Adult Summary

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July 21, 2017

## Summarize Data

|  |  |  |  |
| --- | --- | --- | --- |
| Variable | Mean | Min | Max |
| AreaSqKM | 239.2 | 0.4 | 18068 |
| forest | 79.15 | 0 | 100 |
| surfcoarse | 6.62 | 0 | 100 |
| temp\_mean\_summer\_1 | 17.74 | 15.21 | 21.66 |
| temp\_mean\_fall\_1 | 3.49 | -0.09 | 7.3 |
| temp\_mean\_winter | -1.77 | -7.99 | 2.87 |
| temp\_mean\_spring | 14.63 | 10.31 | 17.31 |
| prcp\_mean\_summer\_1 | 3.78 | 1.59 | 8.92 |
| prcp\_mean\_fall\_1 | 2.99 | 1.29 | 5.01 |
| prcp\_mean\_winter | 2.58 | 1.1 | 4.73 |
| prcp\_mean\_spring | 2.91 | 1.42 | 6.9 |

The West Susquehanna watershed contained 11220 nodes, comprised of 349 survey sites and 10871 stream reaches. Sites were survey in a total of 34 from 1981 and 2014. There were a total of 683 site visits with a mean of 2 and a range of 1 to 21 visits per site. The total drainage area of the watershed was 1.806810^{4} and the smallest stream had a cumulative drainage area of 0.4. The median drainage area was 4.4. The mean distance between nodes in the network was 1.373 and ranged from 0.001 to 11.613 with a median of 1.114 km.

## Model Comparison

|  |  |  |  |
| --- | --- | --- | --- |
| M\_num | Model | AIC | delta\_AIC |
| 4 | Spatiotemporal | 9408 | 0.0 |
| 5 | Temporal + ST | 9408 | 0.3 |
| 7 | Spatial + Temporal | 9583 | 174.9 |
| 3 | Spatial | 9588 | 180.2 |
| 2 | Temporal | 9783 | 375.3 |
| 1 | Obs | 9794 | 386.5 |

|  |  |  |  |
| --- | --- | --- | --- |
| M\_num | Model | AIC | delta\_AIC |
| 5 | Temporal + ST | 9592 | 0 |
| 6 | S+T+ST | 9596 | 4 |
| 4 | Spatiotemporal | 9663 | 71 |
| 8 | Spatial + ST | 9666 | 74 |
| 7 | Spatial + Temporal | 9739 | 147 |
| 3 | Spatial | 9801 | 209 |
| 2 | Temporal | 9925 | 333 |
| 1 | Obs | 10048 | 456 |

## Adult Coefiecients

|  |  |  |
| --- | --- | --- |
| Parameter | Estimate | Std..Error |
| mean\_N | 36.686 | 4.051 |
| log\_mean | -2.450 | 0.133 |
| mu | 0.086 | 0.011 |
| forest | 0.822 | 0.116 |
| surfcoarse | 0.013 | 0.064 |
| temp\_mean\_summer\_1 | -0.263 | 0.052 |
| temp\_mean\_fall\_1 | 0.092 | 0.032 |
| temp\_mean\_winter | -0.009 | 0.031 |
| temp\_mean\_spring | -0.159 | 0.051 |
| prcp\_mean\_summer\_1 | -0.018 | 0.014 |
| prcp\_mean\_fall\_1 | 0.049 | 0.016 |
| prcp\_mean\_winter | 0.043 | 0.020 |
| prcp\_mean\_spring | 0.045 | 0.022 |
| detectrate | 1.351 | 0.023 |
| extradetectionSD | 0.213 | 0.017 |
| sigmaIID | 0.360 | 0.036 |
| log\_theta\_vec | 0.000 | 0.000 |
| log\_theta\_vec | -1.845 | 0.199 |
| theta | 1.000 | 0.000 |
| SDinput | 1.000 | 0.000 |
| rhot | 0.592 | 0.255 |
| sigmat | 0.158 | 0.059 |
| rho\_st | 0.974 | 0.008 |
| theta\_st | 0.158 | 0.032 |
| SDinput\_st | 0.588 | 0.059 |
| sigmaIID | 0.360 | 0.036 |

## YOY Coefficients

|  |  |  |
| --- | --- | --- |
| Parameter | Estimate | Std..Error |
| mean\_N | 44.398 | 7.786 |
| log\_mean | -3.407 | 0.302 |
| mu | 0.033 | 0.010 |
| forest | 1.120 | 0.155 |
| surfcoarse | 0.042 | 0.083 |
| temp\_mean\_fall\_1 | 0.022 | 0.113 |
| temp\_mean\_winter | 0.054 | 0.106 |
| temp\_mean\_spring | -0.679 | 0.161 |
| prcp\_mean\_fall\_1 | 0.005 | 0.041 |
| prcp\_mean\_winter | -0.011 | 0.046 |
| prcp\_mean\_spring | -0.060 | 0.058 |
| detectrate | 1.084 | 0.024 |
| extradetectionSD | 0.295 | 0.020 |
| sigmaIID | 0.527 | 0.042 |
| log\_theta\_vec | 0.000 | 0.000 |
| log\_theta\_vec | -2.052 | 0.188 |
| theta | 1.000 | 0.000 |
| SDinput | 1.000 | 0.000 |
| rhot | -0.053 | 0.208 |
| sigmat | 0.763 | 0.132 |
| rho\_st | 0.981 | 0.006 |
| theta\_st | 0.129 | 0.024 |
| SDinput\_st | 0.653 | 0.065 |
| sigmaIID | 0.527 | 0.042 |

## Detection

[1] 0.982614 [1] 0.9612889 Estimate Std. Error z value Pr(>|z^2|) log\_SD\_st -0.425463151 0.09956111 -4.2733871 1.925258e-05 rho\_st 0.981456785 0.00581361 168.8205422 0.000000e+00 log\_sigmaIID -0.640287218 0.07875054 -8.1305759 4.272556e-16 log\_mean -3.406665992 0.30200794 -11.2800542 1.646445e-29 log\_extradetectionSD -1.221627551 0.06786354 -18.0012348 1.905236e-72 rhot -0.052837346 0.20809477 -0.2539100 7.995651e-01 log\_sigmat -0.270388440 0.17260840 -1.5664849 1.172352e-01 gamma\_j 1.119523134 0.15484459 7.2299788 4.830693e-13 gamma\_j 0.041895544 0.08335533 0.5026139 6.152358e-01 gamma\_j 0.021577771 0.11343679 0.1902185 8.491380e-01 gamma\_j 0.053736166 0.10595474 0.5071615 6.120415e-01 gamma\_j -0.679362076 0.16051623 -4.2323575 2.312544e-05 gamma\_j 0.005152736 0.04066992 0.1266965 8.991806e-01 gamma\_j -0.010616536 0.04636297 -0.2289874 8.188787e-01 gamma\_j -0.060143923 0.05769235 -1.0424939 2.971827e-01 log\_detectrate 0.080543604 0.02254424 3.5726914 3.533310e-04 log\_theta\_vec -2.051798394 0.18777934 -10.9266459 8.596749e-28 Estimate Std. Error z value Pr(>|z^2|) mean\_N 44.398478268 7.78598835 5.7023561 1.181626e-08 log\_mean -3.406665992 0.30200794 -11.2800542 1.646445e-29 mu 0.033151544 0.01001203 3.3111712 9.290636e-04 gamma\_j 1.119523134 0.15484459 7.2299788 4.830693e-13 gamma\_j 0.041895544 0.08335533 0.5026139 6.152358e-01 gamma\_j 0.021577771 0.11343679 0.1902185 8.491380e-01 gamma\_j 0.053736166 0.10595474 0.5071615 6.120415e-01 gamma\_j -0.679362076 0.16051623 -4.2323575 2.312544e-05 gamma\_j 0.005152736 0.04066992 0.1266965 8.991806e-01 gamma\_j -0.010616536 0.04636297 -0.2289874 8.188787e-01 gamma\_j -0.060143923 0.05769235 -1.0424939 2.971827e-01 detectrate 1.083876107 0.02443516 44.3572336 0.000000e+00 extradetectionSD 0.294750055 0.02000278 14.7354525 3.816325e-49 sigmaIID 0.527140998 0.04151264 12.6983262 6.040790e-37 log\_theta\_vec 0.000000000 0.00000000 NaN NaN log\_theta\_vec -2.051798394 0.18777934 -10.9266459 8.596749e-28 theta 1.000000000 0.00000000 Inf 0.000000e+00 SDinput 1.000000000 0.00000000 Inf 0.000000e+00 rhot -0.052837346 0.20809477 -0.2539100 7.995651e-01 sigmat 0.763083025 0.13171454 5.7934609 6.895053e-09 rho\_st 0.981456785 0.00581361 168.8205422 0.000000e+00 theta\_st 0.128503596 0.02413032 5.3253994 1.007315e-07 SDinput\_st 0.653467061 0.06505990 10.0440828 9.755091e-24 sigmaIID 0.527140998 0.04151264 12.6983262 6.040790e-37

Table continues below

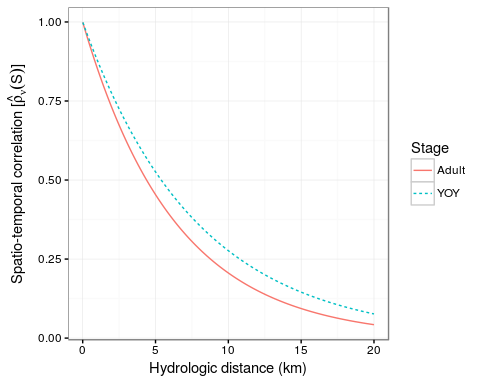
|  |  |  |  |
| --- | --- | --- | --- |
|  | Estimate | Std. Error | z value |
| **mean\_N** | 4e+01 | 8e+00 | 6e+00 |
| **log\_mean** | -3e+00 | 3e-01 | -1e+01 |
| **mu** | 3e-02 | 1e-02 | 3e+00 |
| **gamma\_j** | 1e+00 | 2e-01 | 7e+00 |
| **gamma\_j** | 4e-02 | 8e-02 | 5e-01 |
| **gamma\_j** | 2e-02 | 1e-01 | 2e-01 |
| **gamma\_j** | 5e-02 | 1e-01 | 5e-01 |
| **gamma\_j** | -7e-01 | 2e-01 | -4e+00 |
| **gamma\_j** | 5e-03 | 4e-02 | 1e-01 |
| **gamma\_j** | -1e-02 | 5e-02 | -2e-01 |
| **gamma\_j** | -6e-02 | 6e-02 | -1e+00 |
| **detectrate** | 1e+00 | 2e-02 | 4e+01 |
| **extradetectionSD** | 3e-01 | 2e-02 | 1e+01 |
| **sigmaIID** | 5e-01 | 4e-02 | 1e+01 |
| **log\_theta\_vec** | 0e+00 | 0e+00 | NaN |
| **log\_theta\_vec** | -2e+00 | 2e-01 | -1e+01 |
| **theta** | 1e+00 | 0e+00 | Inf |
| **SDinput** | 1e+00 | 0e+00 | Inf |
| **rhot** | -5e-02 | 2e-01 | -3e-01 |
| **sigmat** | 8e-01 | 1e-01 | 6e+00 |
| **rho\_st** | 1e+00 | 6e-03 | 2e+02 |
| **theta\_st** | 1e-01 | 2e-02 | 5e+00 |
| **SDinput\_st** | 7e-01 | 7e-02 | 1e+01 |
| **sigmaIID** | 5e-01 | 4e-02 | 1e+01 |

|  |  |
| --- | --- |
|  | Pr(> |
| **mean\_N** | 1e-08 |
| **log\_mean** | 2e-29 |
| **mu** | 9e-04 |
| **gamma\_j** | 5e-13 |
| **gamma\_j** | 6e-01 |
| **gamma\_j** | 8e-01 |
| **gamma\_j** | 6e-01 |
| **gamma\_j** | 2e-05 |
| **gamma\_j** | 9e-01 |
| **gamma\_j** | 8e-01 |
| **gamma\_j** | 3e-01 |
| **detectrate** | 0e+00 |
| **extradetectionSD** | 4e-49 |
| **sigmaIID** | 6e-37 |
| **log\_theta\_vec** | NaN |
| **log\_theta\_vec** | 9e-28 |
| **theta** | 0e+00 |
| **SDinput** | 0e+00 |
| **rhot** | 8e-01 |
| **sigmat** | 7e-09 |
| **rho\_st** | 0e+00 |
| **theta\_st** | 1e-07 |
| **SDinput\_st** | 1e-23 |
| **sigmaIID** | 6e-37 |

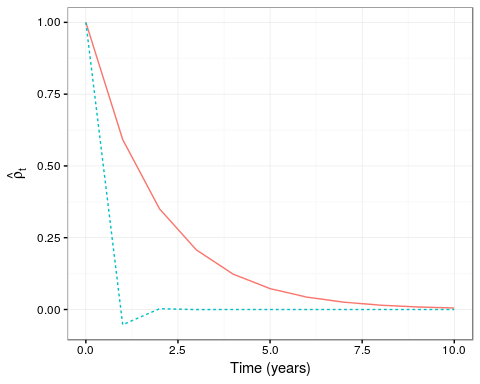
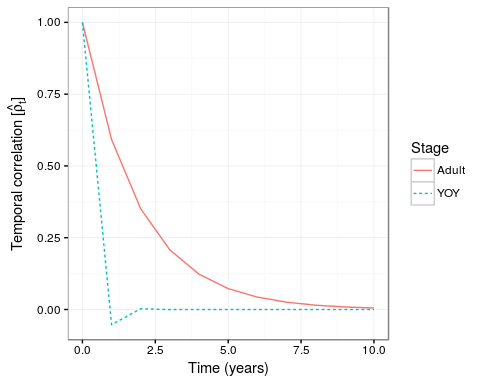
The overall mean probability of detection was 0.7409402 for adults and 0.6617182 for YOY, with random variance among sites and years of 0.0455228 and 0.0868776 for adults and YOY, respectively.

Compare values to where fall in relation to simulations

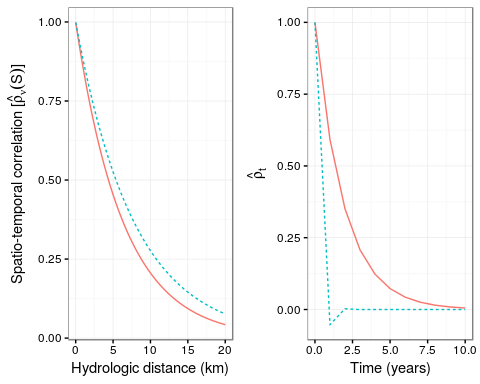
## Plot Adult and YOY spatio-temporal decay functions



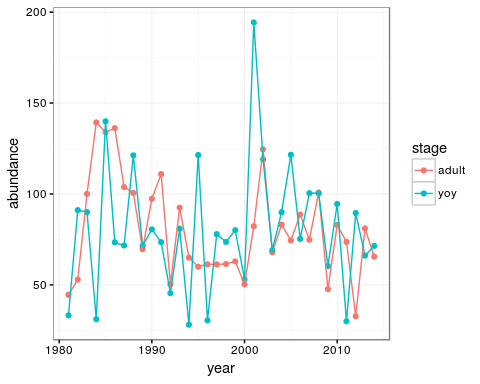
## Plot Adult and YOY temporal decay rate



### Combine plots



## Abundances over time



## Evaluate Model Fit

