Table A2 a-c

Table A1. Model selection tests of time-dependency the log catch during spawning months using F-tests of nested linear models. S_t is the catch during the spawning period (Jul-Sep). N_t is the catch during the non-spawning period (Oct-Jun). S_{t-1} and N_{t-1} are the catch during the prior season during and after the spawning period respectively. S_{t-2} and N_{t-2} are the same for two seasons prior. Test A uses catch during the spawning period as the explanatory variable. Test B uses catch during the non-spawning period as the explanatory variable. The numbers in front of the model equation indicate the level of nestedness. For Test C, there are two nested model sets, each with a different model 3. The Naive model is a model that uses the previous data point in the time series as the prediction; thus the Naive model has no estimated parameters.

Model	Residual df	MASE	Adj. R2	F	p value	AIC	LOOCV
Naive Model 1984-2015 data							
$ln(S_t) = ln(S_{t-1}) + \epsilon_t$	32	1				122.85	1.599
Time dependency test A 1984-2015 data							1.599
1. $ln(S_t) = \alpha + ln(S_{t-1}) + \epsilon_t$	31	0.992	-29			124.83	1.65
2. $ln(S_t) = \alpha + \beta ln(S_{t-1}) + \epsilon_t$	30	0.814	10.3	15.14	0.001	114.14	1.43
3. $ln(S_t) = \alpha + \beta_1 ln(S_{t-1}) + \beta_2 ln(S_{t-2}) + \epsilon_t$	29	0.803	13.6	2.13	0.155	113.88	1.414
Time dependency test B 1984-2015 data							
1. $ln(S_t) = \alpha + ln(N_{t-1}) + \epsilon_t$	31	0.856	14.2			111.78	1.346
2. $ln(S_t) = \alpha + \beta ln(N_{t-1}) + \epsilon_t$	30	0.794	22.2	4.06	0.053	109.59	1.308
3. $ln(S_t) = \alpha + \beta_1 ln(N_{t-1}) + \beta_2 ln(N_{t-2}) + \epsilon_t$	29	0.797	19.6	0.01	0.919	111.57	1.346
Time dependency test C 1984-2015 data							
1. $ln(S_t) = \alpha + ln(N_{t-1}) + \epsilon_t$	31	0.856	14.2			111.78	1.346
2. $ln(S_t) = \alpha + \beta ln(N_{t-1}) + \epsilon_t$	30	0.794	22.2	4.08	0.053	109.59	1.308
3a. $ln(S_t) = \alpha + \beta_1 ln(N_{t-1}) + \beta_2 ln(S_{t-1}) + \epsilon_t$	29	0.804	20	0.16	0.688	111.4	1.37
3b. $ln(S_t) = \alpha + \beta_1 ln(N_{t-1}) + \beta_2 ln(S_{t-2}) + \epsilon_t$	29	0.778	20.8	0.45	0.508	111.09	1.331

Table A2. Model selection tests of time-dependency the catch during spawning months using non-linear or time-varying linear responses instead of time-constant linear responses as in Table A1. See Table A1 for an explanation of the parameters and model set-up.

Model	Residual df	MASE	Adj. R2	F	p value	AIC	LOOCV
Time dependency test A 1984-2015 data							
1. $ln(S_t) = \alpha + \beta ln(S_{t-1}) + \epsilon_t$	30	0.814	10.3			114.14	1.43
2. $ln(S_t) = \alpha + s(ln(S_{t-1})) + \epsilon_t$	28.2	0.798	19.6	2.74	0.089	111.79	1.371
3. $ln(S_t) = \alpha + s_1(ln(S_{t-1})) + s_2(ln(S_{t-2})) + \epsilon_t$	25.5	0.77	20.7	0.97	0.416	113.23	1.382
Time dependency test B 1984-2015 data							
1. $ln(S_t) = \alpha + \beta ln(N_{t-1}) + \epsilon_t$	30	0.794	22.2			109.59	1.308
2. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	28.6	0.761	24.4	1.26	0.287	109.52	1.299
3. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(N_{t-2})) + \epsilon_t$	26.4	0.761	21.2	0.28	0.785	112.42	1.342
Time dependency test C 1984-2015 data							
1. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	28.6	0.761	24.4			109.52	1.299
2. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(S_{t-1})) + \epsilon_t$	26.1	0.698	28.5	1.49	0.242	109.55	1.273
3. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(S_{t-2})) + \epsilon_t$	25.9	0.724	26.3	1.09	0.367	110.63	1.295
Time varying test D 1984-2015 data							
1. $ln(S_t) = \alpha_t + \epsilon_t$	29	0.658				114.45	1.304
2. $ln(S_t) = \alpha_t + \beta_t t + \epsilon_t$	27	0.85				114.24	1.379
3. $ln(S_t) = \alpha + \beta_t ln(S_{t-1}) + \epsilon_t$	28	0.723				115.66	1.446
3. $ln(S_t) = \alpha + \beta_t ln(N_{t-1}) + \epsilon_t$	28	0.794				111.59	1.327

Table A3. Table A2 with 1956-1983 data instead of 1984 to 2015 data. See Table A1 for an explanation of the parameters and model set-up.

Model	Residual df	MASE	Adj. R2	F	p value	AIC	LOOCV
Time dependency test A 1956-1983 data							
1. $ln(S_t) = \alpha + \beta ln(S_{t-1}) + \epsilon_t$	24	0.633	-0.7			64.69	0.821
2. $ln(S_t) = \alpha + s(ln(S_{t-1})) + \epsilon_t$	22.1	0.614	-0.2	0.78	0.464	65.71	0.844
3. $ln(S_t) = \alpha + s_1(ln(S_{t-1})) + s_2(ln(S_{t-2})) + \epsilon_t$	19.9	0.58	3.1	1.19	0.329	66.35	1.053
Time dependency test B 1956-1983 data							
1. $ln(S_t) = \alpha + \beta ln(N_{t-1}) + \epsilon_t$	24	0.634	-3.8			65.48	0.821
2. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	21.6	0.584	8.2	2.24	0.127	63.8	0.783
3. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(N_{t-2})) + \epsilon_t$	18.5	0.495	16.9	1.56	0.231	63.13	0.785
Time dependency test C 1956-1983 data							
1. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	22.5	0.586	4.3			66.2	0.8
2. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(S_{t-1})) + \epsilon_t$	20.7	0.556	4.8	0.91	0.41	67.3	0.829
3. $ln(S_t) = \alpha + s_1(ln(N_{t-1})) + s_2(ln(S_{t-2})) + \epsilon_t$	19.5	0.55	12.9	1.42	0.266	63.79	0.967
1. $ln(S_t) = \alpha_t + \epsilon_t$	55	0.595				183.33	1.083
2. $ln(S_t) = \alpha_t + \beta_t t + \epsilon_t$	53	0.626				186.72	1.122
3. $ln(S_t) = \alpha + \beta_t ln(S_{t-1}) + \epsilon_t$	54	0.683				183.7	1.155
3. $ln(S_t) = \alpha + \beta_t ln(N_{t-1}) + \epsilon_t$	54	0.667				179.9	1.065