TABLE 1. Model selection table for GLM (Generalized Linear Model) of oyster count data from intertidal reefs in the Big Bend region of Florida, without covariates. AIC (Akaike Information Criteria), Delta AIC, and AIC Weights are provided to inform comparisons of model statistical fit to data.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Number of parameters | AIC | Delta AIC | AIC Weight |
| Period \* locality + site | 11 | 3185.65 | 0.00 | 0.94 |
| Period + site | 5 | 3192.36 | 6.71 | 0.03 |
| Period + locality + site | 8 | 3193.41 | 7.76 | 0.02 |
| Period \* site | 7 | 3196.27 | 10.62 | 0.00 |
| Period + locality \* site | 14 | 3196.62 | 10.97 | 0.00 |
| Period \* site + locality | 10 | 3197.27 | 11.63 | 0.00 |
| Period + locality | 6 | 3259.43 | 77.78 | 0.00 |
| Period | 3 | 3263.49 | 77.84 | 0.00 |
| Period \* locality | 9 | 3263.51 | 77.86 | 0.00 |

TABLE 2. Model results for the best fitting GLM (Generalized Linear Model) without covariates (Table 1) of oyster counts on intertidal reefs in the Big Bend region of Florida, where oyster counts = period \* site + locality + offset(log(transect length)). Parameter estimates are on log scale.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Std. Error | z value | Pr(>|z|) |
| Intercept | 5.18 | 0.38 | 13.57 | < 0.01 |
| Period | -0.10 | 0.03 | -2.79 | 0.005 |
| Nearshore site | -1.57 | 0.21 | -7.38 | < 0.01 |
| Offshore site | -1.85 | 0.21 | -8.99 | < 0.01 |
| Corrigan’s Reef | -0.06 | 0.43 | -0.14 | 0.89 |
| Horseshoe Beach | -0.38 | 0.43 | -0.89 | 0.37 |
| Lone Cabbage | -1.21 | 0.42 | -2.87 | <0.01 |
| Period: locality Corrigan’s Reef | 0.03 | 0.05 | 0.60 | 0.55 |
| Period: locality Horseshoe Beach | -0.001 | 0.05 | -0.02 | 0.98 |
| Period: locality  Lone Cabbage | 0.11 | 0.004 | 2.76 | < 0.01 |

TABLE 3. Model selection table assessing improvements in the fit of best fit GLM (Generalized Linear Model) from Table 1 (oyster counts = period \* locality + site + offset(log(transect length))) with the addition of covariate described.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Covariate description | Number of parameters | AIC | Delta AIC | AIC Weight |
| Mean annual daily discharge with one-year lag | 12 | 3154.37 | 0.00 | 0.50 |
| Annual landings with two-year lag | 12 | 3175.76 | 21.38 | 0.00 |
| Annual discharge year of count | 12 | 3176.98 | 22.61 | 0.00 |
| Annual trips with two-year lag | 12 | 3178.02 | 23.64 | 0.00 |
| Annual landings year of count | 12 | 3178.90 | 24.53 | 0.00 |
| Annual trips year of count | 12 | 3184.47 | 30.10 | 0.00 |
| No covariates | 12 | 3185.65 | 31.27 | 0.00 |
| Harvest in year of count | 12 | 3185.86 | 31.49 | 0.00 |
| Annual discharge with two-year lag | 12 | 3186.51 | 32.13 | 0.00 |
| Annual trips with one-year lag | 12 | 3186.89 | 32.51 | 0.00 |
| Landings with one-year lag | 12 | 3187.05 | 32.68 | 0.00 |

TABLE 4. Model results for the best fitting GLM (Generalized Linear Model) (Table 3) of oyster counts on intertidal reefs in the Big Bend region of Florida where oyster counts = period \* locality + site + mean daily discharge with one-year lag + offset(log(transect length)). Parameter estimates are on log scale.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | Estimate | Standard Error | z value | Pr(>|z|) |
| Intercept | 5.59 | 0.37 | 15.23 | < 0.01 |
| Period | -0.12 | 0.03 | -3.84 | < 0.01 |
| Nearshore site | -1.67 | 0.20 | -8.33 | < 0.01 |
| Offshore site | -2.15 | 0.20 | -11.03 | < 0.01 |
| Corrigan’s Reef | -0.16 | 0.41 | -0.40 | 0.69 |
| Horseshoe Beach | -0.60 | 0.41 | -1.47 | 0.14 |
| Lone Cabbage | -1.52 | 0.40 | -3.80 | < 0.01 |
| Mean daily discharge with one-year lag | 0.56 | 0.08 | 6.88 | < 0.01 |
| Period: locality Corrigan’s Reef | 0.04 | 0.04 | 0.99 | 0.32 |
| Period: locality Horseshoe Beach | 0.01 | 0.04 | 0.22 | 0.83 |
| Period: locality Lone Cabbage | 0.12 | 0.04 | 3.21 | 0.001 |

Figure 1. Map of the study area, showing locations of sampling sites within localities of major oyster reef complexes. Within each locality, note that transects were placed on reefs representing a gradient from inshore to offshore. For offshore reefs, note the coastwise orientation and linearity of reefs.

Figure 2. Histogram of probability density function (y-axis) of live oysters counted (x-axis) on intertidal reefs in Suwannee Sound, Florida. The red line represents the predicted density of oyster counts if these data follow a negative binomial distribution.

Figure 3. Predicted oyster counts using the best-fit negative binomial model offset by transect length from each locality CK = Cedar Key, CR = Corrigan’s reef, HB = Horseshoe Beach, and LC = Lone Cabbage based on data from 2010-2018. Colored lines represent Inshore (blue), Nearshore (red), and Offshore (green) sites within each locality. Shaded regions represent 95% CI for the predicted values.

Figure 4. Mean daily discharge by year (panel A) and associated variance (panel B) and CV (panel C) of daily discharge for the Suwannee River measured at USGS Wilcox gauge from October 1941 to December 2018. Red LOWESS (Locally Weighted Scatterplot Smoothing) line provided to show general trends in discharge. Blue dashed line is the average mean daily discharge, variance, or CV from 1941-2018. Cf/s – cubic feet per second.

Figure 5. Mean daily discharge by year (panel A) and associated variance (panel B) and CV (panel C) of daily discharge for the Suwannee River measured at USGS Wilcox gauge from January 2010 to December 2018. Red LOWESS (Locally Weighted Scatterplot Smoothing) smoothing line provided to show general trends in discharge from January 2010 – December 2018. Blue dashed line is the average mean daily discharge, variance, or CV from 1941-2018. Cf/s – cubic feet per second.

Figure 6. Oyster landings (whole meat weight, panel A), oyster fishing trips (panel B), and oyster catch per trip (CPUE, panel C) for Suwannee Sound, Florida (Levy, Dixie, Taylor counties) from 1986-July 2019. Data for 2018 and 2019 are provisional.

Figure 7. Predicted oyster counts using the best-fit negative binomial model offset by transect length including mean daily discharge with a one-year lag as a covariate. Shaded regions represent 95% CI on the predicted values. Cf/s – cubic feet per second.

Table S1. Period surveyed for each locality and site combination. CK = Cedar Key, CR = Corrigan’s Reef, HB = Horseshoe Beach, and LC = Lone Cabbage

|  |  |  |  |
| --- | --- | --- | --- |
| Locality | Site | Period | Time |
| CK | I | 1 | Summer 2010 |
| CK | I | 6 | Winter 2012-2013 |
| CK | I | 17 | Summer 2018 |
| CK | N | 1 | Summer 2010 |
| CK | N | 6 | Winter 2012-2013 |
| CK | N | 17 | Summer 2018 |
| CK | O | 1 | Summer 2010 |
| CK | O | 6 | Winter 2012-2013 |
| CK | O | 17 | Summer 2018 |
| CR | I | 1 | Summer 2010 |
| CR | I | 2 | Winter 2010-2011 |
| CR | I | 3 | Summer 2011 |
| CR | I | 6 | Winter 2012-2013 |
| CR | I | 17 | Summer 2018 |
| CR | N | 1 | Summer 2010 |
| CR | N | 2 | Winter 2010-2011 |
| CR | N | 3 | Summer 2011 |
| CR | N | 6 | Winter 2012-2013 |
| CR | N | 17 | Summer 2018 |
| CR | O | 1 | Summer 2010 |
| CR | O | 2 | Winter 2010-2011 |
| CR | O | 3 | Summer 2011 |
| CR | O | 6 | Winter 2012-2013 |
| CR | O | 17 | Summer 2018 |
| HB | I | 1 | Summer 2010 |
| HB | I | 2 | Winter 2010-2011 |
| HB | I | 3 | Summer 2011 |
| HB | I | 6 | Winter 2012-2013 |
| HB | I | 17 | Summer 2018 |
| HB | N | 1 | Summer 2010 |
| HB | N | 2 | Winter 2010-2011 |
| HB | N | 3 | Summer 2011 |
| HB | N | 6 | Winter 2012-2013 |
| HB | N | 17 | Summer 2018 |
| HB | O | 1 | Summer 2010 |
| HB | O | 2 | Winter 2010-2011 |
| HB | O | 3 | Summer 2011 |
| HB | O | 17 | Summer 2018 |
| LC | I | 1 | Summer 2010 |
| LC | I | 2 | Winter 2010-2011 |
| LC | I | 3 | Summer 2011 |
| LC | I | 6 | Winter 2012-2013 |
| LC | I | 16 | Winter 2017-2018 |
| LC | I | 17 | Summer 2018 |
| LC | N | 1 | Summer 2010 |
| LC | N | 2 | Winter 2010-2011 |
| LC | N | 3 | Summer 2011 |
| LC | N | 6 | Winter 2012-2013 |
| LC | N | 16 | Winter 2017-2018 |
| LC | N | 17 | Summer 2018 |
| LC | O | 1 | Summer 2010 |
| LC | O | 2 | Winter 2010-2011 |
| LC | O | 3 | Summer 2011 |
| LC | O | 6 | Winter 2012-2013 |
| LC | O | 7 | Summer 2013 |
| LC | O | 10 | Winter 2014-2015 |
| LC | O | 11 | Summer 2015 |
| LC | O | 14 | Winter 2016-2017 |
| LC | O | 16 | Winter 2017-2018 |

Figure S1. Predicted oyster counts using the best-fit negative binomial model offset by transect length (oyster counts = period \* locality + site + offset(log(transect length))) fit to 1000 simulated data sets (black lines) for all localities combined based on data from 2010-2018. Solid blue line is predicted values fit to observed (actual) field data.

Figure S2. Kernel density plot (y-axis) and p-value (x-axis) for the “period” beta term fit to the model oyster counts = period \* locality + site + offset(log(transect length)) from 1000 simulated datasets.

Figure S3. Panel A: Monthly Palmer drought severity index (PDSI, y-axis) for north Florida (red line) and southeast Georgia (black line) by year (x-axis). Negative values indicate periods of drought and positive values periods of higher soil moisture. Data from NOAA 2019c. Panel B: Monthly mean sea level (y-axis, solid black line) over year (x-axis) from NOAA station 8727520, Cedar Key, Florida with a linear model (dotted black line) plotted for reference. Average seasonal cycle removed by NOAA (NOAA 2019b).