**Added Covariates of Pre-adult & Adult stage models**

The below are the results of adding additional variables into our existing models for *C. clemensi*  & *L. salmonis.* Year (2015 – 2018), and the fork length of the individual fish were added to the model as fixed effects, such that salmon species, year, and fork length were the fixed effects of the model, while collection number remained a random effect. This analysis was performed only on the portion of the data that had fork length measurements, as all fish missing this measurement were excluded for the purposes of this analysis. The formula for the model is as follows:

*all.leps ~ spp + year + fork.length - 1 + (1|collection)*

With the family being specified as ‘negative binomial’ and the zero-inflation term set to false. This model was run for both ‘all.leps’ and ‘all.cal’, representing measurements for both for *C. clemensi*  & *L. salmonis.*

**Table 1:** A summary of some important result values from our null and alternate models for both *C. clemensi*  & *L. salmonis* lice species with added covariates from the initial models.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Model** | **Fixed Effect** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| ***C. clemensi*  Null** | -- | -935.136 | 1876.3 | 0.0 |
| ***C. clemensi*  Alternate** | Salmon Species, year, and fork length | -919.534 | 1857.1 | 19.2 |
| ***L. salmonis*****Null** | -- | -334.275 | 674.5 | 0.0 |
| ***L. salmonis*****Alternate** | Salmon Species, year, and fork length | -298.099 | 614.2 | 60.4 |

**Table 2:** A summary of the coefficients and standard errors from the two alternate models run for both *C. clemensi*  & *L. salmonis* lice species.

|  |  |  |  |
| --- | --- | --- | --- |
| **Output** | **Coefficient** | **Standard Error** | **Significance** |
| ***L. salmonis* Chum** | 0.2925 | 1.4383 | 0.839 |
| ***C. clemensi*  Chum** | -1.4823 | 0.6760 | 0.028 |
| ***L. salmonis* Pink** | 1.1187 | 1.4312 | 0.434 |
| ***C. clemensi*  Pink** | -0.8779 | 0.6572 | 0.182 |
| ***L. salmonis* Sockeye** | -1.5174 | 1.3732 | 0.269 |
| ***C. clemensi*  Sockeye** | -0.9154 | 0.6290 | 0.146 |
| ***L. salmonis* 2016** | -0.7260 | 0.3576 | 0.042 |
| ***C. clemensi*  2016** | -0.6478 | 0.1955 | 0.001 |
| ***L. salmonis* 2017** | -2.9020 | 1.1372 | 0.011 |
| ***C. clemensi*  2017** | -0.9501 | 0.3367 | 0.005 |
| ***L. salmonis* 2018** | -8.0512 | 283.24 | 0.977 |
| ***C. clemensi*  2018** | -11.330 | 350.36 | 0.974 |
| ***L. salmonis* Fork Length** | -0.0184 | 0.0116 | 0.112 |
| ***C. clemensi*  Fork Length** | 0.0046 | 0.0053 | 0.379 |

**Full Model Set**

|  |  |  |  |
| --- | --- | --- | --- |
| ***C. clemensi*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Null** | -935.136 | 1876.3 | 0.0 |
| **Species** | - 927.65 | 1865.3 | 11 |
| **Fork Length** | -938.254 | 1882.5 | 6.2 |
| **Year** | -927.3 | 1866.6 | 9.7 |
| **Site Region** | -932.821 | 1873.6 | 2.6 |
| **Species, Fork Length** | -926.073 | 1864.1 | 12.1 |
| **Species, Year** | -919.92 | 1855.8 | 20.4 |
| **Species, Site Region** | -925.257 | 1862.5 | 13.8 |
| **Fork Length, Year** | -927.288 | 1868.6 | 7.7 |
| **Fork Length, Site Region** | -932.616 | 1875.2 | 1 |
| **Year, Site Region** | -924.69 | 1863.4 | 12.9 |
| **Species, Fork Length, Year** | -919.534 | 1857.1 | 19.2 |
| **Species, Fork Length, Site Region** | -924.31 | 1862.6 | 13.7 |
| **Species, Year, Site Region** | -917.225 | 1852.5 | 23.8 |
| **Fork Length, Year, Site Region** | -924.579 | 1865.2 | 11.1 |
| **Species, Fork Length, Year, Site Region** | -917.191 | 1854.4 | 21.9 |

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. salmonis*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Null** | -334.275 | 674.5 | 0.0 |
| **Species** | -303.27 | 616.5 | 58 |
| **Fork Length** | -338.475 | 683 | 8.4 |
| **Year** | -329.181 | 670.4 | 4.2 |
| **Site Region** | -334.129 | 676.3 | 1.7 |
| **Species, Fork Length** | -303.134 | 618.3 | 56.3 |
| **Species, Year** | -299.249 | 614.5 | 60.1 |
| **Species, Site Region** | -303.012 | 618 | 56.5 |
| **Fork Length, Year** | -329.067 | 672.1 | 2.4 |
| **Fork Length, Site Region** | -333.184 | 676.4 | 1.8 |
| **Year, Site Region** | -328.885 | 671.8 | 2.8 |
| **Species, Fork Length, Year** | -298.099 | 614.2 | 60.4 |
| **Species, Fork Length, Site Region** | -302.963 | 619.9 | 54.6 |
| **Species, Year, Site Region** | -298.851 | 615.7 | 58.8 |
| **Fork Length, Year, Site Region** | -328.606 | 673.2 | 1.3 |
| **Species, Fork Length, Year, Site Region** | -298.04 | 616.1 | 58.5 |

**Full Model Set – No Fork Length**

|  |  |  |  |
| --- | --- | --- | --- |
| ***C. clemensi*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Null** | -1509.74 | 3025.5 | 35.2 |
| **Site Region** | -1505.65 | 3019.3 | 29 |
| **Year** | -1502.83 | 3017.7 | 27.3 |
| **Year, Site Region** | -1498.2 | 3010.4 | 20.1 |
| **Species** | -1497.33 | 3004.7 | 14.3 |
| **Species, Site Region** | -1493.2 | 2998.4 | 8.1 |
| **Species, Year** | -1490.78 | 2997.6 | 7.2 |
| **Species, Year, Site Region** | -1486.16 | 2990.3 | 0.0 |

|  |  |  |  |
| --- | --- | --- | --- |
| ***C. clemensi*  Output** | **Coefficient** | **Standard Error** | **Reverse Trans. Est.** |
| **Chum** | -1.161 | 0.173 | 0.313 (0.222, 0.443) |
| **Pink** | -0.581 | 0.158 | 0.559 (0.408, 0.767) |
| **Sockeye** | -0.686 | 0.153 | 0.504 (0.371, 0.684) |
| **2016** | -0.579 | 0.158 | 0.560 (0.409, 0.769) |
| **2017** | -0.778 | 0.285 | 0.459 (0.260, 0.812) |
| **2018** | -0.516 | 0.177 | 0.597 (0.419, 0.850) |
| **Johnstone Strait** | 0.402 | 0.126 | 1.495 (1.162, 1.923) |

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. salmonis*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Site Region** | -461.316 | 930.6 | 77.8 |
| **Null** | -461.325 | 928.6 | 75.8 |
| **Year, Site Region** | -452.342 | 918.7 | 65.8 |
| **Year** | -452.366 | 916.7 | 63.9 |
| **Species, Site Region** | -427.751 | 867.5 | 14.7 |
| **Species** | -427.833 | 865.7 | 12.8 |
| **Species, Year, Site Region** | -418.292 | 854.6 | 1.7 |
| **Species, Year** | -418.419 | 852.8 | 0.0 |

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. salmonis*  Output** | **Coefficient** | **Standard Error** | **Reverse Trans. Est.** |
| **Chum** | -2.074 | 0.362 | 0.126 (0.061, 0.259) |
| **Pink** | -1.283 | 0.324 | 0.277 (0.145, 0.530) |
| **Sockeye** | -3.572 | 0.403 | 0. 028 (0.013, 0.063) |
| **2016** | -0.662 | 0.392 | 0.516 (0.236,1.130) |
| **2017** | -2.108 | 0.900 | 0.121 (0.020, 0.735) |
| **2018** | -2.138 | 0.518 | 0.118 (0.042, 0.332) |

**Full Model Set – No Fork Length**

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. salmonis*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Site Region** | -461.316 | 930.6 | 77.8 |
| **Null** | -461.325 | 928.6 | 75.8 |
| **Year, Site Region** | -452.342 | 918.7 | 65.8 |
| **Year** | -452.366 | 916.7 | 63.9 |
| **Species, Site Region** | -427.751 | 867.5 | 14.7 |
| **Species** | -427.833 | 865.7 | 12.8 |
| **Species, Year, Site Region** | -418.292 | 854.6 | 1.7 |
| **Species, Year** | -418.419 | 852.8 | 0.0 |

**Crossed Effects Models**

|  |  |  |  |
| --- | --- | --- | --- |
| ***L. salmonis*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Species\*Year** | -413.367 | 854.7 |  |
| **Species\*Site Region** | -427.098 | 870.2 |  |
| **Year\*Site Region** | -444.677 | 909.4 |  |
| **Species\*Year\*Site Region** |  |  |  |

**Additive**

|  |  |  |  |
| --- | --- | --- | --- |
| ***C. clemensi*  Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Null** | -1509.74 | 3025.5 | 35.2 |
| **Site Region** | -1505.65 | 3019.3 | 29 |
| **Year** | -1502.83 | 3017.7 | 27.3 |
| **Year, Site Region** | -1498.2 | 3010.4 | 20.1 |
| **Species** | -1497.33 | 3004.7 | 14.3 |
| **Species, Site Region** | -1493.2 | 2998.4 | 8.1 |
| **Species, Year** | -1490.78 | 2997.6 | 7.2 |
| **Species, Year, Site Region** | -1486.16 | 2990.3 | 0.0 |

**Crossed Effects**

|  |  |  |  |
| --- | --- | --- | --- |
| ***C. clemensi* Model** | **Negative Log Likelihood** | **AIC value** | **Delta-AIC value** |
| **Species\*Year\*Site Region** | -1473.48 | 2987 |  |
| **Species\*Year** | -1485.55 | 2999.1 |  |
| **Species\*Site Region** | -1491.22 | 2998.4 |  |
| **Year\*Site Region** | -1493.32 | 3006.6 |  |