Appendix C: Spawner and Non-Spawner Chlorophyll Analysis

Table 1: Table C1. Model selection tests of Chlorophyll-a (CHL) as an explanatory variable for the Jul-Sep catch (S_t) using 1998 to 2014 data. The data range is determined by the years for which CHL was available. V_t is CHL in the current season which spans two calendar years from July to June in the next year. V_{t-1} is CHL in the prior Jul-Jun season. Only CHL in Oct-Dec and Jan-Mar in the prior season is used since for the current season, these months are after the Jul-Sep catch being modeled. Non-linearity is modeled as a 2nd-order polynomial due to data constraints and appears as $p()$ in the model equations. The Jul-Sep catch is modeled as a function of Oct-Jun catch in the prior year only, without Jul-Sep catch 2-years prior as in the other covariate analyses (Appendix B). This is done due to data constraints. The models are nested; the Roman numeral indicates the level of nestedness. Models at levels II and higher are shown with the component that is added to the base level model (M) at top.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1998-2014 data						
1. $ln(S_t) = \alpha + p(ln(N_{t-1})) + \epsilon_t$	14	0.516	25.3			18.29
V_t = Jul-Sep Chlorophyll						
2. $ln(S_t) = M + \beta V_t$	13	0.503	24.6	0.69	0.427	19.2
3. $ln(S_t) = M + p(V_t)$	12	0.48	19.5	0.16	0.699	20.94
4. $ln(S_t) = M + p(V_t) + \beta V_{t-1}$	11	0.5	13.7	0.17	0.688	22.65
5. $ln(S_t) = M + p(V_t) + p(V_{t-1})$	10	0.497	5.1	0.01	0.935	24.64
V_t = Oct-Dec Chlorophyll						
2. $ln(S_t) = M + \beta V_{t-1}$	13	0.516	19.6	0	0.99	20.29
3. $ln(S_t) = M + p(V_{t-1})$	12	0.456	21.5	1.33	0.272	20.51
V_t = Jan-Mar Chlorophyll						
2. $ln(S_t) = M + \beta V_{t-1}$	13	0.522	20.6	0.16	0.697	20.08
3. $ln(S_t) = M + p(V_{t-1})$	12	0.526	16.7	0.4	0.541	21.52

Table 2: Table C2. Model selection tests of Chlorophyll-a (CHL) as an explanatory variable for Oct-Jun catch (N_t) using 1998 to 2014 data. The data range is determined by the years for which CHL was available. V_t is CHL in the current season which spans two calendar years from July to June in the next year. V_{t-1} is CHL in the prior Jul-Jun season. Non-linearity is modeled as a 2nd-order polynomial due to data constraints and appears as $p()$ in the model equations. The Oct-Jun catch is modeled as a function of Oct-Jun catch in the prior year only, without Jul-Sep catch 2-years prior as in the other covariate analyses (Appendix B). This was done due to data constraints. The models are nested; the numeral indicates the level of nestedness. Models at levels 2 and higher are shown with the component that is added to the base level model (M) at top.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1998-2014 data						
1-M. $ln(N_t) = \alpha + p(ln(N_{t-1})) + \epsilon_t$	14	0.875	26.5			18.94
V_t = Jul-Sep Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.893	23.1	0.32	0.587	20.45
3. $ln(N_t) = M + p(V_t)$	12	0.874	17.9	0.15	0.709	22.21
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.86	25	0.69	0.422	20.03
3. $ln(N_t) = M + p(V_{t-1})$	11.7	0.839	21.7	0.27	0.677	21.36
V_t = Oct-Dec Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.883	23.9	0.59	0.458	20.29
3. $ln(N_t) = M + p(V_t)$	12	0.744	29.5	2.22	0.167	19.62
4. $ln(N_t) = M + p(V_t) + \beta V_{t-1}$	11	0.679	40.8	2.99	0.114	17.16
5. $ln(N_t) = M + p(V_t) + p(V_{t-1})$	10	0.68	34.9	0	0.976	19.16
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.764	39.4	3.87	0.074	16.41
3. $ln(N_t) = M + p(V_{t-1})$	11.3	0.728	37.7	0.49	0.595	17.62
V_t = Jan-Mar Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.901	23.6	0.4	0.541	20.34
3. $ln(N_t) = M + p(V_t)$	12	0.829	23.9	0.89	0.367	20.92
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.866	21.2	0.05	0.829	20.88
3. $ln(N_t) = M + p(V_{t-1})$	11.1	0.873	15.2	0.23	0.791	22.97

Table 3: Table C3. Model selection tests of Chlorophyll-a as an explanatory variable for the catch during the non-spawning months (Oct-Jun) using box 5.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1998-2014 data						
1. $ln(N_t) = \alpha + p(ln(N_{t-1})) + \epsilon_t$	14	0.875	26.5			18.94
V_t = Jul-Sep Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.865	22.5	0.24	0.635	20.6
3. $ln(N_t) = M + p(V_t)$	12	0.904	20.4	0.61	0.451	21.69
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.839	28.5	1.33	0.271	19.22
3. $ln(N_t) = M + p(V_{t-1})$	12	0.837	25.2	0.07	0.789	20.42
V_t = Oct-Dec Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.864	28.4	1.4	0.265	19.25
3. $ln(N_t) = M + p(V_t)$	12	0.844	24	0.26	0.62	20.91
4. $ln(N_t) = M + p(V_t) + \beta V_{t-1}$	11	0.666	35.6	2.9	0.119	18.62
5. $ln(N_t) = M + p(V_t) + p(V_{t-1})$	10	0.649	29.9	0.11	0.743	20.42
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.739	35.5	2.88	0.116	17.48
3. $ln(N_t) = M + p(V_{t-1})$	11.7	0.732	34.2	0.52	0.534	18.39
V_t = Jan-Mar Chlorophyll						
2. $ln(N_t) = M + \beta V_t$	13	0.847	29.5	1.56	0.24	18.98
3. $ln(N_t) = M + p(V_t)$	12	0.804	31.6	1.33	0.276	19.11
2. $ln(N_t) = M + \beta V_{t-1}$	13	0.89	21.4	0.09	0.769	20.84
3. $ln(N_t) = M + p(V_{t-1})$	8.9	0.682	27.9	1.07	0.427	20.97