**Supplemental Figure 1.** Correlations among time-constant reach-specific habitat covariates. The upper matrix triangle of plots shows Pearson correlation coefficients between covariates listed along the diagonal. The lower matrix triangle shows scatter plots along with a trendline.

**Supplemental Figure 2.** Annual detection probabilities with 95% confidence intervals. Standard errors could not be calculated for estimates on a boundary of zero or one, and therefore do not include confidence intervals.

**Supplemental Table 1.** Variance inflation factors (VIF) for the spatial parameters included in the top-ranked model. VIF provides an index of how much of the variance (square of the estimate’s standard deviation) for each coefficient is increased because of collinearity.

|  |  |
| --- | --- |
| **Parameter** | **VIF** |
| Revetment | 2.5 |
| Wooded bank | 3.3 |
| Diversions | 2.1 |
| Tributaries | 2.2 |
| Width: Depth | 4.8 |
| Slope | 6.6 |
| Sinuosity | 1.7 |

**Supplemental Table 2.** The detection model (p) with the lowest ranking QAICc with ĉ of 1.54 contained mean reach water velocity and a site x year interaction, removing the intercept (~-1) for expressing beta parameters. This model was used for all survival (phi) models reported in Table 4.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model** | **npar** | **QAICc** | **ΔQAICc** | **weight** | **QDeviance** |
| Phi(~-1 + site:year)p(~-1 + site:year + velocity) | 171 | 13474 | 0 | 1 | 13130 |
| Phi(~-1 + site:year)p(~-1 + time:year) | 170 | 15543 | 2069 | 0 | 3745 |
| Phi(~-1 + site:year)p(~-1 + site + year + velocity) | 107 | 16175 | 2700 | 0 | 15959 |
| Phi(~-1 + site:year)p(~-1 + site + velocity) | 103 | 16668 | 3193 | 0 | 16461 |
| Phi(~-1 + site:year)p(~-1 + site + year) | 106 | 17935 | 4461 | 0 | 6267 |
| Phi(~-1 +site:year)p(~-1 + site) | 102 | 23207 | 9732 | 0 | 11546 |