

Appendices: Covariate tests

Table 1: Table 1. Top covariates for the monsoon (Jul-Sep) and post-monsoon (Oct-Mar) catch (S_t and N_t) models. M0, M1 and M2 are the base models with only prior catch as covariates. To the base models, the environmental covariates are added. ns-SST is nearshore (0-80km) and r-SST is regional (0-160km). The full set of nested covariate models and tests are given in Appendix B. The LOOCV RMSE (root mean square error) is the out-of-sample prediction error. The LOOCV RSME for the null model for Jul-Sep catch was 1.599 and the LOOCV RMSE for the null model for Oct-Mar catch was 1.015. The fitted versus observed catches from the models with and without 2.5-year average ns-SST are shown in Figure 1.

Model	Residual df	Adj. R2	RMSE	AIC	LOOCV RMSE
Jul-Sep catch models with covariates					
V_t = Jun-Sep ns-SST current season					
W_t = Jun-Sep Bakun-UPW current season					
Z_t = 2.5-year ave r-SST					
M0: $\ln(S_t) = \alpha + s(\ln(N_{t-1})) + \epsilon_t$	29.6	22	1.204	113.82	1.313
$\Rightarrow \ln(S_t) = M0 + s(V_t)$	26.9	35	1.055	109.33	1.238
$\ln(S_t) = M0 + \beta W_t$	28.6	27	1.14	112.22	1.391
$\ln(S_t) = M1 + s(Z_t)$	26.8	37	1.037	108.4	1.288
Oct-Mar catch models with covariates					
U_t = Mar-May r-SST current season					
V_t = Jun-Sep ns-SST current season					
Z_t = 2.5-year ave r-SST					
X_{t-1} = fall DMI prior season					
M1: $\ln(N_t) = \alpha + s(\ln(N_{t-1})) + s(\ln(S_{t-2})) + \epsilon_t$	25.6	57	0.7	80.76	1.055
$\ln(N_t) = M1 + s(U_t)$	22.9	64	0.614	76.75	0.999
$\ln(N_t) = M1 + \beta V_t$	24.7	64	0.635	76.5	1.029
$\Rightarrow \ln(N_t) = M1 + s(Z_t)$	23.2	72	0.546	68.72	0.752
$\ln(N_t) = M1 + s(X_{t-1})$	22.2	69	0.565	72.69	0.876
M2: $\ln(N_t) = \alpha + s(\ln(N_{t-1})) + \epsilon_t$					
$\ln(N_t) = M2 + s(U_t)$	25.7	47	0.784	87.72	0.961
$\ln(N_t) = M2 + \beta V_t$	27.6	52	0.76	83.14	0.914
$\Rightarrow \ln(N_t) = M2 + s(Z_t)$	26	65	0.642	74.62	0.758
$\ln(N_t) = M2 + s(X_{t-1})$	24.9	44	0.791	89.78	0.947