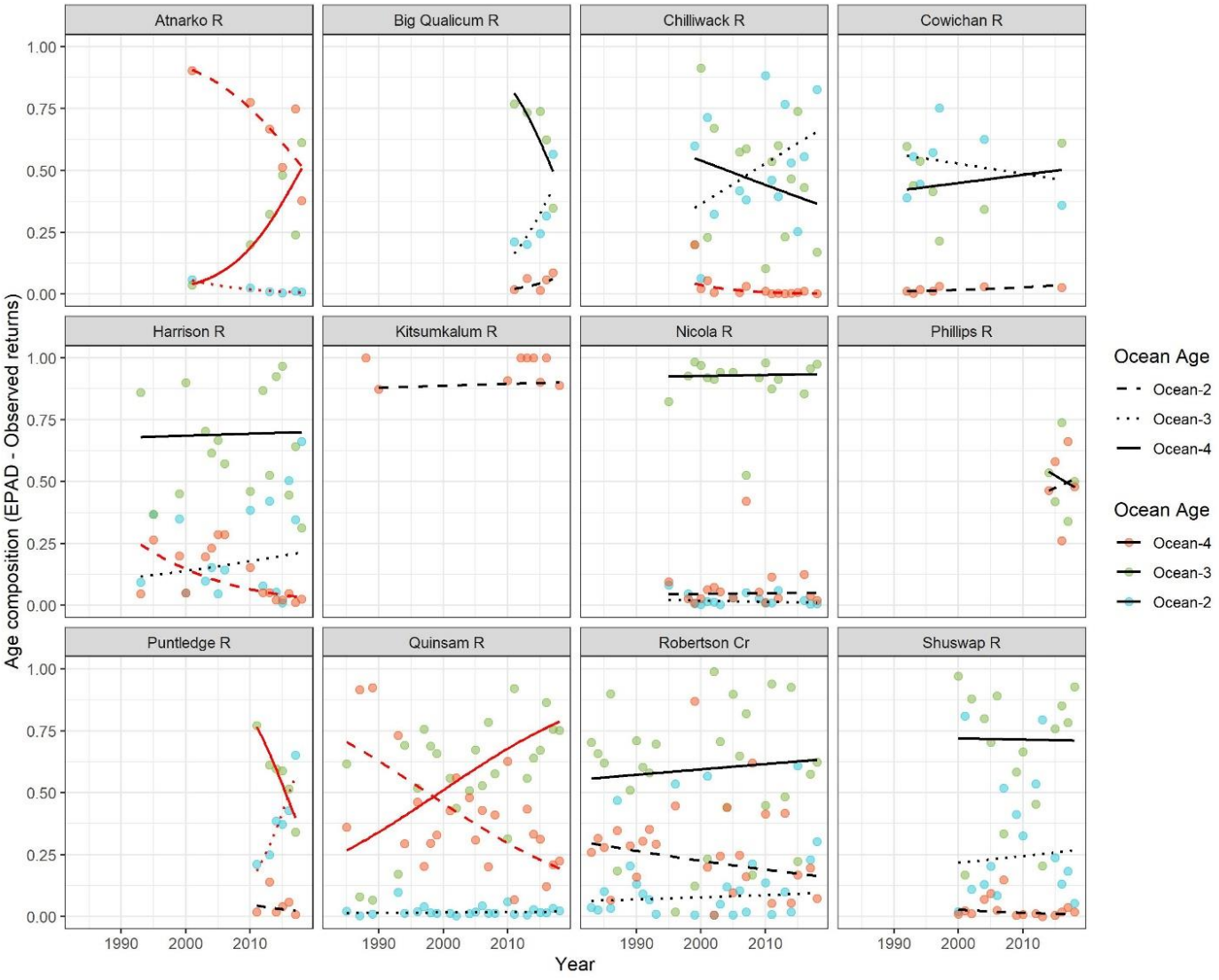

Figure SI 8a. Time series of the relative proportion and respective logistic regressions of female Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Observed returns. Statistically significant trends are indicated by red logistic regression lines.

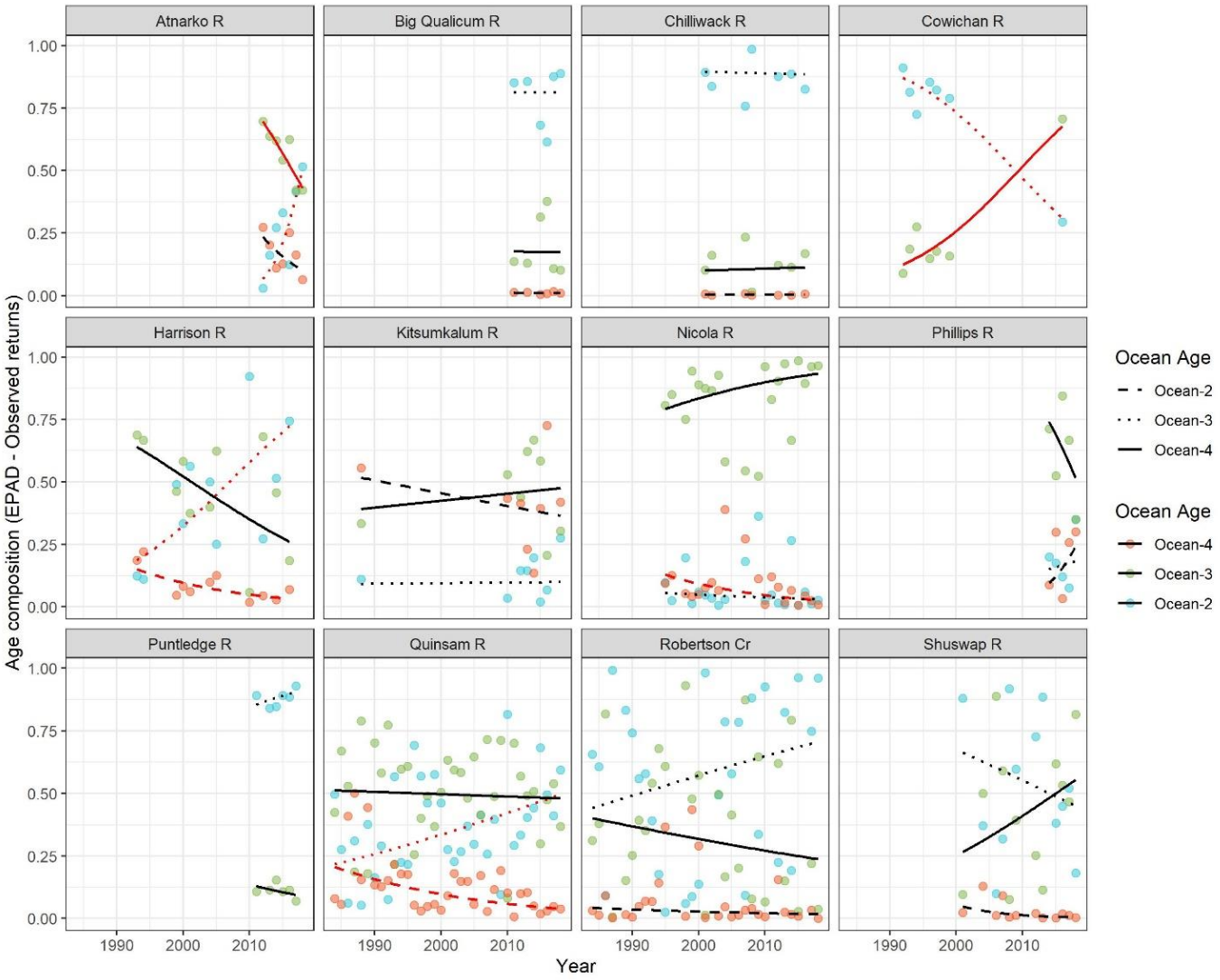

Figure S8b. Time series of the relative proportion and respective logistic regressions of male Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Observed returns. Statistically significant trends are indicated by red logistic regression lines.

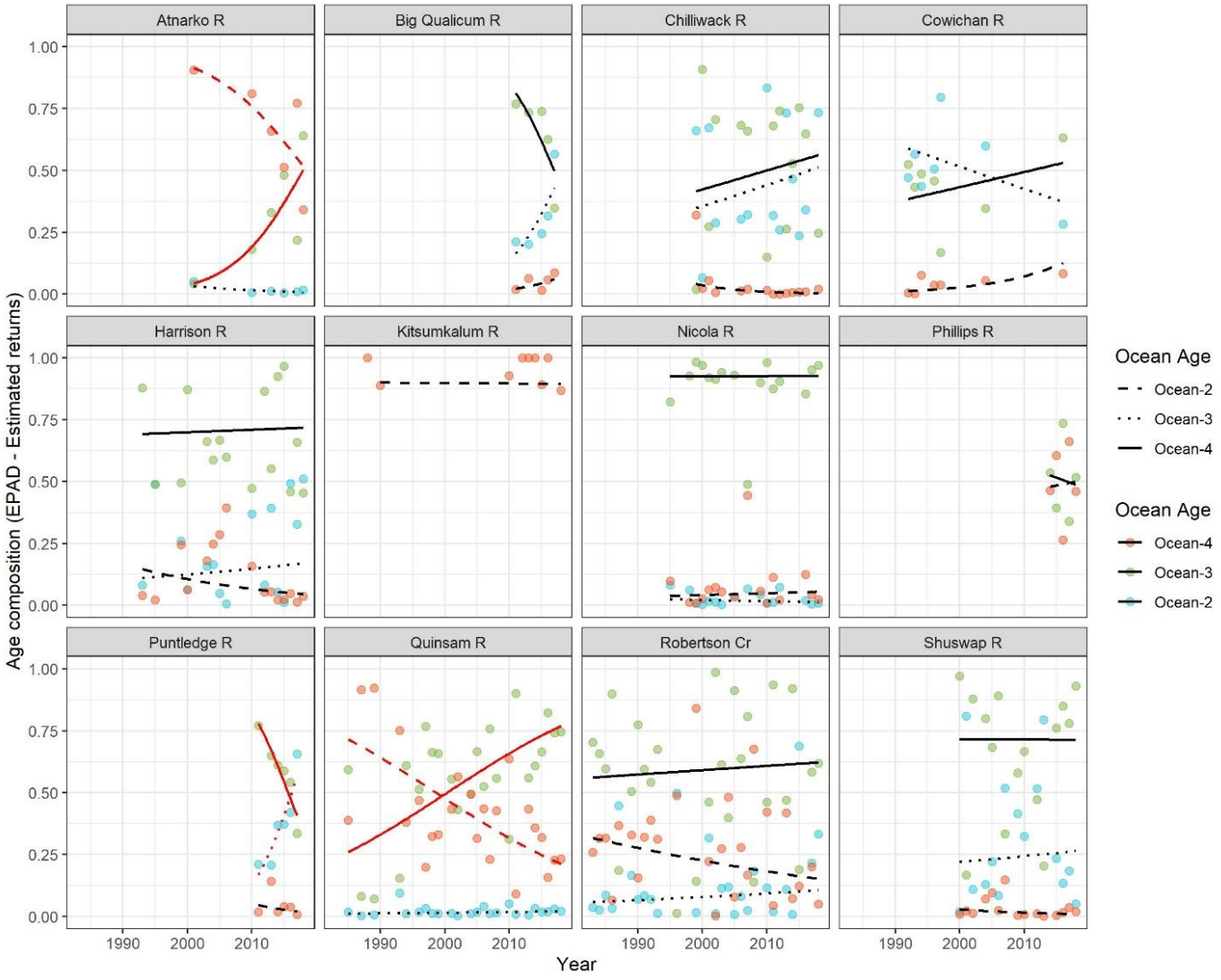

Figure SI 9a. Time series of the relative proportion and respective logistic regressions of female Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Estimated returns. Statistically significant trends are indicated by red logistic regression lines.

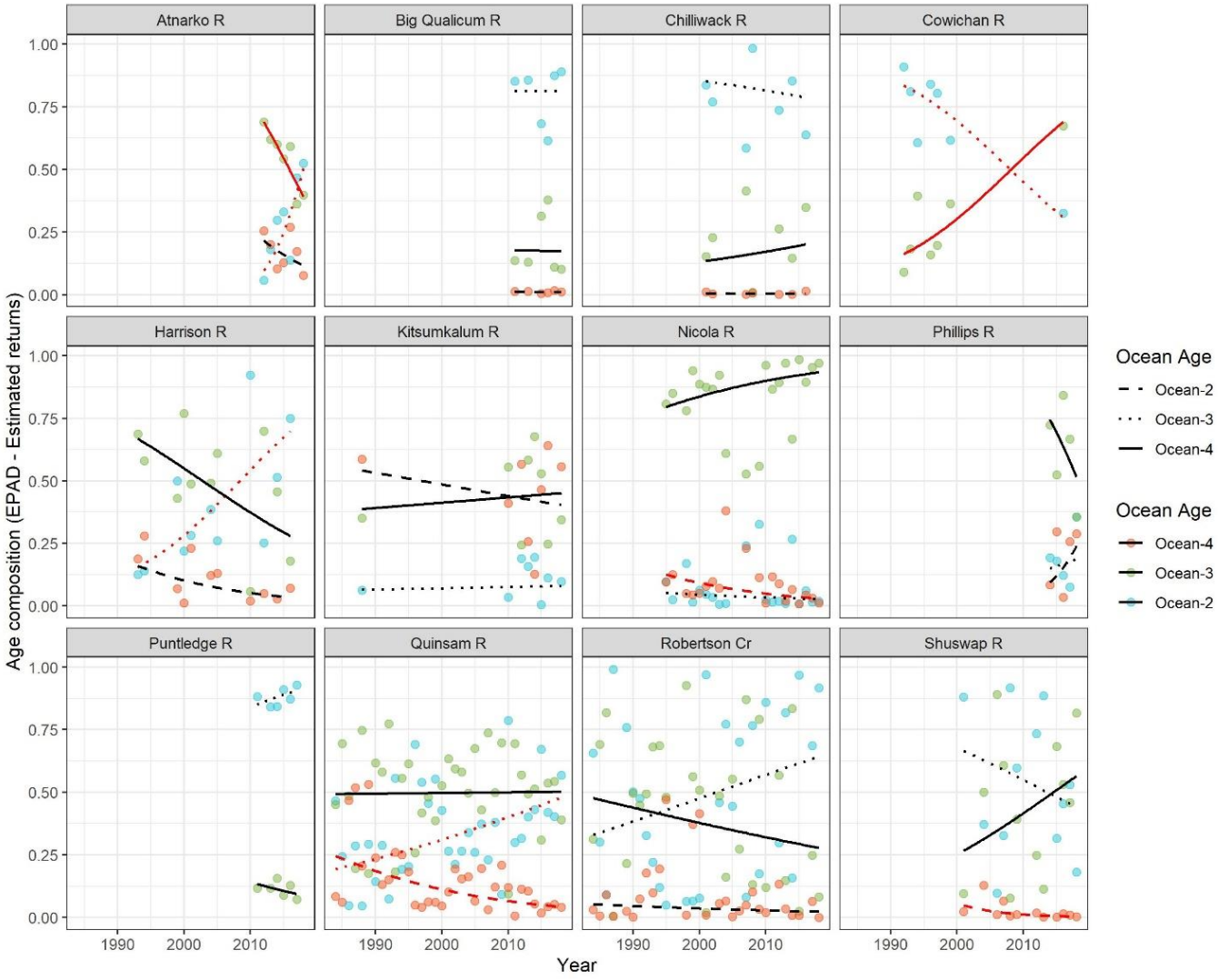

Figure SI 9b. Time series of the relative proportion and respective logistic regressions of male Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Estimated returns. Statistically significant trends are indicated by red logistic regression lines.

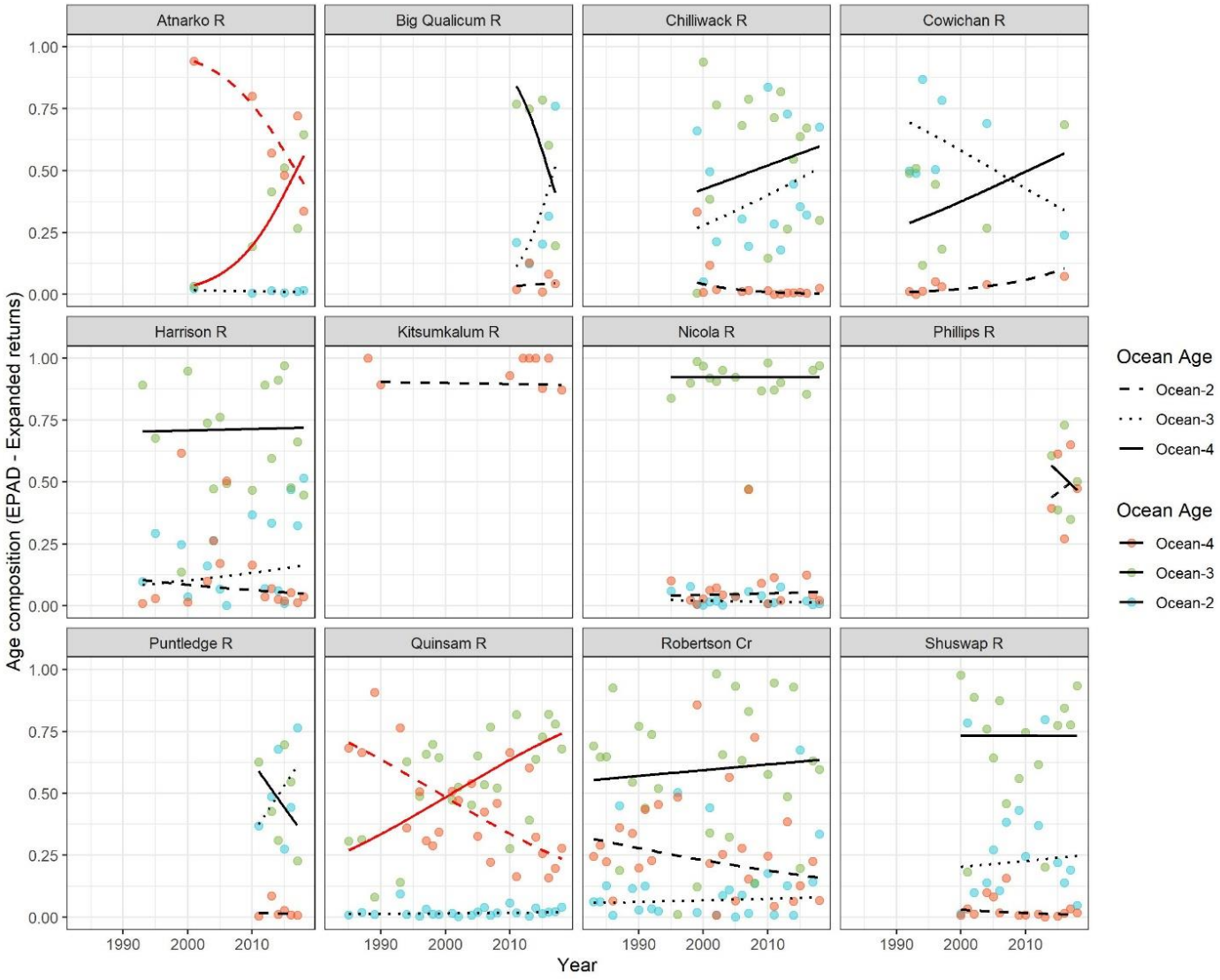

Figure SI 10a. Time series of the relative proportion and respective logistic regressions of female Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Expanded returns. Statistically significant trends are indicated by red logistic regression lines.

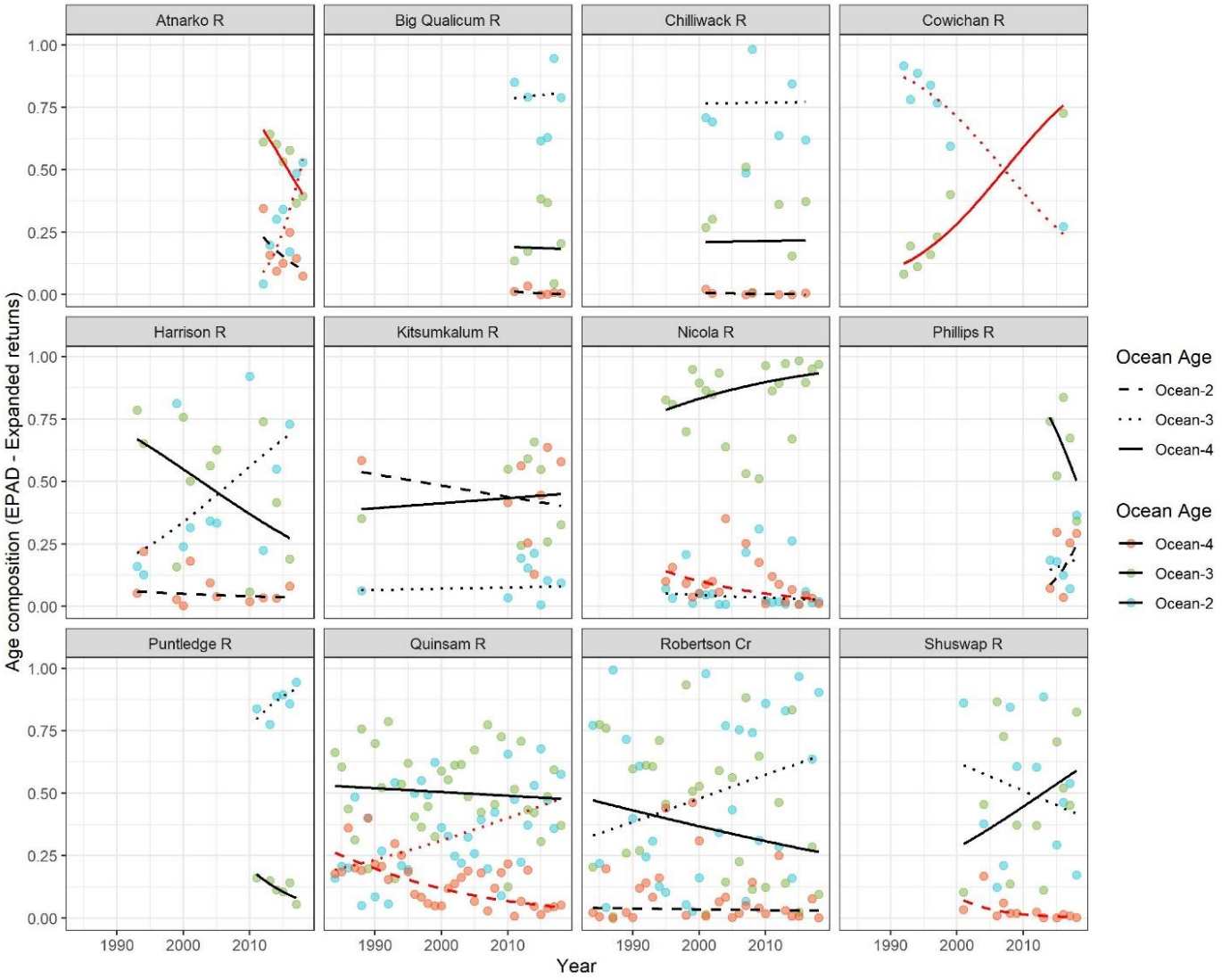

Figure SI 10b. Time series of the relative proportion and respective logistic regressions of male Ocean-2 (blue, dashed), Ocean-3 (green, solid) and Ocean-4 (red, dotted) Chinook salmon, calculated from EPADS Expanded returns. Statistically significant trends are indicated by red logistic regression lines.

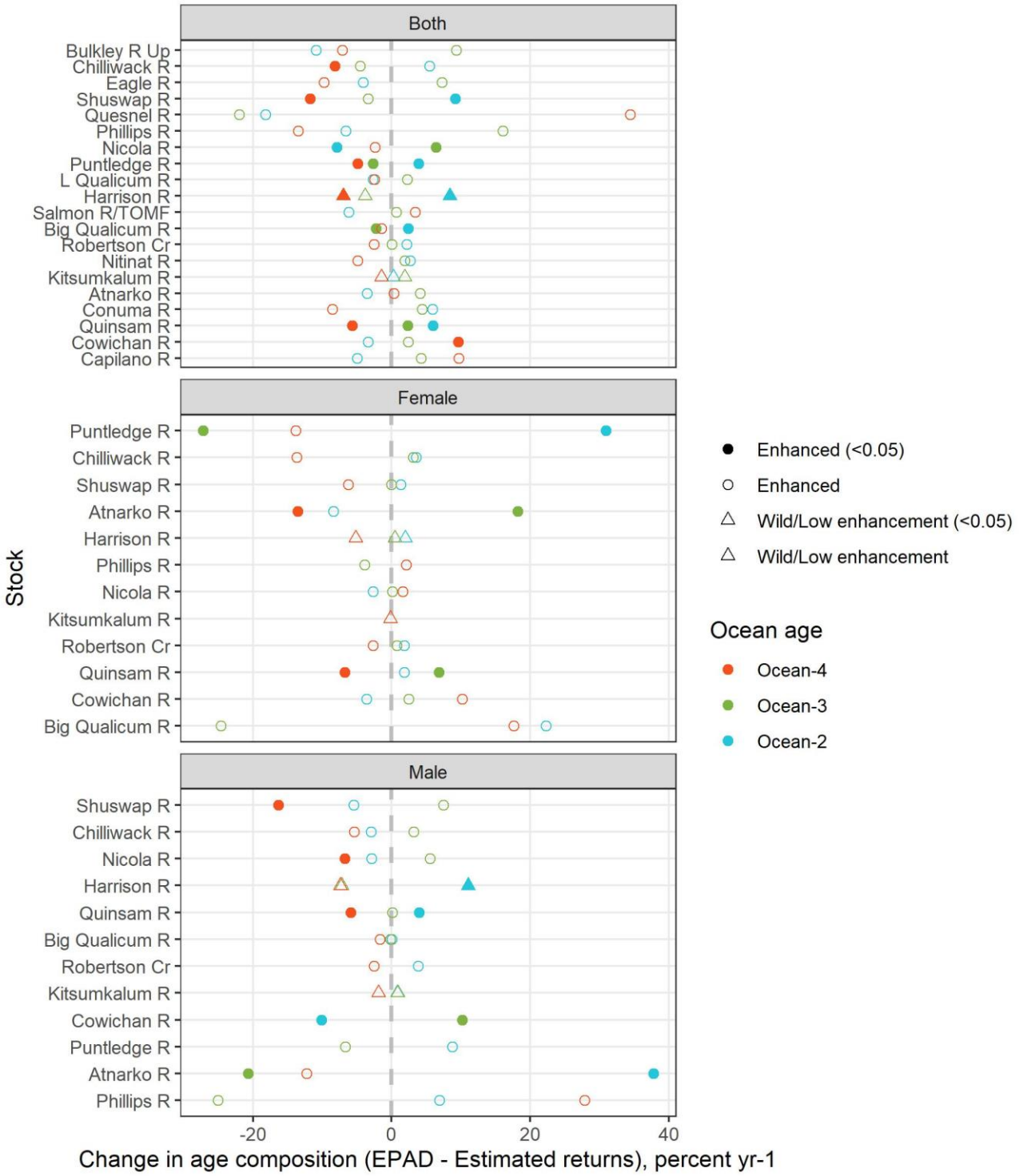

Figure SI 11. Change in the relative proportion of ocean-2 (blue), ocean-3 (green) and ocean-4 (red) Chinook salmon calculated from EPADS Estimated returns broken down by sex where possible. Statistically significant trends are represented by filled points.

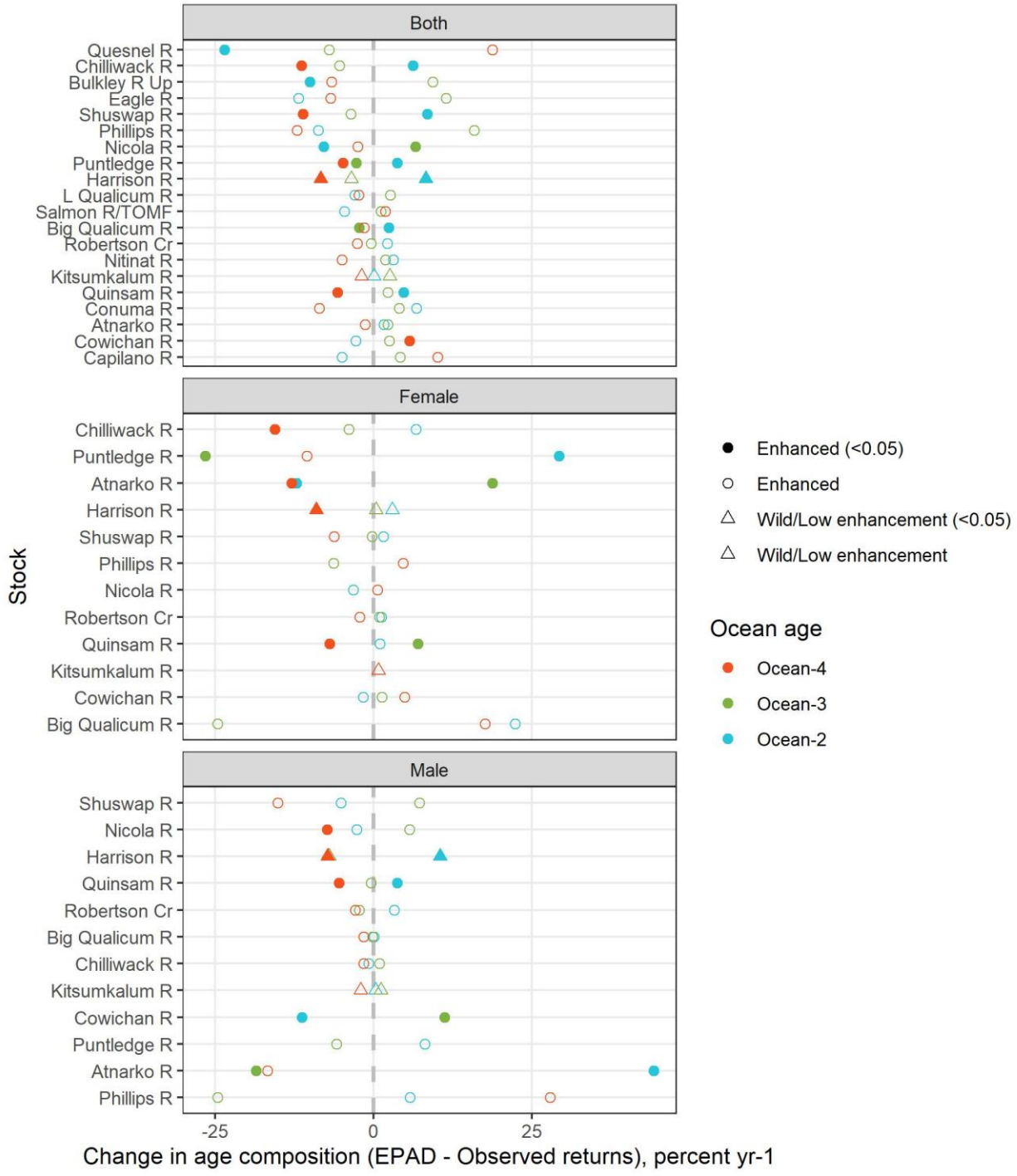

Figure SI 12. Change in the relative proportion of ocean-2 (blue), ocean-3 (green) and ocean-4 (red) Chinook salmon calculated from EPADS Observed returns broken down by sex where possible. Statistically significant trends are represented by filled points, while wild and low-enhancement stocks are represented by triangular points.

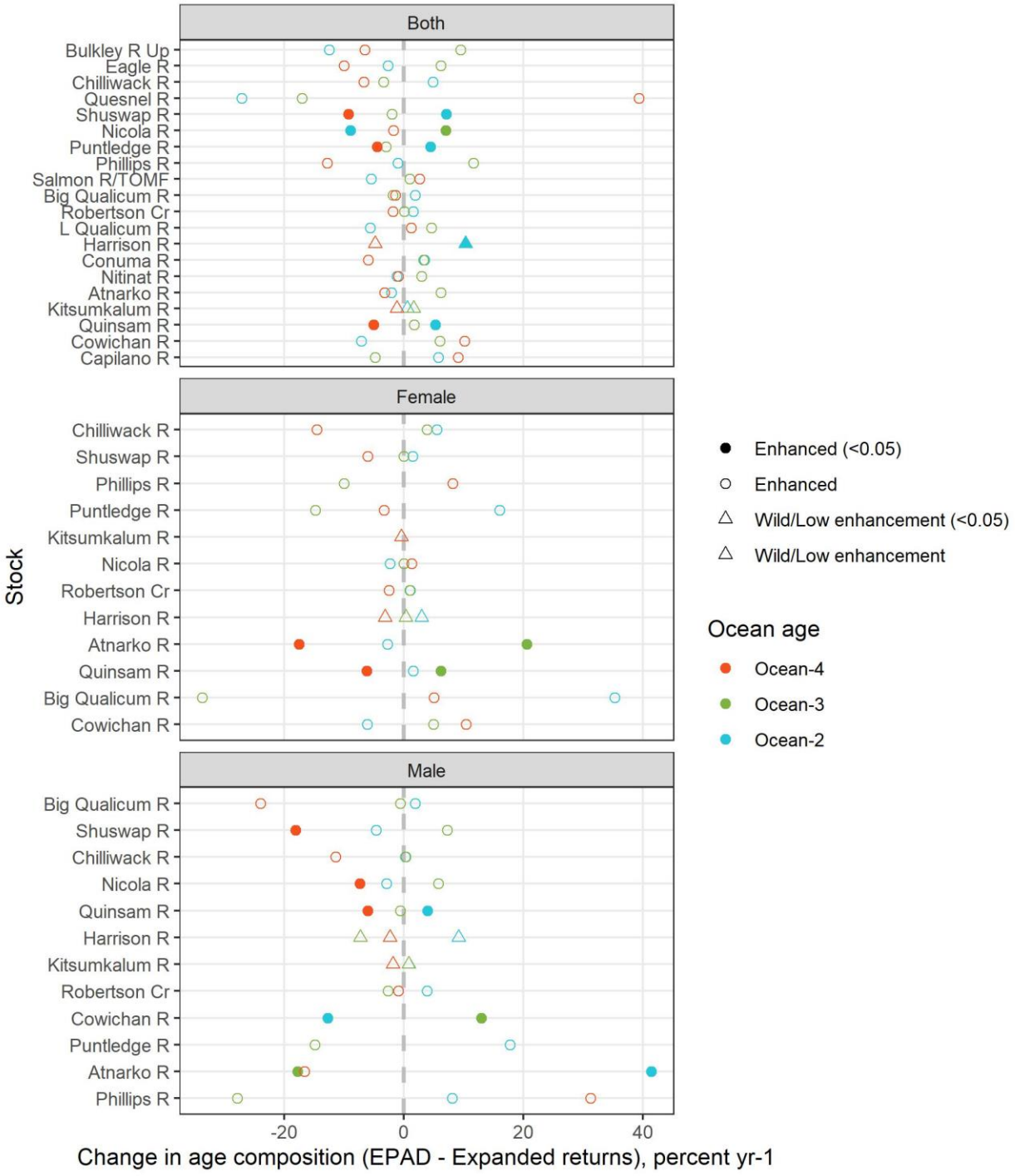

Figure SI 13. Change in the relative proportion of ocean-2 (blue), ocean-3 (green) and ocean-4 (red) Chinook salmon calculated from EPADS Expanded returns broken down by sex where possible. Statistically significant trends are represented by filled points, while wild and low-enhancement stocks are represented by triangular points.

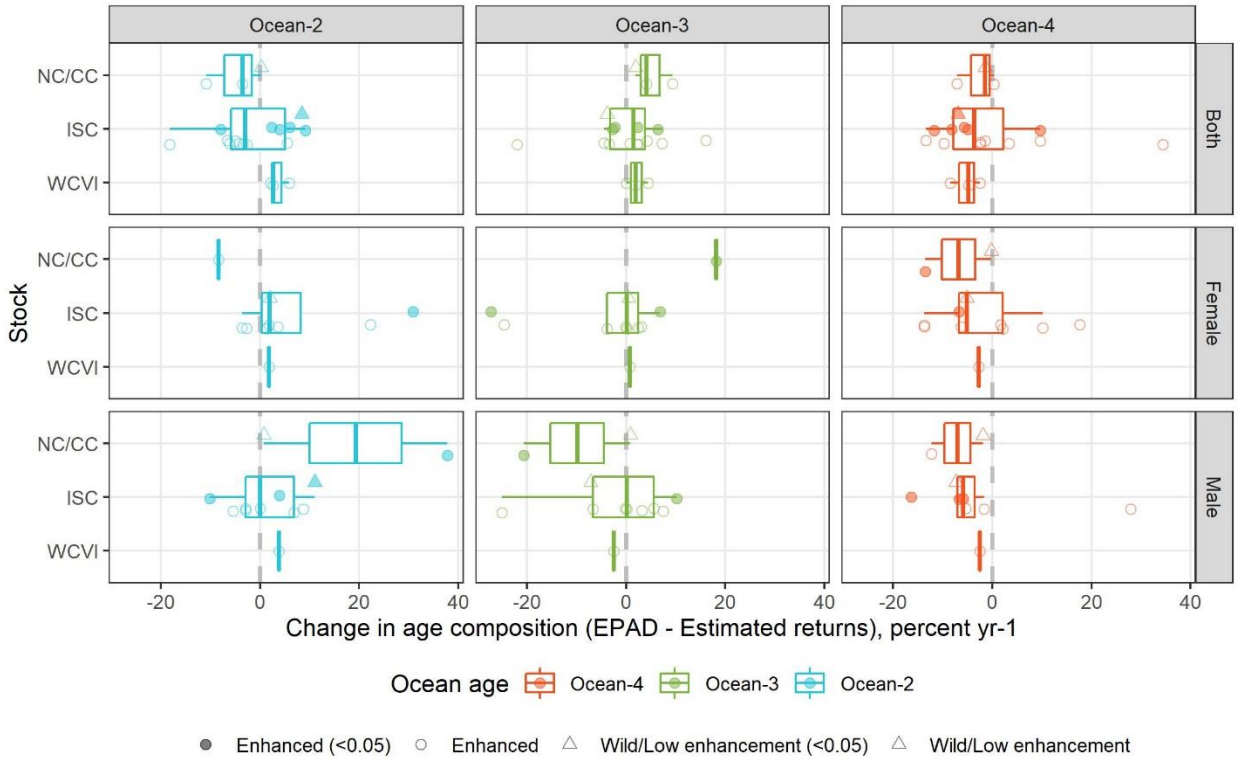

Figure SI 14. Boxplots of change in the proportion of each age class (Estimated returns) by geographical region comparing combined trends with those from male and female fish. Age class is given by colour, statistically significant trends are represented by larger filled points, while wild and low-enhancement stocks are represented by triangular points.

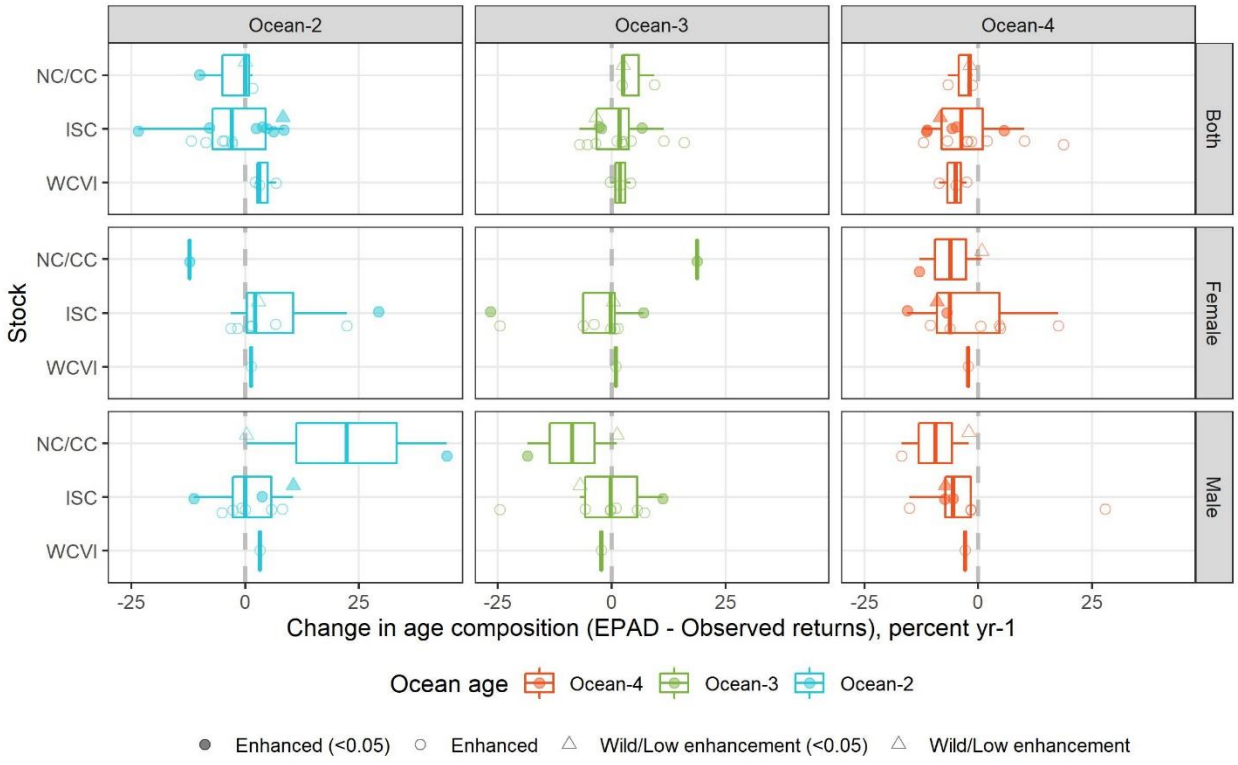

Figure SI 15. Boxplots of change in the proportion of each age class (Observed returns) by geographical region comparing combined trends with those from male and female fish. Age class is given by colour, statistically significant trends are represented by larger filled points, while outlier points are represented by smaller filled points.

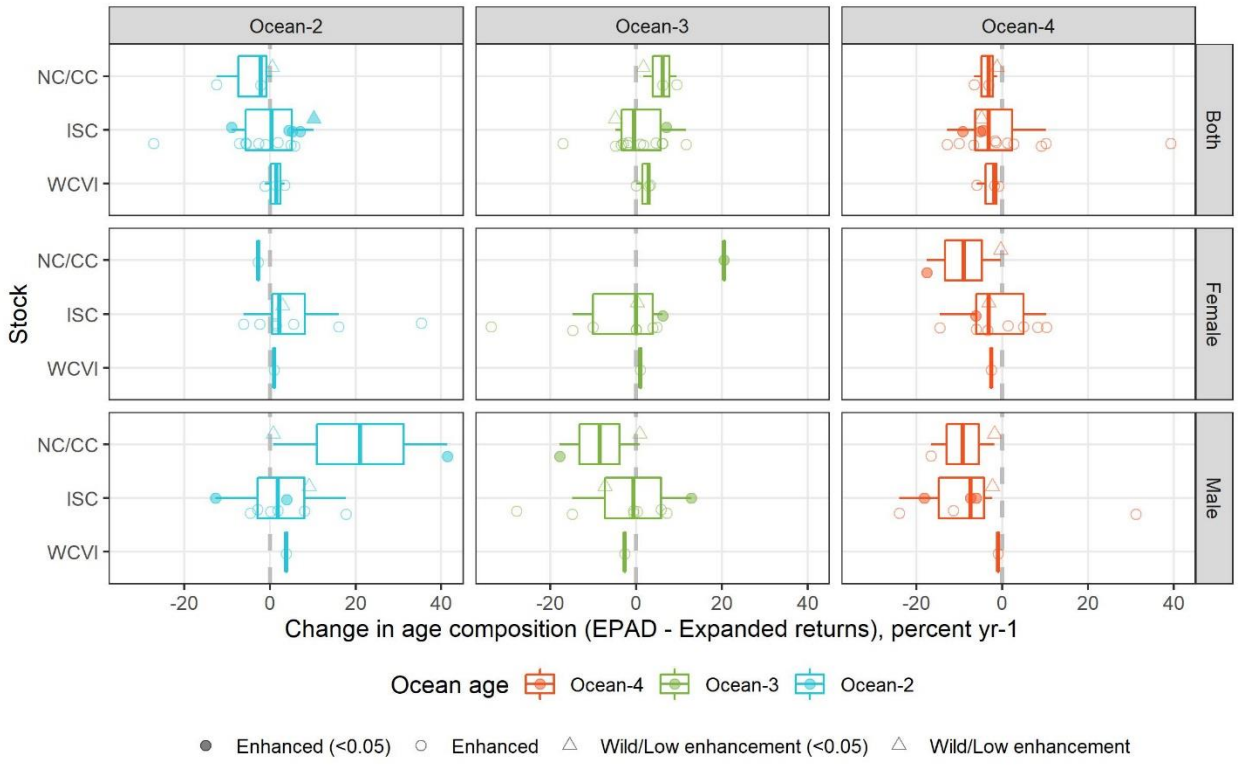

Figure SI 16. Boxplots of change in the proportion of each age class (Expanded returns) by geographical region comparing combined trends with those from male and female fish. Age class is given by colour, statistically significant trends are represented by larger filled points, while wild and low-enhancement stocks are represented by triangular points.

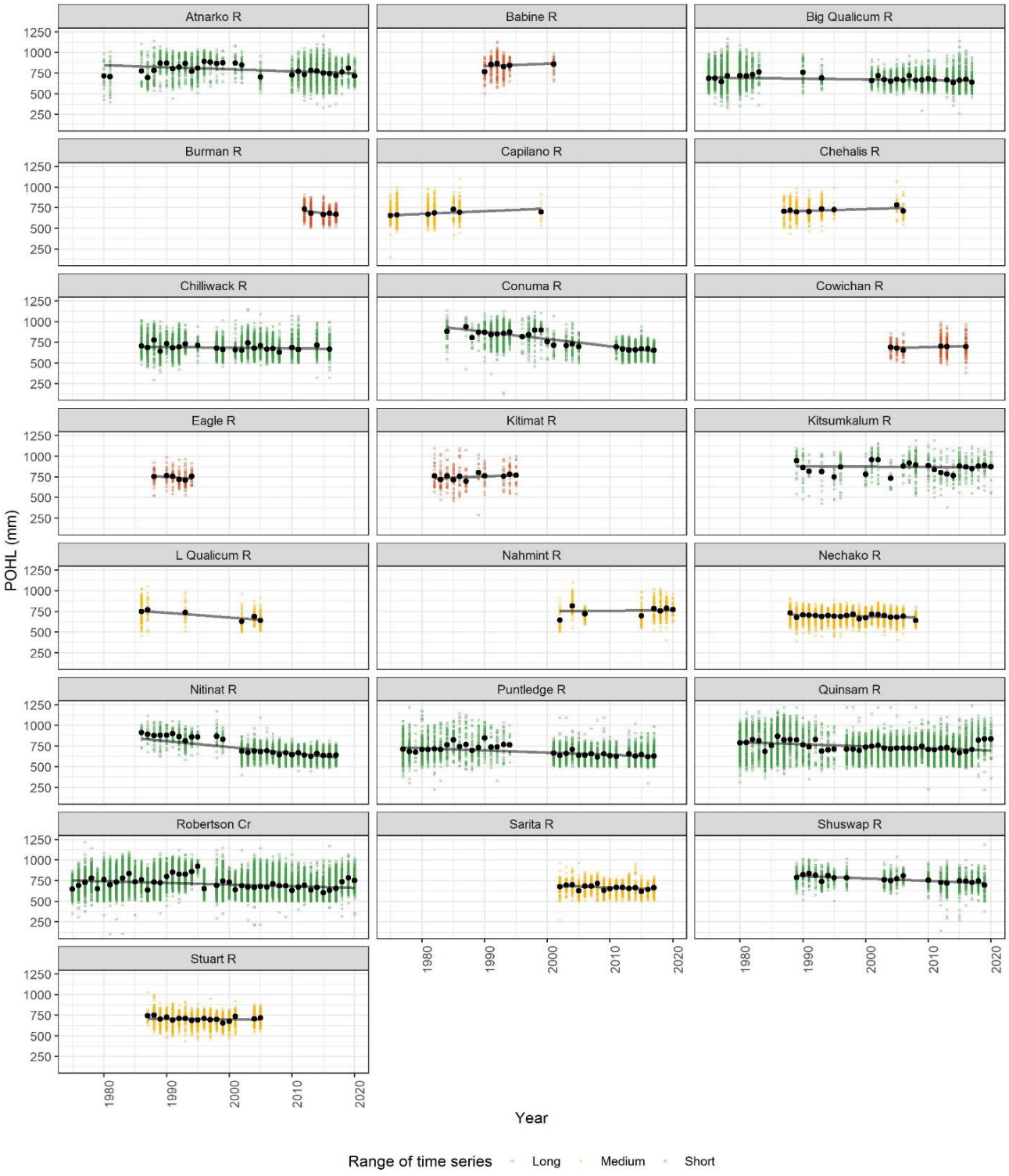

Figure SI 17. Time series of mean size calculated from biodata. Annual mean size is shown in black dots, while individual lengths from which means are calculated are shown as smaller, colored points. Point color indicates whether time series were determined to be long (green), medium (yellow) or short (orange).

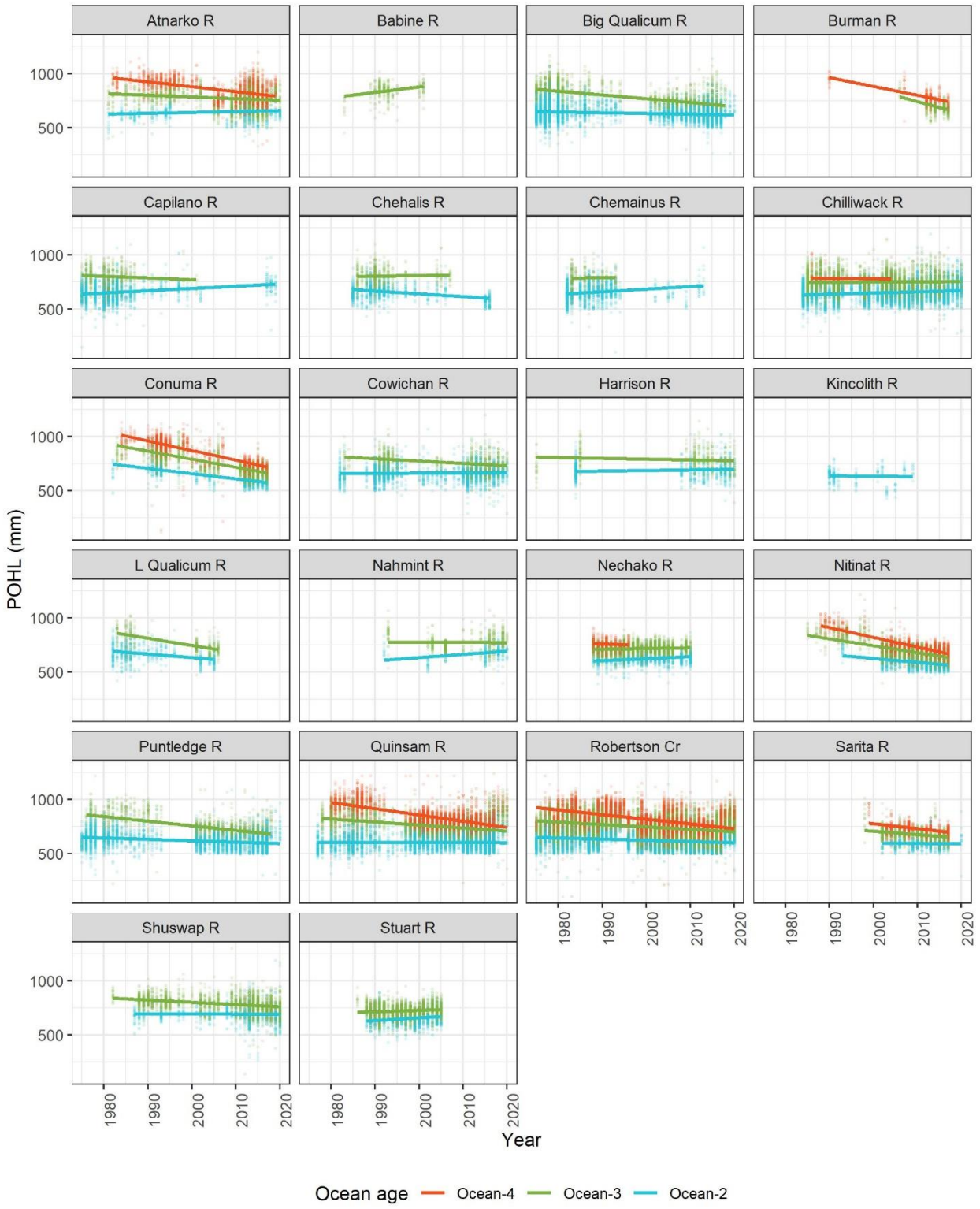

Figure SI 18a. Time series of size for Ocean-2 (blue), Ocean-3 (green) and Ocean-4 (red) Chinook salmon, calculated from biodata.

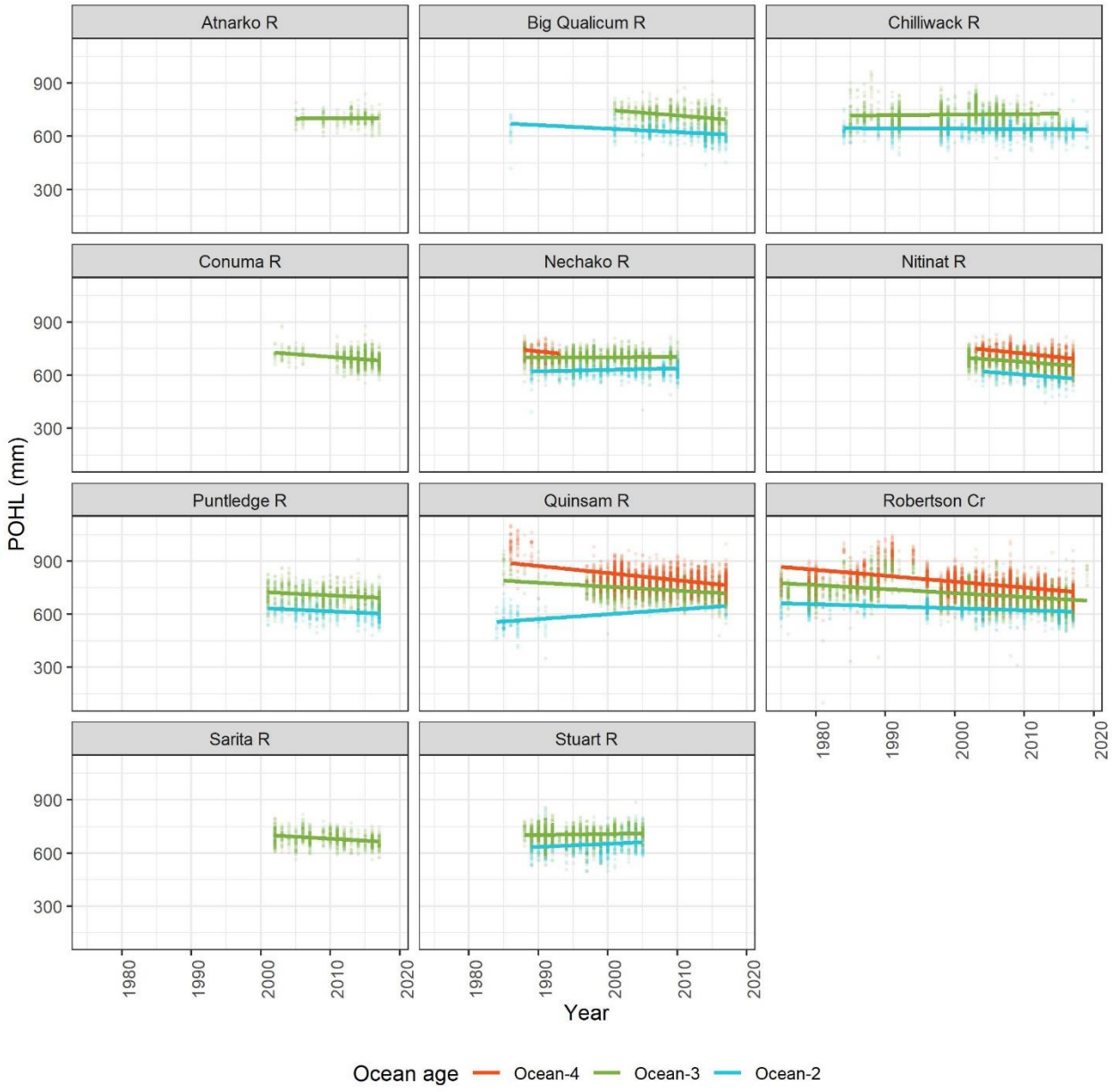

Figure S18b. Time series of size for female Ocean-2 (blue), Ocean-3 (green) and Ocean-4 (red) Chinook salmon, calculated from biodata.

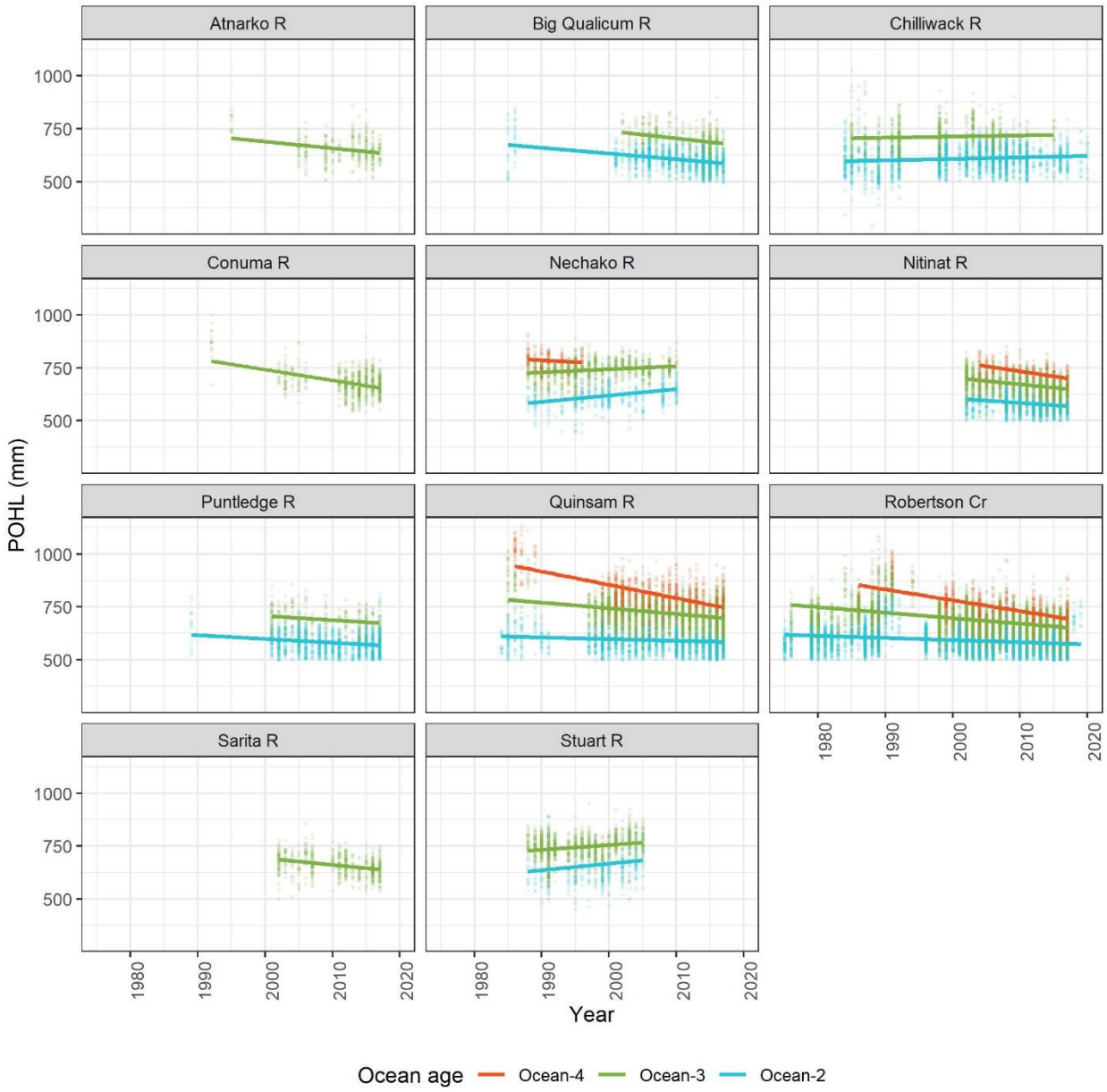

Figure SI 18c. Time series of size for male Ocean-2 (blue), Ocean-3 (green) and Ocean-4 (red) Chinook salmon, calculated from biodata.

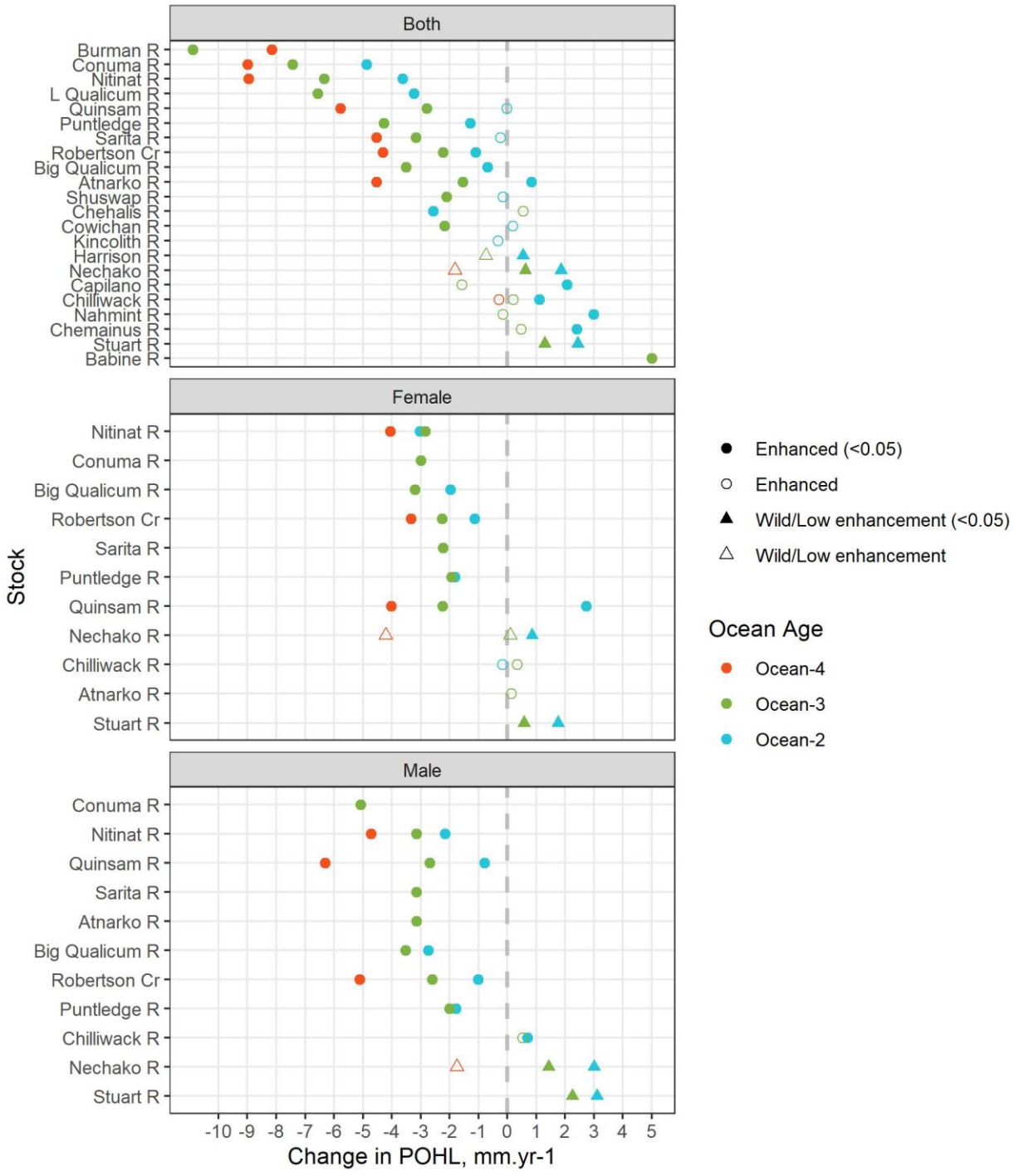

Figure SI 19. Scatterplot of change in size by age class across stocks comparing combined trends with those from male and female fish. Age classes are shown by point colour while statistically significant trends are represented by filled points, while wild and low-enhancement stocks are represented by triangular points.

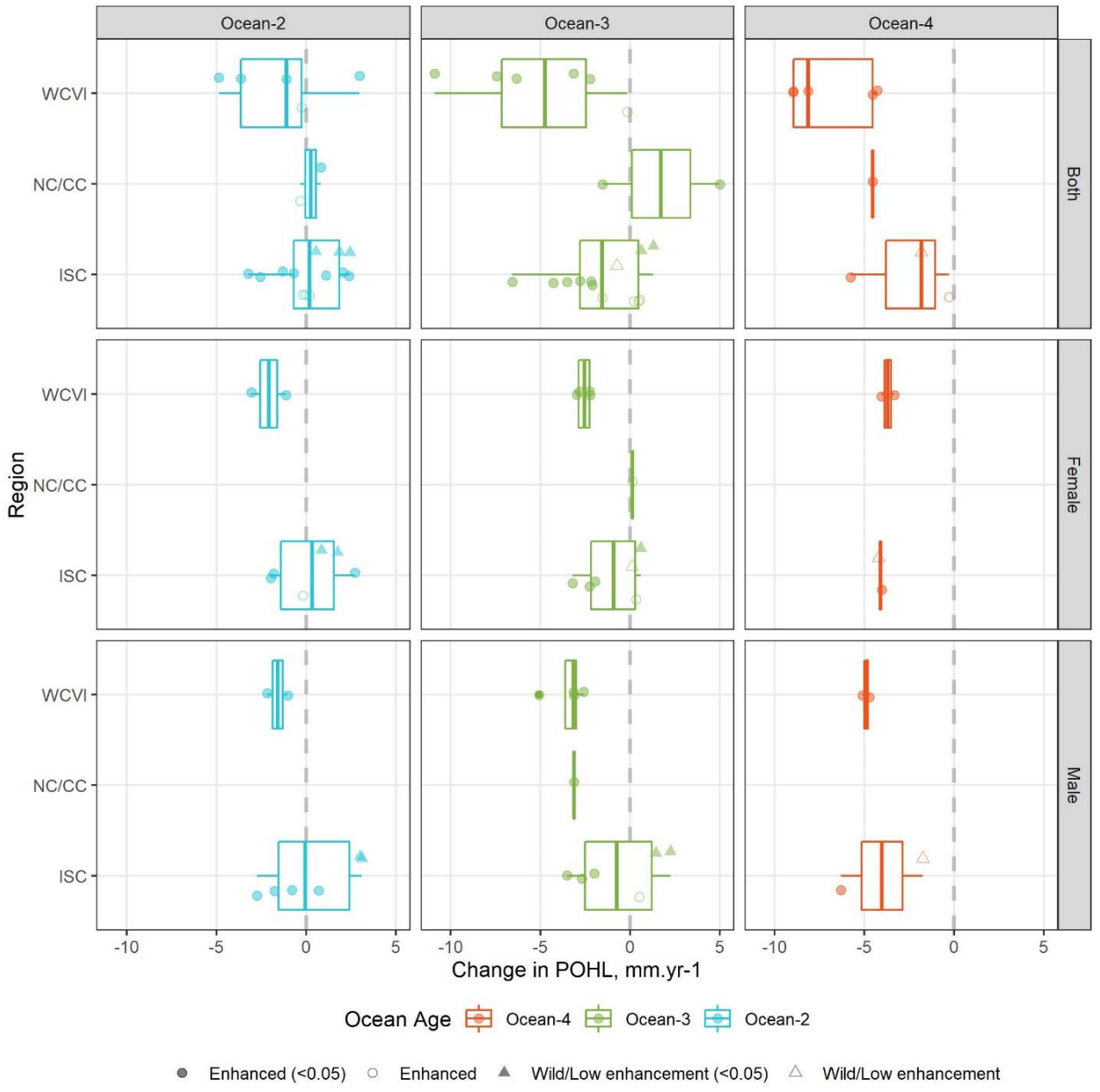

Figure SI 20. Boxplots showing the geographical distribution of size changes by age class. Age classes are shown by colour while statistically significant trends are represented by filled points.

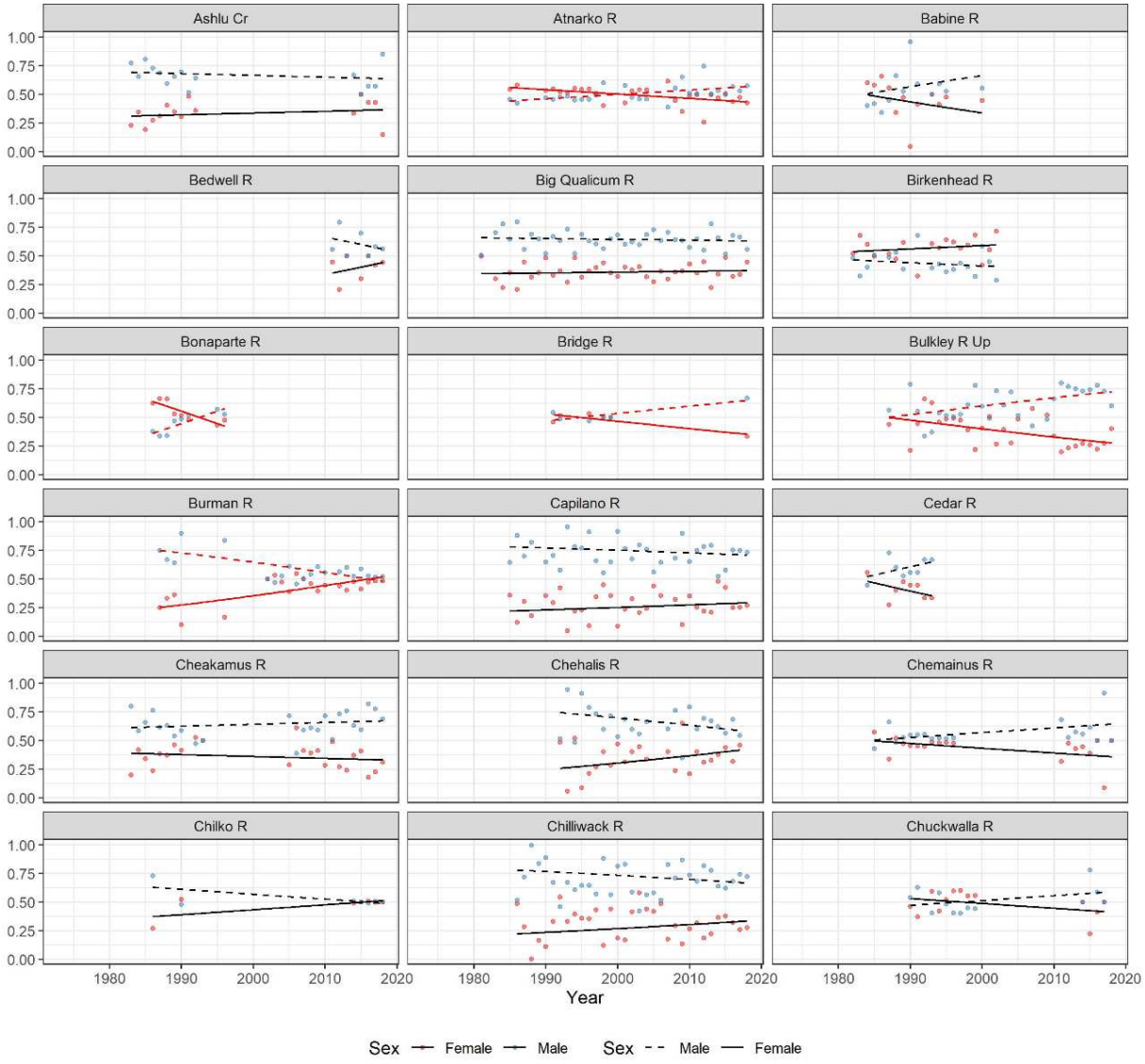

Figure SI 21a. Time series and respective logistic regressions of the relative proportion of male (blue, dashed) and female (red, solid) Chinook salmon calculated from EPADS 'River' returns.

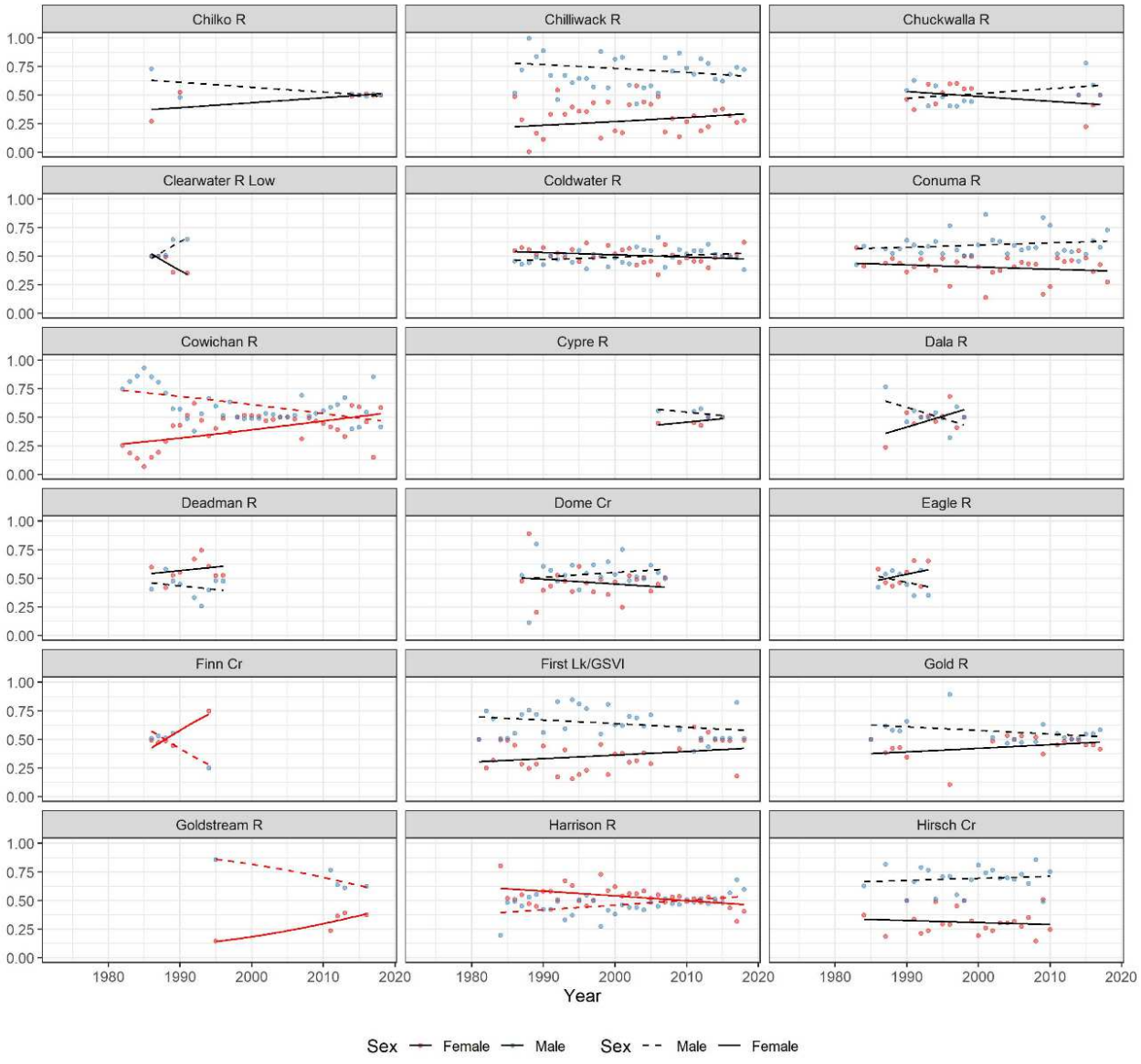

Figure SI 21b. Time series and respective logistic regressions of the relative proportion of male (blue, dashed) and female (red, solid) Chinook salmon calculated from EPADS 'River' returns.

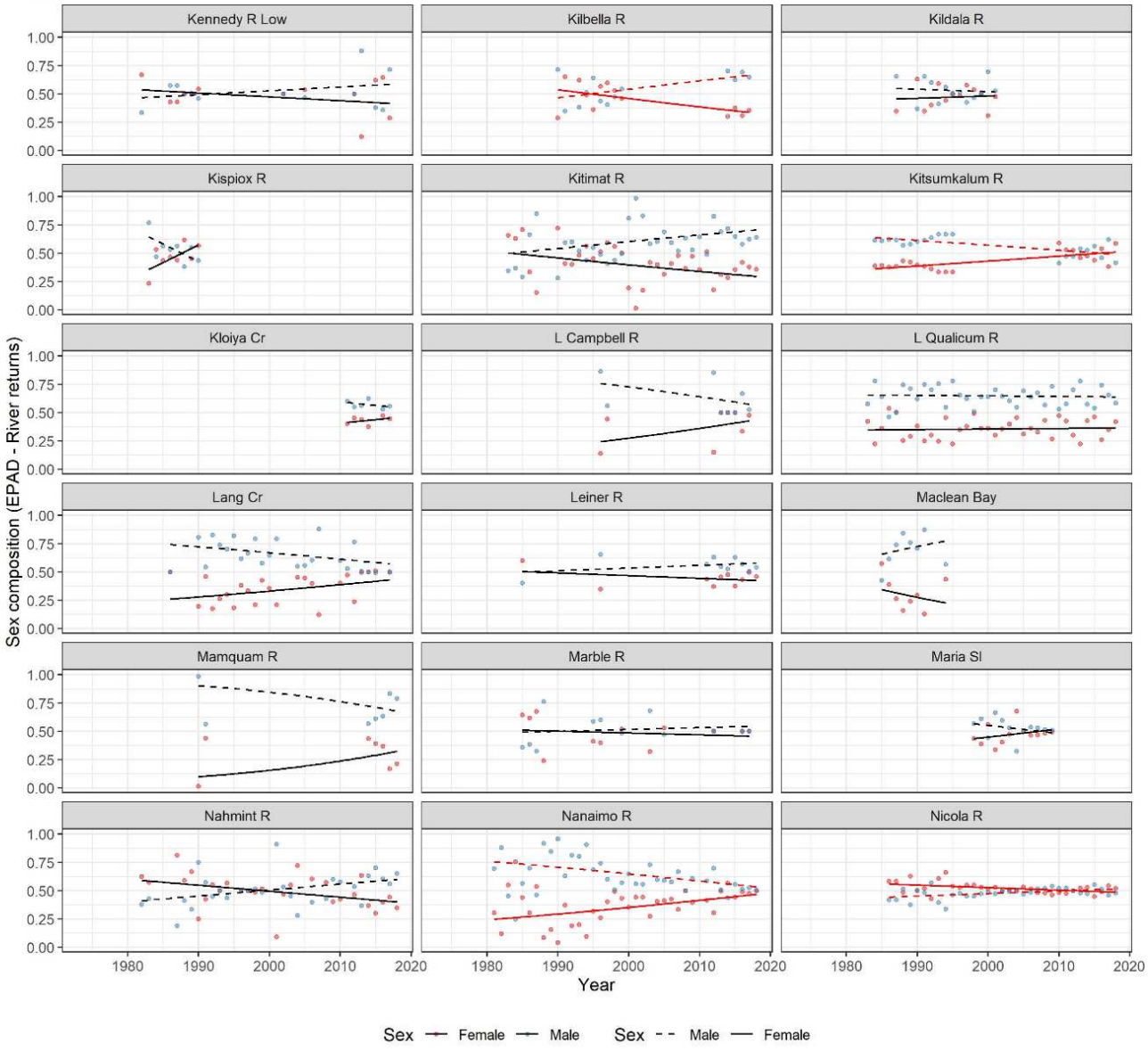

Figure SI 21c. Time series and respective logistic regressions of the relative proportion of male (blue, dashed) and female (red, solid) Chinook salmon calculated from EPADS 'River' returns.

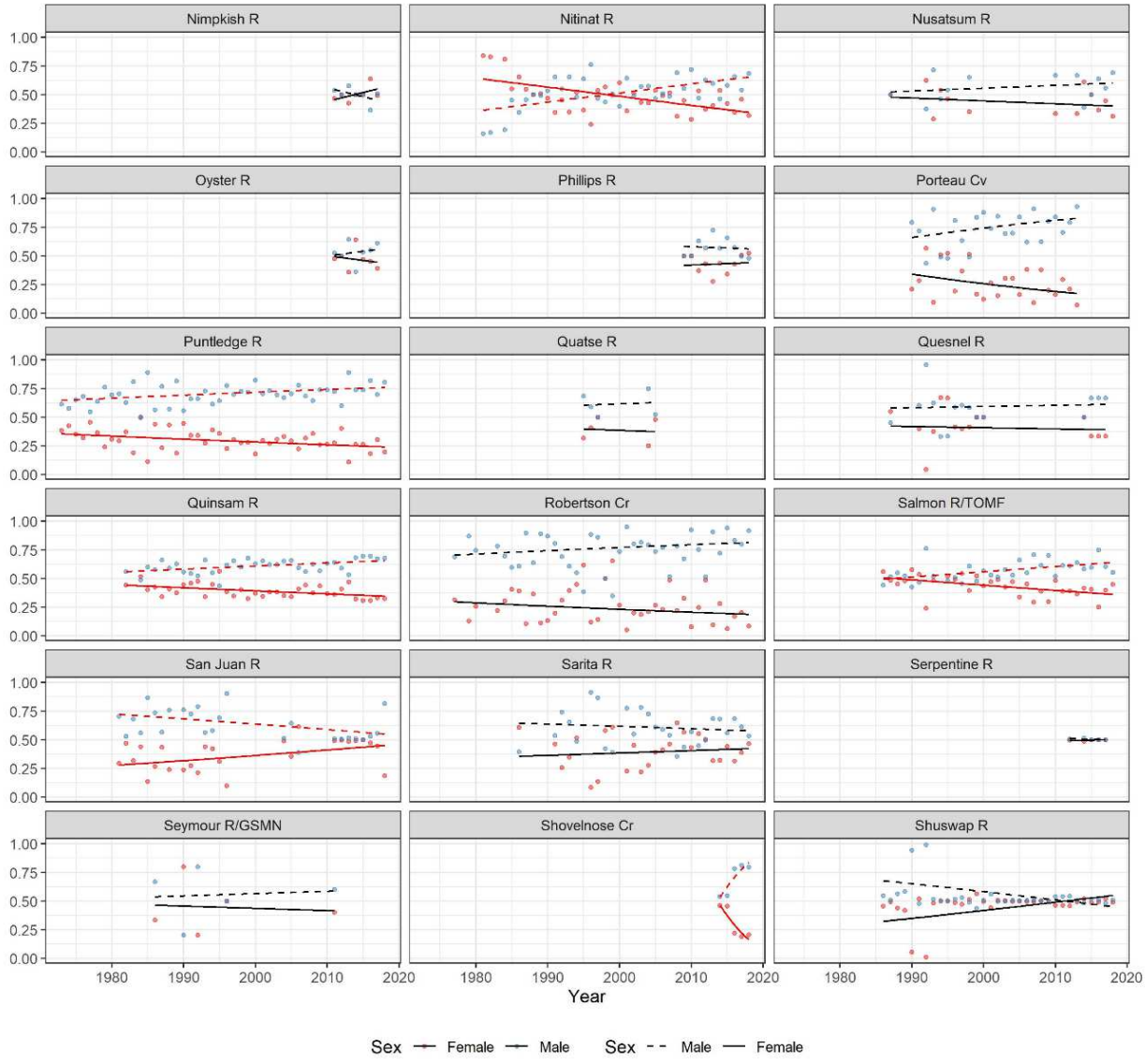

Figure SI 21d. Time series and respective logistic regressions of the relative proportion of male (blue, dashed) and female (red, solid) Chinook salmon calculated from EPADS 'River' returns.

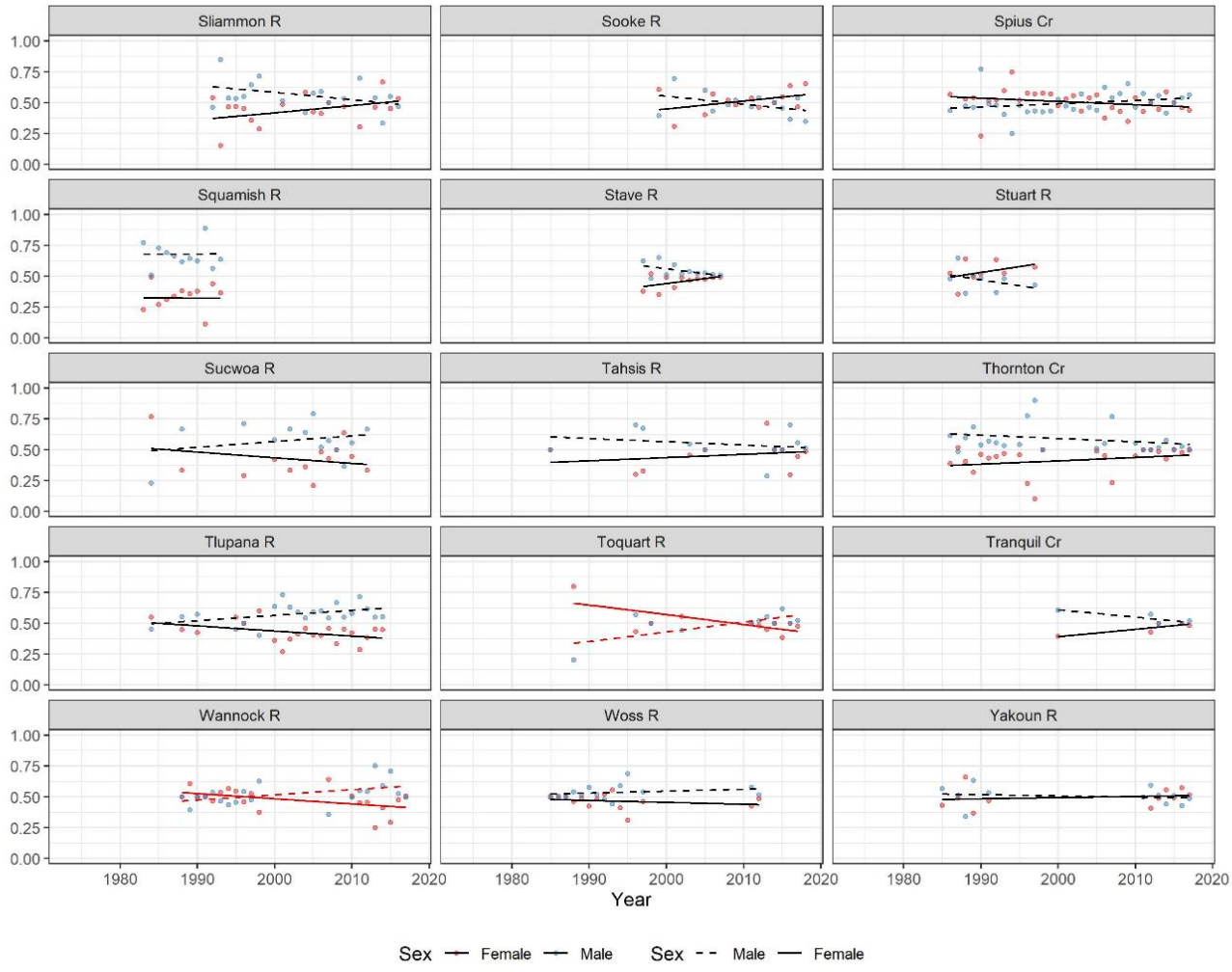

Figure SI 21e. Time series and respective logistic regressions of the relative proportion of male (blue, dashed) and female (red, solid) Chinook salmon calculated from EPADS 'River' returns.

TABLES

Table SI 1. Stocks contained in the Biodatabase that were included in this analysis. Stocks without enough information to include are not shown, even though there are many more stocks than those listed here.

Stock	Mean size	Size-at-age	By sex
Atnarko R	Y	Y	Y
Big Qualicum R	Y	Y	Y
Chilliwack R	Y	Y	Y
Conuma R	Y	Y	Y
Nechako R	Y	Y	Y
Nitinat R	Y	Y	Y
Puntledge R	Y	Y	Y
Quinsam R	Y	Y	Y
Robertson Cr	Y	Y	Y
Sarita R	Y	Y	Y
Stuart R	Y	Y	Y
Babine R	Y	Y	
Burman R	Y	Y	
Capilano R	Y	Y	
Chehalis R	Y	Y	
Cowichan R	Y	Y	
Eagle R	Y	Y	
Kitimat R	Y	Y	
L Qualicum R	Y	Y	
Nahmint R	Y	Y	
Shuswap R	Y	Y	
Shuswap R Low	Y	Y	
Kitsumkalum R	Y		
Kincolith R		Y	

Table SI 2. Stocks contained in the EPADS Observed, Estimated and Expanded returns, showing those used to create specific indices.

Stock	Mean age	Age composition	By sex
Atnarko R Low	Y	Y	Y
Atnarko R Up	Y	Y	Y
Big Qualicum R	Y	Y	Y
Bulkley R Up	Y	Y	Y
Capilano R	Y	Y	Y
Chilliwack R	Y	Y	Y
Conuma R	Y	Y	Y
Cowichan R	Y	Y	Y
Eagle R	Y	Y	Y
Harrison R	Y	Y	Y
Kitsum Abv Canyon	Y	Y	Y
Kitsum Bel Canyon	Y	Y	Y
Kitsumkalum R	Y	Y	Y
L Qualicum R	Y	Y	Y
Nicola R	Y	Y	Y
Nitinat R	Y	Y	Y
Phillips R	Y	Y	Y
Puntledge R	Y	Y	Y
Quesnel R	Y	Y	Y
Quinsam R	Y	Y	Y
Robertson Cr	Y	Y	Y
Salmon R/TOMF	Y	Y	Y
Shuswap R Low	Y	Y	Y
Shuswap R Middle	Y	Y	Y

Table SI 3. Stocks contained in the EPADS River returns, showing only those used to estimate sex composition.

Stock	Female composition	Stock	Female composition	Stock	Female composition
Ashlu Cr	Y	Dome Cr	Y	Nicola R	Y
Atnarko R	Y	Eagle R	Y	Nimpkish R	Y
Atnarko R Low	Y	Finn Cr	Y	Nitinat R	Y
Atnarko R Mid	Y	First Lk/GSVI	Y	Nusatsum R	Y
Atnarko R Up	Y	Gold R	Y	Oyster R	Y
Babine R	Y	Goldstream R	Y	Phillips R	Y
Bedwell R	Y	Harrison R	Y	Porteau Cv	Y
Big Qualicum R	Y	Hirsch Cr	Y	Puntledge R	Y
Birkenhead R	Y	Kennedy R Low	Y	Quatse R	Y
Bonaparte R	Y	Kilbella R	Y	Quesnel R	Y
Bridge R	Y	Kildala R	Y	Quinsam R	Y
Bulkley R Up	Y	Kispiox R	Y	Robertson Cr	Y
Burman R	Y	Kitimat R	Y	Salloomt R	Y
Capilano R	Y	Kitimat R Low	Y	Salmon R/JNST	Y
Cedar R	Y	Kitimat R Up	Y	San Juan R	Y
Cheakamus R	Y	Kitsum Abv Canyon	Y	Sarita R	Y
Chehalis R	Y	Kitsum Bel Canyon	Y	Serpentine R	Y
Chemainus R	Y	Kitsumkalum R	Y	Stave R	Y
Chilko R	Y	Kloiya Cr	Y	Stuart R	Y
Chilliwack R	Y	L Campbell R	Y	Sucwoa R	Y
Chuckwalla R	Y	L Qualicum R	Y	Tahsis R	Y
Clearwater R Low	Y	Lang Cr	Y	Thornton Cr	Y
Clearwater R Up	Y	Leiner R	Y	Tlupana R	Y
Coldwater Cr	Y	Maclean Bay	Y	Toquart R	Y
Conuma R	Y	Mamquam R	Y	Tranquil Cr	Y
Cowichan R	Y	Marble R	Y	Wannock R	Y
Cypre R	Y	Maria Sl	Y	Woss R	Y
Dala R	Y	Nahmint R	Y	Yakoun R	Y
Deadman R	Y	Nanaimo R	Y	Yukon R	Y

Table SI 4. Regression statistics from time series of mean age estimated from EPADS Observed returns.

Stock	Slope	SE	p
Conuma R	-0.024	0.004	**<0.05**
Phillips R	-0.021	0.007	**<0.05**
Shuswap R	-0.017	0.002	**<0.05**
Harrison R	-0.017	0.002	**<0.05**
Quinsam R	-0.017	0.001	**<0.05**
Chilliwack R	-0.013	0.001	**<0.05**
Puntledge R	-0.010	0.001	**<0.05**
Bulkley R Up	-0.010	0.003	**<0.05**
Nitinat R	-0.010	0.002	**<0.05**
Big Qualicum R	-0.006	0.001	**<0.05**
Robertson Cr	-0.005	0.002	**<0.05**
Atnarko R	-0.005	0.002	**<0.05**
Kitsumkalum R	-0.004	0.002	0.063
Nicola R	0.004	0.001	**<0.05**
Cowichan R	0.008	0.002	**<0.05**
L Qualicum R	0.009	0.006	0.131
Eagle R	0.009	0.004	**<0.05**
Salmon R/TOMF	0.010	0.007	0.161
Capilano R	0.014	0.007	0.062
Quesnel R	0.050	0.018	**<0.05**

Table SI 5. Regression statistics from time series of mean age estimated from EPADS Estimated returns.

Stock	Slope	SE	p
Phillips R	-0.026	0.007	**<0.05**
Conuma R	-0.025	0.004	**<0.05**
Shuswap R	-0.018	0.002	**<0.05**
Quinsam R	-0.017	0.001	**<0.05**
Harrison R	-0.017	0.002	**<0.05**
Chilliwack R	-0.013	0.002	**<0.05**
Bulkley R Up	-0.011	0.008	0.158
Puntledge R	-0.011	0.001	**<0.05**
Nitinat R	-0.009	0.002	**<0.05**
Robertson Cr	-0.006	0.002	**<0.05**
Big Qualicum R	-0.006	0.001	**<0.05**
Eagle R	-0.004	0.004	0.334
Kitsumkalum R	-0.003	0.002	0.170
Nicola R	0.003	0.001	**<0.05**
Atnarko R	0.007	0.003	**0.050**
L Qualicum R	0.008	0.006	0.145
Cowichan R	0.011	0.002	**<0.05**
Capilano R	0.014	0.007	0.067
Salmon R/TOMF	0.018	0.005	**<0.05**
Quesnel R	0.067	0.019	**<0.05**

Table SI 6. Regression statistics from time series of mean age estimated from EPADS Expanded returns.

Stock	Slope	SE	p
Phillips R	-0.032	0.007	**<0.05**
Conuma R	-0.018	0.004	**<0.05**
Quinsam R	-0.015	0.001	**<0.05**
Harrison R	-0.015	0.002	**<0.05**
Capilano R	-0.014	0.009	0.131
Shuswap R	-0.013	0.002	**<0.05**
Chilliwack R	-0.012	0.002	**<0.05**
Puntledge R	-0.011	0.001	**<0.05**
Bulkley R Up	-0.009	0.008	0.223
Eagle R	-0.007	0.005	0.174
Big Qualicum R	-0.004	0.001	**<0.05**
Atnarko R	-0.004	0.004	0.353
Robertson Cr	-0.003	0.002	0.192
Kitsumkalum R	-0.002	0.002	0.260
Nitinat R	0.003	0.003	0.347
Nicola R	0.006	0.001	**<0.05**
Salmon R/TOMF	0.014	0.004	**<0.05**
L Qualicum R	0.016	0.005	**<0.05**
Cowichan R	0.017	0.002	**<0.05**
Quesnel R	0.081	0.026	**<0.05**

Table SI 7a. Regression statistics from time series of age composition estimated from EPADS Observed returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	-34.087	0.016	0.041	0.392	0.703
Big Qualicum R	Ocean-2	-47.351	0.024	0.010	2.260	**<0.05**
Bulkley R Up	Ocean-2	197.795	-0.101	0.020	-4.921	**<0.05**
Capilano R	Ocean-2	98.389	-0.050	0.132	-0.376	0.732
Chilliwack R	Ocean-2	-123.321	0.062	0.025	2.479	**<0.05**
Conuma R	Ocean-2	-136.193	0.067	0.045	1.504	0.151
Cowichan R	Ocean-2	56.607	-0.028	0.035	-0.805	0.444
Eagle R	Ocean-2	233.837	-0.118	0.098	-1.208	0.272
Harrison R	Ocean-2	-166.500	0.083	0.031	2.623	**<0.05**
Atnarko R	Ocean-3	-45.542	0.023	0.043	0.528	0.609
Big Qualicum R	Ocean-3	44.963	-0.023	0.011	-2.113	**<0.05**
Bulkley R Up	Ocean-3	-188.792	0.094	0.104	0.903	0.433
Capilano R	Ocean-3	-82.612	0.042	0.114	0.366	0.739
Chilliwack R	Ocean-3	107.037	-0.054	0.026	-2.068	0.050
Conuma R	Ocean-3	-81.793	0.041	0.046	0.880	0.391
Cowichan R	Ocean-3	-49.899	0.024	0.036	0.672	0.520
Eagle R	Ocean-3	-227.116	0.115	0.086	1.326	0.233
Harrison R	Ocean-3	70.540	-0.035	0.027	-1.290	0.213
Atnarko R	Ocean-4	26.451	-0.013	0.032	-0.416	0.686
Big Qualicum R	Ocean-4	26.152	-0.015	0.011	-1.303	0.201
Bulkley R Up	Ocean-4	133.838	-0.066	0.088	-0.749	0.508
Capilano R	Ocean-4	-203.891	0.101	0.089	1.137	0.338
Chilliwack R	Ocean-4	223.500	-0.114	0.019	-5.954	**<0.05**
Conuma R	Ocean-4	171.073	-0.086	0.051	-1.694	0.109
Cowichan R	Ocean-4	-118.425	0.057	0.020	2.805	**<0.05**
Eagle R	Ocean-4	133.221	-0.068	0.083	-0.819	0.444
Harrison R	Ocean-4	165.218	-0.084	0.019	-4.378	**<0.05**

Table SI 7b. Regression statistics from time series of age composition estimated from EPADS Observed returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Kitsumkalum R	Ocean-2	-3.851	0.001	0.027	0.019	0.985
L Qualicum R	Ocean-2	60.678	-0.030	0.084	-0.360	0.737
Nicola R	Ocean-2	155.232	-0.079	0.027	-2.924	**<0.05**
Nitinat R	Ocean-2	-64.332	0.031	0.034	0.909	0.374
Phillips R	Ocean-2	173.805	-0.087	0.136	-0.642	0.556
Puntledge R	Ocean-2	-74.971	0.038	0.012	3.017	**<0.05**
Quesnel R	Ocean-2	465.823	-0.235	0.046	-5.109	**<0.05**
Quinsam R	Ocean-2	-96.614	0.048	0.012	4.027	**<0.05**
Robertson Cr	Ocean-2	-43.948	0.022	0.033	0.655	0.517
Salmon R/TOMF	Ocean-2	90.627	-0.046	0.114	-0.402	0.704
Shuswap R	Ocean-2	-170.934	0.085	0.031	2.739	**<0.05**
Kitsumkalum R	Ocean-3	-51.908	0.025	0.033	0.768	0.462
L Qualicum R	Ocean-3	-52.681	0.026	0.072	0.362	0.735
Nicola R	Ocean-3	-129.896	0.066	0.024	2.789	**<0.05**
Nitinat R	Ocean-3	-36.341	0.018	0.022	0.825	0.419
Phillips R	Ocean-3	-319.880	0.159	0.134	1.183	0.302
Puntledge R	Ocean-3	54.580	-0.027	0.012	-2.225	**<0.05**
Quesnel R	Ocean-3	139.718	-0.070	0.330	-0.214	0.845
Quinsam R	Ocean-3	-44.220	0.022	0.012	1.873	0.069
Robertson Cr	Ocean-3	6.680	-0.004	0.030	-0.124	0.902
Salmon R/TOMF	Ocean-3	-22.046	0.011	0.126	0.089	0.933
Shuswap R	Ocean-3	72.953	-0.036	0.028	-1.269	0.217
Kitsumkalum R	Ocean-4	39.040	-0.019	0.030	-0.637	0.540
L Qualicum R	Ocean-4	43.072	-0.023	0.096	-0.242	0.821
Nicola R	Ocean-4	47.838	-0.025	0.029	-0.876	0.390
Nitinat R	Ocean-4	98.581	-0.050	0.028	-1.793	0.087
Phillips R	Ocean-4	242.901	-0.121	0.119	-1.013	0.368
Puntledge R	Ocean-4	92.930	-0.048	0.015	-3.251	**<0.05**
Quesnel R	Ocean-4	-372.709	0.187	0.324	0.578	0.604
Quinsam R	Ocean-4	112.922	-0.057	0.012	-4.686	**<0.05**
Robertson Cr	Ocean-4	49.529	-0.026	0.026	-1.017	0.317
Salmon R/TOMF	Ocean-4	-39.497	0.019	0.107	0.175	0.868
Shuswap R	Ocean-4	220.493	-0.112	0.027	-4.098	**<0.05**

Table SI 8a. Regression statistics from time series of age composition estimated from EPADS Estimated returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	70.330	-0.036	0.039	-0.903	0.388
Big Qualicum R	Ocean-2	-47.338	0.024	0.011	2.199	**<0.05**
Bulkley R Up	Ocean-2	214.744	-0.109	0.178	-0.612	0.584
Capilano R	Ocean-2	97.872	-0.050	0.132	-0.374	0.733
Chilliwack R	Ocean-2	-108.868	0.054	0.028	1.971	0.061
Conuma R	Ocean-2	-119.961	0.059	0.054	1.087	0.292
Cowichan R	Ocean-2	68.426	-0.034	0.032	-1.054	0.323
Eagle R	Ocean-2	80.133	-0.041	0.088	-0.469	0.655
Harrison R	Ocean-2	-169.696	0.084	0.030	2.835	**<0.05**
Kitsumkalum R	Ocean-2	-9.012	0.003	0.041	0.069	0.947
L Qualicum R	Ocean-2	54.255	-0.027	0.080	-0.338	0.753
Atnarko R	Ocean-3	-82.447	0.041	0.042	0.979	0.351
Big Qualicum R	Ocean-3	44.956	-0.023	0.011	-2.067	**<0.05**
Bulkley R Up	Ocean-3	-187.653	0.093	0.128	0.727	0.520
Capilano R	Ocean-3	-83.848	0.042	0.114	0.373	0.734
Chilliwack R	Ocean-3	90.247	-0.045	0.029	-1.578	0.128
Conuma R	Ocean-3	-88.896	0.044	0.054	0.818	0.425
Cowichan R	Ocean-3	-48.123	0.024	0.035	0.674	0.519
Eagle R	Ocean-3	-143.015	0.072	0.075	0.970	0.370
Harrison R	Ocean-3	77.207	-0.038	0.025	-1.511	0.148
Kitsumkalum R	Ocean-3	-38.890	0.019	0.034	0.560	0.589
Atnarko R	Ocean-4	-6.656	0.003	0.035	0.087	0.933
Big Qualicum R	Ocean-4	25.648	-0.015	0.011	-1.285	0.207
Bulkley R Up	Ocean-4	143.596	-0.071	0.057	-1.245	0.301
Capilano R	Ocean-4	-195.417	0.097	0.092	1.046	0.372
Chilliwack R	Ocean-4	159.124	-0.082	0.029	-2.836	**<0.05**
Conuma R	Ocean-4	170.467	-0.086	0.057	-1.495	0.153
Cowichan R	Ocean-4	-196.206	0.096	0.037	2.572	**<0.05**
Eagle R	Ocean-4	191.473	-0.097	0.087	-1.122	0.305
Harrison R	Ocean-4	136.581	-0.070	0.025	-2.836	**<0.05**
Kitsumkalum R	Ocean-4	29.547	-0.014	0.030	-0.486	0.638

Table SI 8b. Regression statistics from time series of age composition estimated from EPADS Estimated returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Nicola R	Ocean-2	155.103	-0.079	0.029	-2.750	**<0.05**
Nitinat R	Ocean-2	-55.798	0.027	0.035	0.771	0.449
Phillips R	Ocean-2	130.595	-0.066	0.111	-0.591	0.587
Puntledge R	Ocean-2	-77.573	0.039	0.012	3.169	**<0.05**
Quesnel R	Ocean-2	359.628	-0.182	0.141	-1.292	0.287
Quinsam R	Ocean-2	-121.425	0.060	0.013	4.649	**<0.05**
Robertson Cr	Ocean-2	-43.976	0.022	0.031	0.687	0.497
Salmon R/TOMF	Ocean-2	121.567	-0.062	0.103	-0.596	0.577
Shuswap R	Ocean-2	-185.579	0.092	0.033	2.781	**<0.05**
L Qualicum R	Ocean-3	-45.846	0.023	0.068	0.330	0.758
Nicola R	Ocean-3	-126.138	0.064	0.023	2.736	**<0.05**
Nitinat R	Ocean-3	-38.099	0.019	0.023	0.852	0.404
Phillips R	Ocean-3	-322.864	0.160	0.142	1.127	0.323
Puntledge R	Ocean-3	53.868	-0.027	0.012	-2.175	**<0.05**
Quesnel R	Ocean-3	436.497	-0.220	0.384	-0.573	0.607
Quinsam R	Ocean-3	-46.790	0.023	0.011	2.047	**<0.05**
Robertson Cr	Ocean-3	-0.876	0.000	0.030	0.007	0.994
Salmon R/TOMF	Ocean-3	-13.955	0.007	0.131	0.054	0.959
Shuswap R	Ocean-3	68.761	-0.034	0.028	-1.197	0.243
L Qualicum R	Ocean-4	45.400	-0.024	0.097	-0.251	0.814
Nicola R	Ocean-4	45.096	-0.024	0.029	-0.831	0.414
Nitinat R	Ocean-4	95.980	-0.049	0.028	-1.727	0.099
Phillips R	Ocean-4	270.257	-0.134	0.141	-0.951	0.395
Puntledge R	Ocean-4	94.405	-0.049	0.015	-3.198	**<0.05**
Quesnel R	Ocean-4	-684.638	0.344	0.388	0.887	0.440
Quinsam R	Ocean-4	112.341	-0.057	0.012	-4.873	**<0.05**
Robertson Cr	Ocean-4	48.853	-0.026	0.026	-0.971	0.339
Salmon R/TOMF	Ocean-4	-69.012	0.034	0.111	0.305	0.773
Shuswap R	Ocean-4	231.322	-0.117	0.027	-4.278	**<0.05**

Table SI 9a. Regression statistics from time series of age composition estimated from EPADS Expanded returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	40.984	-0.021	0.037	-0.572	0.58
Big Qualicum R	Ocean-2	-36.916	0.018	0.011	1.609	0.116
Bulkley R Up	Ocean-2	246.975	-0.125	0.171	-0.732	0.517
Capilano R	Ocean-2	-114.357	0.057	0.187	0.307	0.779
Chilliwack R	Ocean-2	-97.344	0.049	0.029	1.672	0.108
Conuma R	Ocean-2	-70.104	0.034	0.056	0.606	0.553
Cowichan R	Ocean-2	143.515	-0.071	0.034	-2.094	0.070
Eagle R	Ocean-2	51.335	-0.027	0.146	-0.184	0.860
Harrison R	Ocean-2	-207.053	0.103	0.036	2.883	**<0.05**
Kitsumkalum R	Ocean-2	-14.580	0.006	0.042	0.134	0.896
L Qualicum R	Ocean-2	113.432	-0.057	0.068	-0.827	0.455
Atnarko R	Ocean-3	-125.151	0.062	0.034	1.828	0.097
Big Qualicum R	Ocean-3	36.086	-0.018	0.011	-1.607	0.116
Bulkley R Up	Ocean-3	-191.072	0.095	0.128	0.741	0.512
Capilano R	Ocean-3	95.428	-0.048	0.167	-0.287	0.793
Chilliwack R	Ocean-3	68.614	-0.034	0.031	-1.098	0.284
Conuma R	Ocean-3	-66.288	0.033	0.053	0.622	0.542
Cowichan R	Ocean-3	-121.566	0.060	0.037	1.635	0.141
Eagle R	Ocean-3	-122.064	0.062	0.122	0.506	0.631
Harrison R	Ocean-3	97.257	-0.048	0.028	-1.704	0.106
Kitsumkalum R	Ocean-3	-34.255	0.017	0.035	0.475	0.646
Atnarko R	Ocean-4	64.169	-0.032	0.035	-0.927	0.376
Big Qualicum R	Ocean-4	25.105	-0.014	0.014	-1.034	0.308
Bulkley R Up	Ocean-4	132.492	-0.066	0.056	-1.179	0.323
Capilano R	Ocean-4	-183.444	0.090	0.159	0.568	0.610
Chilliwack R	Ocean-4	129.214	-0.067	0.033	-2.040	0.053
Conuma R	Ocean-4	119.613	-0.060	0.057	-1.050	0.308
Cowichan R	Ocean-4	-207.069	0.101	0.051	1.993	0.081
Eagle R	Ocean-4	197.115	-0.100	0.078	-1.281	0.248
Harrison R	Ocean-4	94.347	-0.049	0.027	-1.822	0.085
Kitsumkalum R	Ocean-4	24.995	-0.012	0.031	-0.394	0.703

Table S9b. Regression statistics from time series of age composition estimated from EPADS Expanded returns.

Stock	Ocean age	Intercept	Slope	SE	Z	p
Nicola R	Ocean-2	176.246	-0.090	0.030	-3.011	**<0.05**
Nitinat R	Ocean-2	22.554	-0.012	0.037	-0.329	0.745
Phillips R	Ocean-2	18.012	-0.010	0.113	-0.089	0.934
Puntledge R	Ocean-2	-89.213	0.045	0.016	2.844	**<0.05**
Quesnel R	Ocean-2	537.985	-0.272	0.317	-0.858	0.454
Quinsam R	Ocean-2	-107.372	0.053	0.011	4.604	**<0.05**
Robertson Cr	Ocean-2	-31.650	0.015	0.032	0.486	0.630
Salmon R/TOMF	Ocean-2	108.982	-0.055	0.112	-0.494	0.642
Shuswap R	Ocean-2	-143.079	0.071	0.034	2.086	**<0.05**
L Qualicum R	Ocean-3	-92.441	0.046	0.059	0.776	0.481
Nicola R	Ocean-3	-138.703	0.070	0.025	2.820	**<0.05**
Nitinat R	Ocean-3	-58.683	0.030	0.021	1.402	0.175
Phillips R	Ocean-3	-233.834	0.116	0.142	0.820	0.458
Puntledge R	Ocean-3	59.776	-0.030	0.018	-1.657	0.107
Quesnel R	Ocean-3	337.789	-0.171	0.458	-0.372	0.734
Quinsam R	Ocean-3	-33.814	0.017	0.010	1.625	0.113
Robertson Cr	Ocean-3	-1.874	0.001	0.031	0.023	0.981
Salmon R/TOMF	Ocean-3	-18.930	0.010	0.139	0.069	0.947
Shuswap R	Ocean-3	41.580	-0.020	0.028	-0.743	0.465
L Qualicum R	Ocean-4	-28.343	0.012	0.082	0.151	0.887
Nicola R	Ocean-4	31.666	-0.017	0.030	-0.579	0.568
Nitinat R	Ocean-4	16.756	-0.009	0.033	-0.275	0.786
Phillips R	Ocean-4	258.666	-0.129	0.145	-0.889	0.424
Puntledge R	Ocean-4	86.368	-0.045	0.020	-2.297	**<0.05**
Quesnel R	Ocean-4	-781.504	0.393	0.526	0.747	0.509
Quinsam R	Ocean-4	101.165	-0.051	0.010	-5.303	**<0.05**
Robertson Cr	Ocean-4	34.168	-0.018	0.024	-0.754	0.457
Salmon R/TOMF	Ocean-4	-54.879	0.026	0.104	0.254	0.810
Shuswap R	Ocean-4	182.216	-0.093	0.027	-3.472	**<0.05**

Table SI 10a. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Observed returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Female	241.346	-0.122	0.028	-4.396	**<0.05**
Big Qualicum R	Ocean-2	Female	-450.320	0.223	0.097	2.302	0.105
Chilliwack R	Ocean-2	Female	-133.864	0.067	0.051	1.317	0.212
Cowichan R	Ocean-2	Female	33.124	-0.017	0.030	-0.548	0.607
Harrison R	Ocean-2	Female	-60.316	0.029	0.046	0.639	0.533
Nicola R	Ocean-2	Female	59.799	-0.032	0.038	-0.845	0.413
Puntledge R	Ocean-2	Female	-590.722	0.293	0.059	4.941	**<0.05**
Quinsam R	Ocean-2	Female	-24.656	0.010	0.018	0.579	0.568
Robertson Cr	Ocean-2	Female	-27.783	0.013	0.030	0.416	0.681
Shuswap R	Ocean-2	Female	-31.521	0.015	0.069	0.219	0.830
Atnarko R	Ocean-3	Female	-379.071	0.188	0.043	4.389	**<0.05**
Big Qualicum R	Ocean-3	Female	496.698	-0.246	0.110	-2.239	0.111
Chilliwack R	Ocean-3	Female	79.094	-0.039	0.054	-0.733	0.478
Cowichan R	Ocean-3	Female	-26.828	0.013	0.032	0.417	0.694
Harrison R	Ocean-3	Female	-6.695	0.004	0.040	0.093	0.927
Nicola R	Ocean-3	Female	-10.078	0.006	0.037	0.173	0.865
Phillips R	Ocean-3	Female	127.228	-0.063	0.231	-0.273	0.802
Puntledge R	Ocean-3	Female	536.107	-0.266	0.046	-5.757	**<0.05**
Quinsam R	Ocean-3	Female	-140.375	0.070	0.021	3.316	**<0.05**
Robertson Cr	Ocean-3	Female	-17.634	0.009	0.030	0.296	0.769
Shuswap R	Ocean-3	Female	5.456	-0.002	0.066	-0.034	0.973
Atnarko R	Ocean-4	Female	261.991	-0.130	0.041	-3.176	**<0.05**
Big Qualicum R	Ocean-4	Female	-356.921	0.176	0.165	1.066	0.365
Chilliwack R	Ocean-4	Female	308.979	-0.156	0.044	-3.517	**<0.05**
Cowichan R	Ocean-4	Female	-101.430	0.049	0.032	1.505	0.193
Harrison R	Ocean-4	Female	179.772	-0.091	0.031	-2.883	**<0.05**
Kitsumkalum R	Ocean-4	Female	-13.662	0.008	0.007	1.193	0.355
Nicola R	Ocean-4	Female	-14.684	0.006	0.040	0.147	0.885
Phillips R	Ocean-4	Female	-93.625	0.046	0.232	0.200	0.854
Puntledge R	Ocean-4	Female	208.638	-0.105	0.240	-0.438	0.684
Quinsam R	Ocean-4	Female	138.487	-0.069	0.021	-3.339	**<0.05**
Robertson Cr	Ocean-4	Female	42.169	-0.022	0.023	-0.944	0.354
Shuswap R	Ocean-4	Female	121.386	-0.062	0.063	-0.985	0.343

Table S10b. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Observed returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Male	-892.805	0.442	0.151	2.924	**<0.05**
Big Qualicum R	Ocean-2	Male	0.587	0.000	0.130	0.003	0.997
Chilliwack R	Ocean-2	Male	17.494	-0.008	0.075	-0.102	0.923
Cowichan R	Ocean-2	Male	226.712	-0.113	0.022	-5.178	**<0.05**
Harrison R	Ocean-2	Male	-211.380	0.105	0.043	2.429	**<0.05**
Kitsumkalum R	Ocean-2	Male	-8.031	0.003	0.042	0.068	0.948
Nicola R	Ocean-2	Male	50.760	-0.027	0.040	-0.667	0.513
Phillips R	Ocean-2	Male	-117.695	0.058	0.254	0.226	0.835
Puntledge R	Ocean-2	Male	-161.323	0.081	0.067	1.219	0.290
Quinsam R	Ocean-2	Male	-75.177	0.037	0.015	2.451	**<0.05**
Robertson Cr	Ocean-2	Male	-64.746	0.033	0.039	0.839	0.409
Shuswap R	Ocean-2	Male	103.862	-0.052	0.082	-0.631	0.542
Atnarko R	Ocean-3	Male	373.778	-0.185	0.042	-4.464	**<0.05**
Big Qualicum R	Ocean-3	Male	2.177	-0.002	0.139	-0.013	0.990
Chilliwack R	Ocean-3	Male	-20.226	0.009	0.077	0.116	0.912
Cowichan R	Ocean-3	Male	-225.553	0.112	0.024	4.606	**<0.05**
Harrison R	Ocean-3	Male	140.834	-0.070	0.040	-1.762	0.112
Kitsumkalum R	Ocean-3	Male	-22.917	0.011	0.031	0.369	0.725
Nicola R	Ocean-3	Male	-111.123	0.056	0.034	1.638	0.119
Phillips R	Ocean-3	Male	496.543	-0.246	0.284	-0.866	0.450
Puntledge R	Ocean-3	Male	116.469	-0.059	0.058	-1.007	0.371
Quinsam R	Ocean-3	Male	7.525	-0.004	0.014	-0.269	0.790
Robertson Cr	Ocean-3	Male	44.298	-0.023	0.033	-0.673	0.507
Shuswap R	Ocean-3	Male	-145.980	0.072	0.079	0.915	0.382
Atnarko R	Ocean-4	Male	336.635	-0.168	0.101	-1.665	0.157
Big Qualicum R	Ocean-4	Male	27.275	-0.016	0.101	-0.156	0.883
Chilliwack R	Ocean-4	Male	25.978	-0.016	0.063	-0.252	0.811
Harrison R	Ocean-4	Male	142.789	-0.073	0.025	-2.914	**<0.05**
Kitsumkalum R	Ocean-4	Male	41.205	-0.021	0.035	-0.584	0.581
Nicola R	Ocean-4	Male	144.186	-0.073	0.032	-2.303	**<0.05**
Phillips R	Ocean-4	Male	-563.80	0.279	0.372	0.749	0.508
Quinsam R	Ocean-4	Male	107.714	-0.055	0.015	-3.582	**<0.05**
Robertson Cr	Ocean-4	Male	54.362	-0.029	0.029	-0.983	0.334
Shuswap R	Ocean-4	Male	299.271	-0.151	0.069	-2.194	0.053

Table SI 11a. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Estimated returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Female	164.497	-0.084	0.049	-1.710	0.163
Big Qualicum R	Ocean-2	Female	-449.822	0.223	0.097	2.301	0.105
Chilliwack R	Ocean-2	Female	-71.990	0.036	0.051	0.704	0.495
Cowichan R	Ocean-2	Female	72.905	-0.036	0.033	-1.113	0.316
Harrison R	Ocean-2	Female	-41.937	0.020	0.051	0.391	0.702
Nicola R	Ocean-2	Female	49.924	-0.027	0.040	-0.668	0.515
Puntledge R	Ocean-2	Female	-623.433	0.309	0.071	4.327	**<0.05**
Quinsam R	Ocean-2	Female	-40.733	0.018	0.017	1.045	0.307
Robertson Cr	Ocean-2	Female	-39.215	0.018	0.027	0.677	0.505
Shuswap R	Ocean-2	Female	-27.509	0.013	0.069	0.190	0.852
Atnarko R	Ocean-3	Female	-367.123	0.182	0.048	3.789	**<0.05**
Big Qualicum R	Ocean-3	Female	496.286	-0.246	0.110	-2.238	0.111
Chilliwack R	Ocean-3	Female	-62.180	0.031	0.070	0.442	0.666
Cowichan R	Ocean-3	Female	-49.494	0.025	0.034	0.730	0.498
Harrison R	Ocean-3	Female	-8.824	0.005	0.036	0.133	0.896
Nicola R	Ocean-3	Female	-0.253	0.001	0.038	0.037	0.971
Phillips R	Ocean-3	Female	77.935	-0.039	0.237	-0.163	0.881
Puntledge R	Ocean-3	Female	548.490	-0.272	0.048	-5.690	**<0.05**
Quinsam R	Ocean-3	Female	-136.255	0.068	0.020	3.401	**<0.05**
Robertson Cr	Ocean-3	Female	-14.035	0.007	0.031	0.236	0.815
Shuswap R	Ocean-3	Female	1.834	0.000	0.066	-0.007	0.995
Atnarko R	Ocean-4	Female	272.999	-0.135	0.049	-2.781	**<0.05**
Big Qualicum R	Ocean-4	Female	-357.396	0.176	0.165	1.067	0.364
Chilliwack R	Ocean-4	Female	271.000	-0.137	0.068	-2.013	0.067
Cowichan R	Ocean-4	Female	-207.156	0.102	0.063	1.616	0.167
Harrison R	Ocean-4	Female	101.239	-0.052	0.038	-1.355	0.197
Kitsumkalum R	Ocean-4	Female	5.899	-0.002	0.016	-0.118	0.917
Nicola R	Ocean-4	Female	-35.708	0.016	0.043	0.380	0.710
Phillips R	Ocean-4	Female	-41.993	0.021	0.238	0.087	0.936
Puntledge R	Ocean-4	Female	274.477	-0.138	0.226	-0.610	0.575
Quinsam R	Ocean-4	Female	135.021	-0.068	0.019	-3.468	**<0.05**
Robertson Cr	Ocean-4	Female	52.840	-0.027	0.025	-1.081	0.290
Shuswap R	Ocean-4	Female	122.087	-0.063	0.062	-1.011	0.330

Table SI 11b. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Estimated returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Male	-762.355	0.378	0.128	2.963	**<0.05**
Big Qualicum R	Ocean-2	Male	0.276	0.001	0.130	0.005	0.997
Chilliwack R	Ocean-2	Male	60.764	-0.029	0.097	-0.304	0.773
Cowichan R	Ocean-2	Male	203.691	-0.101	0.031	-3.284	**<0.05**
Harrison R	Ocean-2	Male	-222.070	0.111	0.042	2.655	**<0.05**
Kitsumkalum R	Ocean-2	Male	-18.671	0.008	0.053	0.151	0.885
Nicola R	Ocean-2	Male	54.849	-0.029	0.041	-0.701	0.492
Phillips R	Ocean-2	Male	-140.159	0.069	0.255	0.269	0.805
Puntledge R	Ocean-2	Male	-174.360	0.088	0.069	1.269	0.273
Quinsam R	Ocean-2	Male	-79.601	0.039	0.015	2.584	**<0.05**
Robertson Cr	Ocean-2	Male	-75.948	0.038	0.037	1.028	0.313
Shuswap R	Ocean-2	Male	109.600	-0.054	0.082	-0.661	0.524
Atnarko R	Ocean-3	Male	416.763	-0.207	0.045	-4.587	**<0.05**
Big Qualicum R	Ocean-3	Male	2.267	-0.002	0.139	-0.014	0.990
Chilliwack R	Ocean-3	Male	-65.978	0.032	0.111	0.290	0.784
Cowichan R	Ocean-3	Male	-204.650	0.102	0.030	3.369	**<0.05**
Harrison R	Ocean-3	Male	143.614	-0.072	0.042	-1.696	0.124
Kitsumkalum R	Ocean-3	Male	-17.885	0.009	0.030	0.291	0.781
Nicola R	Ocean-3	Male	-109.664	0.056	0.033	1.672	0.112
Phillips R	Ocean-3	Male	505.953	-0.251	0.279	-0.897	0.436
Puntledge R	Ocean-3	Male	133.118	-0.067	0.063	-1.068	0.346
Quinsam R	Ocean-3	Male	-2.125	0.001	0.014	0.078	0.939
Robertson Cr	Ocean-3	Male	50.074	-0.025	0.033	-0.766	0.450
Shuswap R	Ocean-3	Male	-150.592	0.075	0.080	0.931	0.374
Atnarko R	Ocean-4	Male	245.593	-0.123	0.102	-1.203	0.283
Big Qualicum R	Ocean-4	Male	28.914	-0.017	0.101	-0.164	0.877
Chilliwack R	Ocean-4	Male	102.634	-0.054	0.099	-0.546	0.609
Harrison R	Ocean-4	Male	145.639	-0.074	0.041	-1.798	0.106
Kitsumkalum R	Ocean-4	Male	37.234	-0.019	0.035	-0.526	0.618
Nicola R	Ocean-4	Male	132.980	-0.068	0.030	-2.235	**<0.05**
Phillips R	Ocean-4	Male	-563.207	0.279	0.368	0.757	0.504
Quinsam R	Ocean-4	Male	116.146	-0.059	0.016	-3.765	**<0.05**
Robertson Cr	Ocean-4	Male	46.855	-0.025	0.032	-0.772	0.447
Shuswap R	Ocean-4	Male	324.102	-0.163	0.066	-2.469	**<0.05**

Table SI 12a. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Expanded returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Female	51.575	-0.028	0.044	-0.631	0.562
Big Qualicum R	Ocean-2	Female	-711.651	0.353	0.202	1.744	0.179
Chilliwack R	Ocean-2	Female	-110.827	0.055	0.052	1.058	0.311
Cowichan R	Ocean-2	Female	123.584	-0.062	0.045	-1.371	0.229
Harrison R	Ocean-2	Female	-61.781	0.030	0.058	0.515	0.614
Nicola R	Ocean-2	Female	42.752	-0.023	0.041	-0.569	0.578
Puntledge R	Ocean-2	Female	-322.680	0.160	0.168	0.955	0.394
Quinsam R	Ocean-2	Female	-34.255	0.015	0.019	0.795	0.435
Robertson Cr	Ocean-2	Female	-22.708	0.010	0.033	0.304	0.763
Shuswap R	Ocean-2	Female	-29.740	0.014	0.067	0.211	0.836
Atnarko R	Ocean-3	Female	-414.147	0.205	0.045	4.532	**<0.05**
Big Qualicum R	Ocean-3	Female	680.674	-0.338	0.189	-1.788	0.172
Chilliwack R	Ocean-3	Female	-77.823	0.039	0.086	0.451	0.660
Cowichan R	Ocean-3	Female	-98.991	0.049	0.046	1.068	0.334
Harrison R	Ocean-3	Female	-5.124	0.003	0.046	0.065	0.949
Nicola R	Ocean-3	Female	2.580	0.000	0.039	-0.001	0.999
Phillips R	Ocean-3	Female	202.472	-0.100	0.234	-0.429	0.697
Puntledge R	Ocean-3	Female	298.313	-0.148	0.167	-0.888	0.425
Quinsam R	Ocean-3	Female	-124.042	0.062	0.017	3.633	**<0.05**
Robertson Cr	Ocean-3	Female	-18.939	0.010	0.032	0.305	0.763
Shuswap R	Ocean-3	Female	1.840	0.000	0.065	-0.006	0.995
Atnarko R	Ocean-4	Female	354.555	-0.176	0.044	-3.991	**<0.05**
Big Qualicum R	Ocean-4	Female	-103.840	0.050	0.249	0.201	0.854
Chilliwack R	Ocean-4	Female	288.965	-0.146	0.069	-2.129	0.055
Cowichan R	Ocean-4	Female	-210.995	0.104	0.058	1.794	0.133
Harrison R	Ocean-4	Female	61.701	-0.032	0.050	-0.644	0.530
Kitsumkalum R	Ocean-4	Female	10.759	-0.004	0.017	-0.255	0.822
Nicola R	Ocean-4	Female	-29.483	0.013	0.044	0.299	0.769
Phillips R	Ocean-4	Female	-165.181	0.082	0.236	0.347	0.751
Puntledge R	Ocean-4	Female	63.221	-0.033	0.246	-0.136	0.899
Quinsam R	Ocean-4	Female	123.758	-0.062	0.016	-3.870	**<0.05**
Robertson Cr	Ocean-4	Female	49.573	-0.025	0.023	-1.085	0.288
Shuswap R	Ocean-4	Female	118.399	-0.061	0.058	-1.057	0.310

Table SI 12b. Regression statistics from time series of age composition for female Chinook salmon estimated from EPADS Expanded returns.

Stock	Ocean age	Sex	Intercept	Slope	SE	Z	p
Atnarko R	Ocean-2	Male	-834.742	0.414	0.129	3.201	**<0.05**
Big Qualicum R	Ocean-2	Male	-36.408	0.019	0.170	0.111	0.917
Chilliwack R	Ocean-2	Male	-3.125	0.002	0.104	0.021	0.984
Cowichan R	Ocean-2	Male	255.786	-0.127	0.024	-5.347	**<0.05**
Harrison R	Ocean-2	Male	-183.697	0.092	0.050	1.813	0.103
Kitsumkalum R	Ocean-2	Male	-17.723	0.008	0.053	0.143	0.891
Nicola R	Ocean-2	Male	54.876	-0.029	0.041	-0.714	0.485
Phillips R	Ocean-2	Male	-163.459	0.080	0.265	0.303	0.782
Puntledge R	Ocean-2	Male	-354.726	0.177	0.087	2.043	0.111
Quinsam R	Ocean-2	Male	-79.669	0.039	0.014	2.745	**<0.05**
Robertson Cr	Ocean-2	Male	-77.074	0.038	0.038	1.005	0.324
Shuswap R	Ocean-2	Male	92.957	-0.046	0.076	-0.608	0.556
Atnarko R	Ocean-3	Male	359.315	-0.178	0.047	-3.831	**<0.05**
Big Qualicum R	Ocean-3	Male	10.968	-0.006	0.183	-0.034	0.975
Chilliwack R	Ocean-3	Male	-6.733	0.003	0.118	0.023	0.983
Cowichan R	Ocean-3	Male	-259.289	0.129	0.022	5.808	**<0.05**
Harrison R	Ocean-3	Male	146.456	-0.073	0.050	-1.450	0.181
Kitsumkalum R	Ocean-3	Male	-17.034	0.008	0.030	0.282	0.788
Nicola R	Ocean-3	Male	-114.172	0.058	0.034	1.692	0.108
Phillips R	Ocean-3	Male	562.760	-0.279	0.280	-0.995	0.393
Puntledge R	Ocean-3	Male	297.571	-0.149	0.067	-2.228	0.090
Quinsam R	Ocean-3	Male	12.088	-0.006	0.013	-0.458	0.650
Robertson Cr	Ocean-3	Male	52.904	-0.027	0.033	-0.812	0.424
Shuswap R	Ocean-3	Male	-145.495	0.072	0.075	0.968	0.356
Atnarko R	Ocean-4	Male	333.792	-0.166	0.112	-1.491	0.196
Big Qualicum R	Ocean-4	Male	477.893	-0.240	0.259	-0.925	0.407
Chilliwack R	Ocean-4	Male	223.765	-0.114	0.090	-1.276	0.258
Harrison R	Ocean-4	Male	43.715	-0.023	0.052	-0.453	0.661
Kitsumkalum R	Ocean-4	Male	36.176	-0.018	0.036	-0.508	0.630
Nicola R	Ocean-4	Male	146.057	-0.074	0.031	-2.389	**<0.05**
Phillips R	Ocean-4	Male	-630.833	0.312	0.363	0.860	0.453
Quinsam R	Ocean-4	Male	119.499	-0.061	0.013	-4.633	**<0.05**
Robertson Cr	Ocean-4	Male	15.920	-0.010	0.036	-0.267	0.792
Shuswap R	Ocean-4	Male	360.913	-0.182	0.061	-2.954	**<0.05**

Table SI 13. Regression statistics from time series of mean size estimated from biodata.

Stock	Slope	SE	p
Atnarko R	-2.460	0.062	**<0.05**
Babine R	2.950	0.452	**<0.05**
Big Qualicum R	-0.944	0.019	**<0.05**
Burman R	-9.529	0.330	**<0.05**
Capilano R	3.279	0.062	**<0.05**
Chehalis R	2.248	0.135	**<0.05**
Chilliwack R	-0.866	0.039	**<0.05**
Conuma R	-8.767	0.038	**<0.05**
Cowichan R	1.980	0.092	**<0.05**
Eagle R	-5.123	0.695	**<0.05**
Kitimat R	3.102	0.382	**<0.05**
Kitsumkalum R	-0.433	0.241	0.073
L Qualicum R	-5.676	0.140	**<0.05**
Nahmint R	0.664	0.269	**<0.05**
Nechako R	-1.560	0.048	**<0.05**
Nitinat R	-7.295	0.048	**<0.05**
Puntledge R	-2.607	0.032	**<0.05**
Quinsam R	-2.538	0.026	**<0.05**
Robertson Cr	-2.028	0.021	**<0.05**
Sarita R	-2.709	0.087	**<0.05**
Shuswap R	-2.947	0.043	**<0.05**
Stuart R	-0.590	0.062	**<0.05**

Table SI 14a. Regression statistics from time series of size-at-age estimated from biodata.

Stock	Ocean age	Slope	SE	p
Robertson Cr	Ocean-2	-1.103	0.038	**<0.05**
Conuma R	Ocean-2	-4.871	0.181	**<0.05**
Nitinat R	Ocean-2	-3.632	0.209	**<0.05**
Puntledge R	Ocean-2	-1.293	0.081	**<0.05**
Chilliwack R	Ocean-2	1.099	0.078	**<0.05**
Big Qualicum R	Ocean-2	-0.694	0.058	**<0.05**
Capilano R	Ocean-2	2.066	0.186	**<0.05**
Chehalis R	Ocean-2	-2.572	0.228	**<0.05**
Nechako R	Ocean-2	1.864	0.220	**<0.05**
L Qualicum R	Ocean-2	-3.231	0.396	**<0.05**
Chemainus R	Ocean-2	2.400	0.325	**<0.05**
Stuart R	Ocean-2	2.442	0.351	**<0.05**
Nahmint R	Ocean-2	2.984	0.641	**<0.05**
Atnarko R	Ocean-2	0.829	0.242	**<0.05**
Harrison R	Ocean-2	0.549	0.189	**<0.05**
Cowichan R	Ocean-2	0.191	0.124	0.122
Shuswap R	Ocean-2	-0.162	0.255	0.526
Kincolith R	Ocean-2	-0.325	0.775	0.675
Sarita R	Ocean-2	-0.243	0.599	0.686
Quinsam R	Ocean-2	-0.024	0.083	0.769
Nitinat R	Ocean-3	-6.348	0.108	**<0.05**
Robertson Cr	Ocean-3	-2.232	0.048	**<0.05**
Conuma R	Ocean-3	-7.435	0.116	**<0.05**
Quinsam R	Ocean-3	-2.790	0.078	**<0.05**

Table SI 14b. Regression statistics from time series of size-at-age estimated from biodata.

Stock	Ocean age	Slope	SE	p
Big Qualicum R	Ocean-3	-3.503	0.108	**<0.05**
Puntledge R	Ocean-3	-4.275	0.158	**<0.05**
Shuswap R	Ocean-3	-2.101	0.139	**<0.05**
L Qualicum R	Ocean-3	-6.572	0.473	**<0.05**
Sarita R	Ocean-3	-3.162	0.263	**<0.05**
Burman R	Ocean-3	-10.891	1.087	**<0.05**
Atnarko R	Ocean-3	-1.544	0.207	**<0.05**
Cowichan R	Ocean-3	-2.175	0.292	**<0.05**
Stuart R	Ocean-3	1.295	0.190	**<0.05**
Babine R	Ocean-3	5.002	1.054	**<0.05**
Nechako R	Ocean-3	0.620	0.142	**<0.05**
Harrison R	Ocean-3	-0.747	0.387	0.054
Capilano R	Ocean-3	-1.571	0.870	0.072
Chilliwack R	Ocean-3	0.201	0.146	0.167
Chehalis R	Ocean-3	0.541	0.697	0.438
Nahmint R	Ocean-3	-0.151	0.482	0.754
Chemainus R	Ocean-3	0.472	1.767	0.790
Quinsam R	Ocean-4	-5.774	0.126	**<0.05**
Robertson Cr	Ocean-4	-4.301	0.115	**<0.05**
Nitinat R	Ocean-4	-8.957	0.216	**<0.05**
Conuma R	Ocean-4	-8.985	0.230	**<0.05**
Atnarko R	Ocean-4	-4.534	0.224	**<0.05**
Burman R	Ocean-4	-8.147	0.566	**<0.05**
Sarita R	Ocean-4	-4.538	0.447	**<0.05**
Nechako R	Ocean-4	-1.819	1.358	0.182
Chilliwack R	Ocean-4	-0.293	0.996	0.769

Table SI 15. Regression statistics from time series of sex-specific size-at-age estimated from biodata.

Stock	Ocean age	Sex	Slope	SE	p
Atnarko R	Ocean-3	Female	0.139	0.652	0.831
Big Qualicum R	Ocean-2	Female	-1.976	0.286	**<0.05**
Big Qualicum R	Ocean-3	Female	-3.196	0.345	**<0.05**
Chilliwack R	Ocean-2	Female	-0.170	0.148	0.251
Chilliwack R	Ocean-3	Female	0.332	0.188	0.078
Conuma R	Ocean-3	Female	-2.988	0.380	**<0.05**
Nechako R	Ocean-2	Female	0.858	0.252	**<0.05**
Nechako R	Ocean-3	Female	0.102	0.154	0.508
Nechako R	Ocean-4	Female	-4.212	2.645	0.114
Nitinat R	Ocean-2	Female	-3.034	0.617	**<0.05**
Nitinat R	Ocean-3	Female	-2.834	0.141	**<0.05**
Nitinat R	Ocean-4	Female	-4.047	0.351	**<0.05**
Puntledge R	Ocean-2	Female	-1.810	0.405	**<0.05**
Puntledge R	Ocean-3	Female	-1.937	0.334	**<0.05**
Quinsam R	Ocean-2	Female	2.725	0.506	**<0.05**
Quinsam R	Ocean-3	Female	-2.246	0.114	**<0.05**
Quinsam R	Ocean-4	Female	-4.027	0.179	**<0.05**
Robertson Cr	Ocean-2	Female	-1.127	0.103	**<0.05**
Robertson Cr	Ocean-3	Female	-2.254	0.054	**<0.05**
Robertson Cr	Ocean-4	Female	-3.337	0.114	**<0.05**
Sarita R	Ocean-3	Female	-2.228	0.265	**<0.05**
Stuart R	Ocean-2	Female	1.759	0.369	**<0.05**
Stuart R	Ocean-3	Female	0.580	0.203	**<0.05**
Atnarko R	Ocean-3	Male	-3.140	0.652	**<0.05**
Big Qualicum R	Ocean-2	Male	-2.730	0.196	**<0.05**
Big Qualicum R	Ocean-3	Male	-3.520	0.618	**<0.05**
Chilliwack R	Ocean-2	Male	0.690	0.126	**<0.05**
Chilliwack R	Ocean-3	Male	0.519	0.353	0.142
Conuma R	Ocean-3	Male	-5.075	0.418	**<0.05**
Nechako R	Ocean-2	Male	2.997	0.422	**<0.05**
Nechako R	Ocean-3	Male	1.437	0.229	**<0.05**
Nechako R	Ocean-4	Male	-1.740	1.707	0.310
Nitinat R	Ocean-2	Male	-2.165	0.245	**<0.05**
Nitinat R	Ocean-3	Male	-3.148	0.215	**<0.05**
Nitinat R	Ocean-4	Male	-4.715	0.762	**<0.05**
Puntledge R	Ocean-2	Male	-1.775	0.230	**<0.05**
Puntledge R	Ocean-3	Male	-2.003	0.621	**<0.05**
Quinsam R	Ocean-2	Male	-0.797	0.113	**<0.05**
Quinsam R	Ocean-3	Male	-2.684	0.134	**<0.05**
Quinsam R	Ocean-4	Male	-6.315	0.335	**<0.05**
Robertson Cr	Ocean-2	Male	-1.019	0.035	**<0.05**
Robertson Cr	Ocean-3	Male	-2.597	0.076	**<0.05**
Robertson Cr	Ocean-4	Male	-5.117	0.395	**<0.05**
Sarita R	Ocean-3	Male	-3.142	0.391	**<0.05**
Stuart R	Ocean-2	Male	3.113	0.709	**<0.05**
Stuart R	Ocean-3	Male	2.246	0.309	**<0.05**

Table SI 16a. Regression statistics from time series of the proportion of females of runs estimated from River returns.

Stock	Intercept	Slope	SE	p
Ashlu Cr	-14.529	0.007	0.009	0.474
Atnarko R	30.616	-0.015	0.005	**<0.05**
Babine R	81.243	-0.041	0.064	0.535
Bedwell R	-111.010	0.055	0.080	0.525
Big Qualicum R	-6.795	0.003	0.005	0.552
Birkenhead R	-23.472	0.012	0.015	0.447
Bonaparte R	174.184	-0.087	0.022	**<0.05**
Bridge R	52.127	-0.026	0.008	**<0.05**
Bulkley R Up	61.588	-0.031	0.011	**<0.05**
Burman R	-75.789	0.038	0.010	**<0.05**
Capilano R	-24.403	0.012	0.012	0.356
Cedar R	116.498	-0.059	0.049	0.273
Cheakamus R	13.870	-0.007	0.008	0.395
Chehalis R	-58.361	0.029	0.019	0.142
Chemainus R	33.976	-0.017	0.010	0.108
Chilko R	-35.663	0.018	0.010	0.123
Chilliwack R	-36.096	0.018	0.019	0.366
Chuckwalla R	34.146	-0.017	0.013	0.203
Clearwater R Low	293.439	-0.148	0.048	0.053
Coldwater R	15.916	-0.008	0.005	0.097
Conuma R	15.225	-0.008	0.008	0.339
Cowichan R	-63.862	0.032	0.010	**<0.05**
Cypre R	-49.655	0.025	0.018	0.266
Dala R	-153.820	0.077	0.042	0.106
Deadman R	-51.441	0.026	0.044	0.572
Dome Cr	32.825	-0.017	0.024	0.499
Eagle R	-104.995	0.053	0.060	0.411
Finn Cr	-307.675	0.155	0.046	**<0.05**
First Lk/GSVI	-28.015	0.014	0.009	0.135
Gold R	-26.339	0.013	0.011	0.240
Goldstream R	-129.598	0.064	0.017	**<0.05**
Harrison R	33.950	-0.017	0.006	**<0.05**
Hirsch Cr	15.611	-0.008	0.015	0.594
Kennedy R Low	27.210	-0.014	0.015	0.390
Kilbella R	61.031	-0.031	0.013	**<0.05**
Kildala R	-16.895	0.008	0.030	0.782
Kispiox R	-252.140	0.127	0.065	0.100
Kitimat R	49.999	-0.025	0.015	0.110
Kitsumkalum R	-35.981	0.018	0.004	**<0.05**
Kloiya Cr	-51.258	0.025	0.029	0.427
L Campbell R	-81.579	0.040	0.034	0.281
L Qualicum R	-4.914	0.002	0.006	0.736
Lang Cr	-50.327	0.025	0.014	0.080

Table S16b. Regression statistics from time series of the proportion of females of runs estimated from River returns.

Stock	Intercept	Slope	SE	p
Leiner R	19.167	-0.010	0.009	0.332
Maclean Bay	128.165	-0.065	0.100	0.539
Mamquam R	-108.099	0.053	0.045	0.290
Marble R	13.063	-0.007	0.015	0.666
Maria Sl	-57.788	0.029	0.030	0.363
Nahmint R	42.596	-0.021	0.011	0.074
Nanaimo R	-54.234	0.027	0.012	**<0.05**
Nicola R	18.271	-0.009	0.003	**<0.05**
Nimpkish R	-126.496	0.063	0.048	0.247
Nitinat R	64.347	-0.032	0.008	**<0.05**
Nusatsum R	20.195	-0.010	0.012	0.414
Oyster R	67.736	-0.034	0.075	0.673
Phillips R	-20.398	0.010	0.040	0.809
Porteau Cv	78.651	-0.040	0.022	0.090
Puntledge R	23.631	-0.012	0.005	**<0.05**
Quatse R	19.452	-0.010	0.057	0.871
Quesnel R	8.498	-0.004	0.024	0.858
Quinsam R	21.981	-0.011	0.004	**<0.05**
Robertson Cr	28.529	-0.015	0.012	0.218
Salmon R/TOMF	37.229	-0.019	0.006	**<0.05**
San Juan R	-41.289	0.020	0.010	**<0.05**
Sarita R	-18.075	0.009	0.016	0.585
Serpentine R	-15.589	0.008	0.007	0.326
Seymour R/GSMN	15.985	-0.008	0.062	0.903
Shovelnose Cr	741.971	-0.368	0.112	**<0.05**
Shuswap R	-58.975	0.029	0.017	0.088
Sliammon R	-48.023	0.024	0.015	0.135
Sooke R	-52.036	0.026	0.018	0.179
Spius Cr	21.396	-0.011	0.008	0.181
Squamish R	0.744	-0.001	0.055	0.989
Stave R	-65.377	0.033	0.019	0.127
Stuart R	-76.824	0.039	0.039	0.360
Sucwoa R	37.270	-0.019	0.023	0.423
Tahsis R	-21.763	0.011	0.015	0.496
Thornton Cr	-22.848	0.011	0.011	0.301
Tlupana R	33.611	-0.017	0.009	0.063
Toquart R	65.055	-0.032	0.012	**<0.05**
Tranquil Cr	-49.329	0.024	0.008	0.063
Wannock R	33.554	-0.017	0.008	**<0.05**
Woss R	12.328	-0.006	0.008	0.468
Yakoun R	-7.568	0.004	0.007	0.618

Sensitivity Analyses

Comparison of size-at-age trends between 'Stock' and 'Stock2'

Table SI 17. The number of stocks included in the biodata in each ocean age class when Stock and Stock2 are used.

Ocean age	Indicator	Number of stocks
Ocean-2	Stock	20
Ocean-2	Stock2	22
Ocean-3	Stock	21
Ocean-3	Stock2	24
Ocean-4	Stock	9
Ocean-4	Stock2	13

Table SI 18. Stocks included in the biodata when Stock and Stock2 are used.

Name	Stock	Stock2
Atnarko R	Y	Y
Babine R	Y	Y
Big Qualicum R	Y	Y
Burman R	Y	Y
Campbell R		Y
Capilano R	Y	Y
Cheakamus R		Y
Chehalis R	Y	Y
Chemainus R	Y	Y
Chilliwack R	Y	Y
Conuma R	Y	Y
Cowichan R	Y	Y
Gold R		Y
Harrison R	Y	Y
Kincolith R	Y	Y
L Qualicum R	Y	Y
Nahmint R	Y	Y
Nechako R	Y	Y
Nitinat R	Y	Y
Puntledge R	Y	Y
Quinsam R	Y	Y
Robertson Cr	Y	Y
Sarita R	Y	Y
Shuswap R	Y	Y
Stuart R	Y	Y

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