Non-Spawner (Oct-May Catch) Covariates Analysis

Table 1: Table B1. Model selection tests of GPCP precipitation as an explanatory variable for the catch (N_t) during post-monsoon months (Oct-May) using 1984 to 2014 data. The data range is determined by the years for which SST was available in order to use a consistent dataset across covariate tests. The base model (M) with prior catch dependency was selected independently (Appendix A). N_{t-1} is the post-monsoon catch in prior season, and S_{t-2} is the catch during Jul-Sep two seasons prior. To the base model, covariates are added. V_t is the covariate in the calendar year, and V_{t-1} is the covariate in the prior calendar year. The specific hypothesis (Table 1) being tested is noted in parentheses. The models are tested as nested sets. Thus 1, 2a, 3a is a set and 1, 2b, 3b is another set.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1984-2014 data						
1. $ln(N_t) = \alpha + s(ln(N_{t-1})) + s(ln(S_{t-2})) + \epsilon_t$	24.8	0.743	56.6			79.53
V_t = Jun-Jul Precipitation (S1)						
2a. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.755	56.7	1.03	0.318	80.23
3a. $ln(N_t) = \text{M} + s(V_t)$	22.3	0.75	55.3	0.19	0.767	82.02
2b. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.744	54.9	NA	NA	81.5
3b. $ln(N_t) = \text{M} + s(V_{t-1})$	22.3	0.701	56.4	1.32	0.28	81.18
V_t = Apr-May Precipitation (S2)						
2a. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.742	55.1	0.11	0.735	81.34
3a. $ln(N_t) = \text{M} + s(V_t)$	21.7	0.73	53.7	0.36	0.707	83.39
2b. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.723	56.2	0.74	0.397	80.6
3b. $ln(N_t) = \text{M} + s(V_{t-1})$	22	0.692	55.6	0.5	0.587	81.87

Table 2: Table B2. Model selection tests of sea surface temperature off the Kerala coast (up to 80km offshore in boxes 2-5 in Figure 1), upwelling and ONI as the explanatory variables (V_t) for the catch during post-monsoon months (Oct-May) using 1984 to 2014 data. The hypothesis tested (Table 1) is noted in parentheses. Two upwelling indices were tested. The nearshore-offshore temperature diferential (UPW), which is the offshore (box 13) minus nearshore (box 4) SST, and the average nearshore SST along the Kerala coast (boxes 2-5). These are highly correlated but not identical. The ONI index is the average over all months in the calendar year. The 2.5-year average SST is the average for Jan-Jun in the current calendar year and the prior 2 calendar years (30 months total). Thus the average does not include any months during the Oct-Mar catch. See Table B1 for an explanation of the models.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1984-2014 data						
1. $ln(N_t) = \alpha + s(ln(N_{t-1})) + s(ln(S_{t-2})) + \epsilon_t$	24.8	0.743	56.6			79.53
V_t = Ave Mar-May SST (S5)						
2a. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.701	59	2.84	0.107	78.53
3a. $ln(N_t) = \text{M} + s(V_t)$	22	0.682	63.2	2.29	0.13	76.01
2b. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.762	57.1	1.33	0.26	79.93
3b. $ln(N_t) = \text{M} + s(V_{t-1})$	22	0.747	57.4	0.79	0.455	80.61
V_t = Ave Oct-Dec SST (L1)						
2. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.748	54.9	NA	NA	81.5
3. $ln(N_t) = \text{M} + s(V_{t-1})$	22.5	0.736	56	1.13	0.318	81.37
V_t = Ave. Jun-Sep UPW (L2)						
2a. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.759	62.2	4.91	0.038	76
3a. $ln(N_t) = \text{M} + s(V_t)$	21.4	0.733	62.3	0.74	0.513	77.2
2b. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.742	54.9	0	0.979	81.49
3b. $ln(N_t) = \text{M} + s(V_{t-1})$	21.4	0.711	56.5	1.12	0.351	81.6
V_t = Ave. Jun-Sep SST (L2)						
2a. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.717	62.7	5.27	0.033	75.57
3a. $ln(N_t) = \text{M} + s(V_t)$	21.9	0.714	61.8	0.39	0.67	77.33
2b. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.744	55.3	0.23	0.626	81.18
3b. $ln(N_t) = \text{M} + s(V_{t-1})$	21.8	0.76	54.6	0.49	0.616	82.72
V_t = 2.5-year average SST (A1)						
2. $ln(N_t) = \text{M} + \beta V_t$	23.8	0.667	64.7	7.68	0.012	73.9
3. $ln(N_t) = \text{M} + s(V_t)$	22.7	0.594	67.5	2.58	0.12	71.88
V_t = ONI (A2)						
2. $ln(N_t) = \text{M} + \beta V_{t-1}$	23.8	0.744	54.9	NA	NA	81.46
3. $ln(N_t) = \text{M} + s(V_{t-1})$	23	0.748	55.5	0.99	0.313	81.46