Spawner (Jul-Sep Catch) Covariates Analysis

Table 1: Table B1. Model selection tests of GPCP precipitation as an explanatory variable for the catch 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. S_t is the catch during Jul-Sep of season t. V_t is the covariate in the current season which spans two calendar years from July to June in the next year. V_{t-1} is the covariate in the prior Jul-Jun season.

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. $ln(S_t) = \mathrm{M} + \beta V_t$	28.6	0.786	19.7	0.25	0.62	115.53
3. $ln(S_t) = \mathrm{M} + s(V_t)$	27	0.781	21.4	1.09	0.339	115.77
4. $ln(S_t) = \mathrm{M} + s(V_t) + \beta V_{t-1}$	26	0.776	20.5	0.64	0.428	116.94
5. $ln(S_t) = \mathrm{M} + s(V_t) + s(V_{t-1})$	24.6	0.767	19.9	0.55	0.535	117.96
V_t = Apr-May Precipitation (S2)						
2. $ln(S_t) = \mathrm{M} + \beta V_t$	28.6	0.772	24.1	1.88	0.183	113.65
3. $ln(S_t) = \mathrm{M} + s(V_t)$	26.6	0.745	22.2	0.32	0.728	115.65
4. $ln(S_t) = \mathrm{M} + s(V_t) + \beta V_{t-1}$	25.6	0.722	20	0.22	0.633	117.34
5. $ln(S_t) = \mathrm{M} + s(V_t) + s(V_{t-1})$	23.8	0.695	20	0.68	0.501	118.27

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 spawning 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 + $s(V_t) + s(V_{t-1})$	24.1	0.727	32	1.88	0.168	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 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.

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 + βV_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 + $s(V_t)$ + $s(V_{t-1})$	23.1	0.69	28.8	0.9	0.467	114.86
2b. $ln(S_t)$ = M + βV_{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 + βV_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 + $s(V_t)$ + $s(V_{t-1})$	24	0.686	31	0.21	0.882	113.32
2b. $ln(S_t)$ = M + βV_{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