# Regressions

* I cannot combine the four variables that were suggested to predict the MeanLandingsCPUE.
  + The four independent variables were not lagged.
  + The dependent variable, MeanAnnualLandingsCPUE, had a lead year added to it (not B90/T38/T06/etc. lagged.
    - The “dv” was lead + 1 year for the regressive relationships with harbor and creek trawl subadult CPUEs

### NO LAG

#### Individual Models

Mean Annual Landings CPUE ~ Harbor Trawl CPUE

lm(formula = MeanLandingsCPUE ~ B90\_CPUE, data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.39959 -0.10796 -0.02369 0.09489 0.53296

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.50696 0.11507 21.786 1.29e-11 \*\*\*

B90\_CPUE 0.02933 0.01177 2.491 0.027 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2394 on 13 degrees of freedom

(32 observations deleted due to missingness)

Multiple R-squared: 0.3231, Adjusted R-squared: 0.2711

F-statistic: 6.206 on 1 and 13 DF, p-value: 0.02703

Mean Annual Landings CPUE ~ Trammel Net CPUE

lm(formula = MeanLandingsCPUE ~ T06\_CPUE, data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.31024 -0.17533 -0.00542 0.04975 0.34281

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.31169 0.16882 13.693 2.96e-08 \*\*\*

T06\_CPUE 0.23735 0.09216 2.575 0.0258 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2205 on 11 degrees of freedom

(34 observations deleted due to missingness)

Multiple R-squared: 0.3762, Adjusted R-squared: 0.3194

F-statistic: 6.633 on 1 and 11 DF, p-value: 0.0258

#### Additive Model

Mean Annual Landings CPUE ~ Harbor Trawl CPUE + Trammel Net CPUE)

lm(formula = MeanLandingsCPUE ~ T06\_CPUE + B90\_CPUE, data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.24977 -0.10151 -0.02481 0.07537 0.43159

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.27652 0.15029 15.147 3.18e-08 \*\*\*

T06\_CPUE 0.13187 0.09683 1.362 0.2031

B90\_CPUE 0.03111 0.01542 2.017 0.0713 .

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.195 on 10 degrees of freedom

(34 observations deleted due to missingness)

Multiple R-squared: 0.5566, Adjusted R-squared: 0.4679

F-statistic: 6.276 on 2 and 10 DF, p-value: 0.01714

#### Multiple Regression Model

Mean Annual Landings CPUE ~ Harbor Trawl CPUE \* Trammel Net CPUE)

lm(formula = MeanLandingsCPUE ~ T06\_CPUE \* B90\_CPUE, data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.29022 -0.05661 -0.01850 0.07032 0.26046

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 1.89333 0.21012 9.011 8.46e-06 \*\*\*

T06\_CPUE 0.42851 0.15339 2.794 0.0209 \*

B90\_CPUE 0.10688 0.03566 2.997 0.0150 \*

T06\_CPUE:B90\_CPUE -0.04866 0.02134 -2.280 0.0486 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.1636 on 9 degrees of freedom

(34 observations deleted due to missingness)

Multiple R-squared: 0.7189, Adjusted R-squared: 0.6252

F-statistic: 7.674 on 3 and 9 DF, p-value: 0.007508

### 1-yr LAG

#### Individual Models

Mean Annual Landings CPUE ~ Harbor Trawl Subadults

lm(formula = MeanLandingsCPUE ~ lag(B90\_SubadultCPUE), data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.5004 -0.1245 0.0194 0.1008 0.3399

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.56290 0.09291 27.59 6.37e-13 \*\*\*

lag(B90\_SubadultCPUE) 0.05643 0.02138 2.64 0.0204 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2348 on 13 degrees of freedom

(32 observations deleted due to missingness)

Multiple R-squared: 0.349, Adjusted R-squared: 0.2989

F-statistic: 6.969 on 1 and 13 DF, p-value: 0.0204

Mean Annual Landings CPUE ~ Creek Trawl Subadults

lm(formula = MeanLandingsCPUE ~ lag(T38\_SubadultCPUE), data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.50391 -0.12880 -0.01098 0.12127 0.48439

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.46536 0.12344 19.972 3.87e-11 \*\*\*

lag(T38\_SubadultCPUE) 0.18887 0.07165 2.636 0.0206 \*

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2349 on 13 degrees of freedom

(32 observations deleted due to missingness)

Multiple R-squared: 0.3483, Adjusted R-squared: 0.2982

F-statistic: 6.948 on 1 and 13 DF, p-value: 0.02055

#### Additive Model

Mean Annual Landings CPUE ~ lag(Harbor Trawl Subadult CPUE) + lag(\*Creek Trawl Subadult CPUE)

lm(formula = MeanLandingsCPUE ~ lag(B90\_SubadultCPUE) +

lag(T38\_SubadultCPUE), data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.50928 -0.10005 0.01038 0.10311 0.40099

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.46968 0.12180 20.277 1.19e-10 \*\*\*

lag(B90\_SubadultCPUE) 0.03365 0.02880 1.168 0.265

lag(T38\_SubadultCPUE) 0.11214 0.09647 1.163 0.268

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2317 on 12 degrees of freedom

(32 observations deleted due to missingness)

Multiple R-squared: 0.4149, Adjusted R-squared: 0.3174

F-statistic: 4.254 on 2 and 12 DF, p-value: 0.04013

#### Multiple Regression Model

Mean Annual Landings CPUE ~ lag(Harbor Trawl Subadult CPUE) \* lag(\*Creek Trawl Subadult CPUE)

lm(formula = MeanLandingsCPUE ~ lag(B90\_SubadultCPUE) \*

lag(T38\_SubadultCPUE), data = crab)

Residuals:

Min 1Q Median 3Q Max

-0.54710 -0.09392 0.02667 0.05481 0.35341

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 2.33161 0.20730 11.248 2.26e-07 \*\*\*

lag(B90\_SubadultCPUE) 0.07152 0.05422 1.319 0.214

lag(T38\_SubadultCPUE) 0.18850 0.13431 1.403 0.188

lag(B90\_SubCPUE):lag(T38\_SubCPUE) -0.01540 0.01858 -0.829 0.425

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Signif. codes: 0 ‘\*\*\*’ 0.001 ‘\*\*’ 0.01 ‘\*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.2348 on 11 degrees of freedom

(32 observations deleted due to missingness)

Multiple R-squared: 0.4493, Adjusted R-squared: 0.2991

F-statistic: 2.991 on 3 and 11 DF, p-value: 0.07736

**NO SIGNIFICANCE**

# Creek Trawl, Harbor Trawl & Trammel Net Surveys Catch Analyses

* B90’s catch is dominated by immature females
  + - Correlation between B90 subadult and B90 Immature females = 0.74 R2. That is the highest correlation off all sex and maturity categories.
    - Correlation between B90 CPUE and B90 subadult = 0.83 R2. That is the highest correlation of any size and six/maturity variable

A close up of a piece of paper

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Figure 1: Kendall Rank Correlation Coeffiecients for all harbor trawl CPUEs

* T38’s catch is dominated by immature females, albeit these immature females are less influential on the creek trawl than immature females are on the harbor trawl.
  + - Correlation between T38 subadult and immature females = 0.77 R2. This is slightly higher than the juveniles and immature female correlation (0.72 R2)
    - Correlation between T38 CPUE and both subadults and immature females = 0.82 R2.
* T06

A close up of a piece of paper

Description automatically generatedFigure 2: Kendall Rank Correlation Coeffiecients for all harbor trawl CPUEs

# Metadata for Landings and Dependent CPUEs

* Mean Landings
  + 1972-1977 – Harbor only
  + 1978-2003 – Wando and Harbor
  + 2004-2018 – Ashley, Cooper, Wando and Harbor
* Mean Landings CPUE
  + 2004-2018 – Ashley, Cooper, Wando and Harbor

# Discusison