Monsoon (Jul-Sep) Catch Covariates Analysis

Table 1: Table B1. Model selection tests of GPCP precipitation as an explanatory variable for the catch S_t during spawning months (Jul-Sep) using 1983 to 2015 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). To the base model, covariates are added. V_t is the covariate in same calendar year as the Jul-Sep catch. 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. MASE is the mean absolute square error (residuals).

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1983-2015 data						
1. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	29.6	0.798	21.7			113.82
V_t = Jun-Jul Precipitation (S1)						
2. $ln(S_t) = \text{M} + \beta V_t$	28.6	0.786	19.7	0.25	0.62	115.53
3. $ln(S_t) = \text{M} + s(V_t)$	27	0.781	21.4	1.09	0.339	115.77
V_t = Apr-May Precipitation (S2)						
2. $ln(S_t) = \text{M} + \beta V_t$	28.6	0.772	24.1	1.88	0.183	113.65
3. $ln(S_t) = \text{M} + s(V_t)$	26.6	0.745	22.2	0.32	0.728	115.65

Table 2: Table B2. Model selection tests of average sea surface temperature off the Kerala coast (up to 80km offshore in boxes 2-5 in Figure 1) as the explanatory variable (V_t) for the catch during monsoon months (Jul-Sep) using 1983 to 2015 data. The hypothesis tested (Table 1) is noted in parentheses. See Table B1 for an explanation of the models.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1983-2015 data						
1. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	29.6	0.798	21.7			113.82
V_t = Ave Mar-May SST (S4)						
2a. $ln(S_t)$ = M + βV_t	28.6	0.804	21.4	1.04	0.318	114.81
3a. $ln(S_t)$ = M + $s(V_t)$	26.5	0.777	25.6	1.6	0.222	114.28
4a. $ln(S_t)$ = M + $s(V_t) + \beta V_{t-1}$	25.6	0.766	23.5	0.25	0.602	115.9
4a. $ln(S_t)$ = M + $s(V_t) + s(V_{t-1})$	24.1	0.727	32	2.88	0.089	112.77
2b. $ln(S_t)$ = M + βV_{t-1}	28.6	0.782	20.7	0.71	0.407	115.12
3b. $ln(S_t)$ = M + $s(V_{t-1})$	26.7	0.747	24.7	1.66	0.212	114.5
V_t = Ave Oct-Dec SST (L1)						
2. $ln(S_t)$ = M + βV_{t-1}	28.6	0.801	19.1	0.04	0.843	115.76
3. $ln(S_t)$ = M + $s(V_{t-1})$	27.1	0.811	19.1	0.65	0.489	116.63

Table 3: Table B3. Model selection tests of upwelling intensity off Cochi as the explanatory variable. See Table B1 for an explanation of the models. Two upwelling indices were tested. The nearshore-offshore temperature differential (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. Larger (and positive) UPW indicates stronger upwelling (offshore warmer than nearshore) while smaller SST (during monsoon months) indicates stronger upwelling.

Model	Residual df	MASE	Adj. R2	F	p value	AIC
base model (M) 1983-2015 data						
1. $ln(S_t) = \alpha + s(ln(N_{t-1})) + \epsilon_t$	29.6	0.798	21.7			113.82
V_t = Ave. Jun-Sep UPW (S4 and L2)						
2a. $ln(S_t) =$ M $+ \beta V_t$	28.6	0.74	28.6	3.93	0.059	111.65
3a. $ln(S_t) =$ M $+ s(V_t)$	26.5	0.712	28.1	0.6	0.568	113.15
4a. $ln(S_t) =$ M $+ s(V_t) + \beta V_{t-1}$	25.5	0.723	26.4	0.37	0.542	114.67
4a. $ln(S_t) =$ M $+ s(V_t) + s(V_{t-1})$	23.1	0.69	28.8	1.11	0.355	114.86
2b. $ln(S_t) =$ M $+ \beta V_{t-1}$	28.6	0.775	21.1	0.86	0.364	114.95
3b. $ln(S_t) =$ M $+ s(V_{t-1})$	26	0.737	26.7	1.65	0.21	114.08
V_t = Ave. Jun-Sep SST (S4 and L2)						
2a. $ln(S_t) =$ M $+ \beta V_t$	28.6	0.756	27.5	3.6	0.07	112.15
3a. $ln(S_t) =$ M $+ s(V_t)$	26.9	0.707	35.3	2.6	0.103	109.33
4a. $ln(S_t) =$ M $+ s(V_t) + \beta V_{t-1}$	26	0.695	33.8	0.34	0.559	110.87
4a. $ln(S_t) =$ M $+ s(V_t) + s(V_{t-1})$	24	0.686	31	0.15	0.857	113.32
2b. $ln(S_t) =$ M $+ \beta V_{t-1}$	28.6	0.77	21.4	1	0.326	114.83
3b. $ln(S_t) =$ M $+ s(V_{t-1})$	26.5	0.754	18.8	0.34	0.726	117.14