***Multiple Linear Regression***

The first approach was based on a multiple regression model with juvenile pink salmon catch-per-unit-effort (CPUE) and temperature data from the Southeast Alaska Coastal Monitoring Survey (SECM; Piston et al. 2021) or from satellite sea surface temperature data (NOAA Coral Reef Watch 2021a and 2021b) aggregated using principal component analysis. Three hierarchical models were investigated. The full model was:

(1)

where was the average CPUE for catches in either the June or July survey, whichever month had the highest average catches in a given year, and was based on the pooled-species vessel calibration coefficient, and was a temperature index (SECM survey 20m depth temperature data or PCA-aggregated satellite SST data). The CPUE data were log-transformed in the model, but temperature data were not. The simplest model did not contain a temperature variable. One-step-ahead forecasts for the last five years (years 2017 through 2021), and significant coefficients (i.e., covariates) in the model were used to evaluate forecast accuracy of models. The model with the lowest one-step-ahead MAPE value is the preferred model.

The performance metric MAPE (Hyndman and Koehler 2006) was calculated as:

(2)

where is the observed value and is the predicted value.

The performance metric one-step-ahead MAPE involves five steps:

Estimate the regression parameters at time from data up to time .

Make a prediction of at time based on the predictor variables at time and the estimate of the regression parameters at time .

Calculate the *MAPE* based on the prediction of at time and the observed value of at time .

Repeat this for data up through year 2016 (e.g., data up through year 2016 is and the forecast is for year 2017; ), data up through year 2017 (e.g., data up through year 2017 is and the forecast is for year 2018; ), data up through year 2018 to forecast 2019, data up through year 2019 to forecast 2020, and data up through year 2020 to forecast 2021.

The one-step-ahead MAPE performance metric will then be an average of the MAPE calculated from these five forecasts.

To correct for log transformation bias in a linear-model, a bias correction (Miller 1984) was applied to the predicted 2022 SEAK harvest and its prediction interval (output from the car package (Fox and Weisberg 2019) in program R (R Core Team 2020)) from the preferred model. The bias correction, applied to each value, was:

(3)

where was the predicted value (or 80% upper or lower prediction interval value) from the individual model *i;* (*i* = 1, 2, … , *R*).