2020 Preseason Pink Salmon Forecast

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Objective

To forecast the Southeast Alaska (SEAK) pink salmon harvest in 2020.

Analysis

Three hierarchical models were investigated. The full model was:

$$E(y) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2$$

where X_1 was cpue and X_2 was the average temperature in Icy Strait in May, June, and July. The regression coefficients cpue and temperature (ISTI_MJJ) are significant in the first two models. The interaction term in not significant (Table 1). Therefore, only the first two models will be considered.

Table 1: Parameter estimates

X1	term	estimate	std.error	statistic	p.value
1	(Intercept)	1.3427021	7.641121	0.1757206	0.8622804
2	CPUE	14.6533685	2.674148	5.4796395	0.0000231
3	(Intercept)	136.8505836	42.278874	3.2368550	0.0043400
4	CPUE	17.1659248	2.334149	7.3542529	0.0000006
5	ISTI_MJJ	-15.6825735	4.838540	-3.2411791	0.0042981
6	(Intercept)	-2.4558282	126.116094	-0.0194728	0.9846782
7	CPUE	69.5357104	44.781476	1.5527784	0.1378814
8	ISTI_MJJ	-0.2881339	13.992384	-0.0205922	0.9837975
9	CPUE:ISTI_MJJ	-5.7359519	4.898281	-1.1710132	0.2568628

The model summary results using the metrics AIC, BIC, MAPE (mean absolute percent error), MEAPE (median absolute percent error), and MASE (mean absoluate scaled error) (Hyndman and Kohler 2006) are shown in Tables 2 and 3. For all these metrics, the smallest value is the preferred model. These metrics suggest that model two is the preferred model.

Table 2: Summary of model outputs

X1	model	AdjR2	AIC	AICc	BIC
1	CPUE	0.5802221	183.8258	185.1592	187.0990
2	CPUE+ISTI_MJJ	0.7154553	176.1430	178.4959	180.5072
3	CPUE+ISTI_MJJ+CPUE:ISTI_MJJ	0.7209090	176.5278	180.2778	181.9830

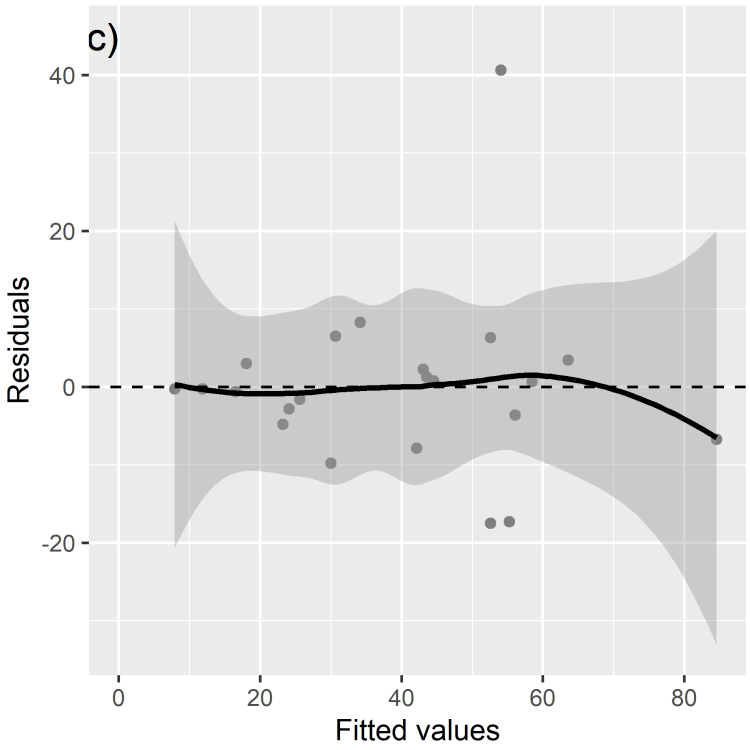

Figure 1: The percent of the run that will be missed at a given risk level, e.g., 11% of the run will be missed 5% of the time using a five day 1% rule for the Chilkoot River.

Table 3: Forecast error measures

X1	model	MAPE	MEAPE	MASE
model.m1	CPUE	0.3071037	0.1807227	0.3013406
model.m2	CPUE+ISTI_MJJ	0.1894439	0.1257433	0.2276793
model.m3	CPUE+ISTI_MJJ+CPUE:ISTI_MJJ	0.2771368	0.1491916	0.2179695

Model Diagnostics

Residuals vs. Fitted Plot

The characteristics of a well-behaved residual vs. fits plot and what they suggest about the appropriateness of the simple linear regression model: 1)The residuals "bounce randomly" around the 0 line. This suggests that the assumption that the relationship is linear is reasonable. 2) The residuals roughly form a "horizontal band" around the 0 line. This suggests that the variances of the error terms are equal. 3) No one residual "stands out" from the basic random pattern of residuals. This suggests that there are no outliers. Source: https://newonlinecourses.science.psu.edu/stat462/node/117/

The one point that stands out is juvenile year 2012 when the SEAK catch was 94.7.