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Quantifying the Importance of Physical and Hydraulic Variables to Salmon Habitat Selection Through Multiple Linear Regression

EcoInformatics Summer Institute
Engineered Log Jam Study
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Engineered Log Jam Study

Methods:
- Compiled data of fish locations and corresponding hydraulic measurements at those locations
- Produced fish trajectories through each variable values to determine territories

Purpose:
- Determine the quantified influence of each variable on fish habitat selection

Variables:

\[ X_1 = \text{Turbulent Kinetic Energy (TKE)} (m^2/s^2) \]
\[ = \text{The change of velocity over time} \]
\[ X_2 = \text{Strain (s}^{-1}) \]
\[ = \text{The change in velocity over space} \]
\[ X_3 = \text{X-Y Averaged Water Velocity} \]
\[ X_4 = \text{Fish Depth} \]
\[ X_5 = \text{Fish Distance to Wood} \]
What is a Habitat?

Determining Territory Times

Fish AW TKE Normalized Derivative

Normalized TKE Derivative vs. Time (Seconds)
## Multiple Linear Regression Results

<table>
<thead>
<tr>
<th></th>
<th>Coefficient Estimate</th>
<th>Standard error of the coefficients</th>
<th>tStat = Estimate/S E</th>
<th>pValue</th>
<th>F Statistic</th>
<th>Variance Inflation Factor</th>
<th>Ordinary R Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.88</td>
<td>0.50</td>
<td>9.76</td>
<td>0.00</td>
<td></td>
<td></td>
<td>0.12</td>
</tr>
<tr>
<td>TKE Coefficient</td>
<td>-27.14</td>
<td>24.05</td>
<td>-1.13</td>
<td>0.26</td>
<td>1.27</td>
<td>4.74</td>
<td></td>
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<tr>
<td>Strain Coefficient</td>
<td>-0.24</td>
<td>0.12</td>
<td>-1.91</td>
<td>0.06</td>
<td>3.67</td>
<td>1.54</td>
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<tr>
<td>Velocity Coefficient</td>
<td>3.60</td>
<td>1.71</td>
<td>2.10</td>
<td>0.04</td>
<td>4.43</td>
<td>4.25</td>
<td></td>
</tr>
<tr>
<td>Depth Coefficient</td>
<td>-3.05</td>
<td>2.27</td>
<td>-1.35</td>
<td>0.18</td>
<td>1.81</td>
<td>1.02</td>
<td></td>
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<tr>
<td>Distance to Wood Coefficient</td>
<td>-0.59</td>
<td>0.26</td>
<td>-2.30</td>
<td>0.02</td>
<td>5.27</td>
<td>1.06</td>
<td></td>
</tr>
</tbody>
</table>
Scatter plots

- Relative to other studies, water velocity is not that high
- Velocity preference may be dependent on fish length
Scatter plots

- Almost all territory times were within a meter of wood
- Protection benefits of wood apparent in preference according to fish length
Use is considered the territory times, clustered at high depths and low distances to wood.

Availability is determined by all locations fish were observed, which are less clustered at high depths and low distances to wood.
Conclusions

• Distance to wood and water velocity are the most significant factors in determining territory time length

• The presences of fish of different lengths affect this model

Future Work:

• Determine the role of depth within this model

• Begin to parse out collinearities amongst hydraulic variables.
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