# Statistical Analyses Performed

A two-sample exact Poisson test was applied to the Snoqualmie River field observation data and remote camera observation data to evaluate the following null (Ho) and alternate (Ha) hypotheses:

| | |
|---|---|
| Ho: | The number of groups observed early (11:00 AM to 3:00 PM) and late (3:00 PM to 7:00 PM) in the day is the same. |
| Ha: | The number of groups observed early (11:00 AM to 3:00 PM) and late (3:00 PM to 7:00 PM) in the day is different. |
| Ho: | The number of people observed early (11:00 AM to 3:00 PM) and late (3:00 PM to 7:00 PM) in the day is the same. |
| Ha: | The number of people observed early (11:00 AM to 3:00 PM) and late (3:00 PM to 7:00 PM) in the day is different. |
| Ho: | The number of groups observed on weekdays and weekends is the same. |
| Ha: | The number of groups observed on weekdays and weekends is different. |
| Ho: | The number of people observed on weekdays and weekends is the same. |
| Ha: | The number of people observed on weekdays and weekends is different. |
| Ho: | The number of groups observed during the peak (July 4 to September 2) and off-peak days of the summer is the same. |
| Ha: | The number of groups observed during the peak (July 4 to September 2) and off-peak days of the summer is different. |
| Ho: | The number of people observed during the peak (July 4 to September 2) and off-peak days of the summer is the same. |
| Ha: | The number of people observed during the peak (July 4 to September 2) and off-peak days of the summer is different. |

These tests were performed on the data from each individual site, pooled data from all sites on the Snoqualmie River above and below Snoqualmie Falls, and pooled data from all sites on the Snoqualmie River. In all cases, statistical significant was evaluated based on alpha ($\alpha$) level of 0.05.

A chi-square test was also applied to the Snoqualmie River field observation data to evaluate the following null and alternate hypotheses:

| | |
|---|---|
| Ho: | There is no relationship between the presence of life vests and children in a group. |
| Ha: | There is relationship between the presence of life vests and children in a group. |
| Ho: | There is no relationship between the presence of alcohol and children in a group. |
| Ha: | There is relationship between the presence of alcohol and children in a group. |

Ho: There is no relationship between the presence of coolers and children in a group.

Ha: There is relationship between the presence of coolers and children in a group.

Ho: There is no relationship between the presence of alcohol and youth in a group.

Ha: There is relationship between the presence of alcohol and youth in a group.

Ho: There is no relationship between the presence of coolers and youth in a group.

Ha: There is relationship between the presence of coolers and youth in a group.

These tests were also performed on the data from each individual site, pooled data from all sites on the Snoqualmie River above and below Snoqualmie Falls, and pooled data from all sites on the Snoqualmie River. Statistical significant was evaluated based on alpha ($\alpha$) level of 0.05.

A Kendall's tau correlation test was applied to the remote camera observation data to evaluate the following null and alternate hypotheses:

Ho: There is no relationship between the average number of groups observed across all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of groups observed across all sites and the maximum daily temperature on a given day.

Ho: There is no relationship between the average number of people observed across all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of people observed across all sites and the maximum daily temperature on a given day.

Ho: There is no relationship between the average number of groups observed on weekdays across all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of groups observed on weekdays across all sites and the maximum daily temperature on a given day.

Ho: There is no relationship between the average number of people observed across on weekdays all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of people observed across all sites on weekdays and the maximum daily temperature on a given day.

Ho: There is no relationship between the average number of groups observed on weekends across all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of groups observed on weekends across all sites and the maximum daily temperature on a given day.

Ho: There is no relationship between the average number of people observed across on weekends all sites and the maximum daily temperature on a given day.

Ha: There is a relationship between the average number of people observed across all sites on weekends and the maximum daily temperature on a given day.

Statistical significant in these correlation analyses was valuated based on alpha ($\alpha$) level of 0.05.

In addition to the tests described above, exploratory regression analyses were performed using the remote camera data to identify key variables for predicting recreational river use. These analyses specifically involved the use of step-wise linear regression to determine if one or more of the following independent variables had a significant influence ($\alpha$ = 0.05) on the number of people and number of groups that were observed at the remote camera locations: maximum daily temperature, weekend or weekday, and average daily river flow rate. Data for average daily river flow rate for each remote camera location were obtained from the closest USGS river gauge that was active during the study period. The specific gauges used in these analyses included:

- Gauge 12144500 on the Snoqualmie River

- Gauge 12100490 on the White River

- Gauge 12113000 on the Green River near Auburn

- Gauge 12113344 on the Green River near Kent

- Gauge 12119000 on the Cedar River

With three independent variables, there are eight possible models that could be developed using subsets of these variables. The best model was selected based on the Akaike Information Criterion (AIC) which is a goodness of fit measure that favors smaller residual error while minimizing the number of variables in the model (Bauman and Anderson 2002).

## Reference

Burnham, K.P. and D.R. Anderson. 2002. Model selection and multimodel inference: a practical information-theoretic approach. New York, Springer. 2nd ed., XXVI, 488 p.

**Table E1. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed Early (11 am to 3 pm) and Late (3 pm to 7 pm) in the Day Based on Snoqualmie River Field Observation Data.**

| Site | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Early (11 am - 3 pm) | Late (3 pm - 7 pm) | p-value | Early (11 am - 3 pm) | Late (3 pm - 7 pm) | p-value |
| 436th Street Bridge | | | 1.000 | | | 1.000 |
| Aldair Levee | | | 0.077 | | | 0.154 |
| Blue Hole | | | 0.180 | | | 0.118 |
| Fall City (SR202 Bridge) | | + | **< 0.001** | | + | **< 0.001** |
| Fall City (Zurfleuh) Boat Ramp | | + | **< 0.001** | | + | **< 0.001** |
| Gardner-Weeks Memorial Park | | | 0.375 | + | | **0.039** |
| Neal Road Take-Out | | | 0.664 | | | 0.053 |
| Plum Creek Boat Ramp | + | | **0.002** | + | | **< 0.001** |
| Snoqualmie Trail Bridge | | | 0.125 | | + | **0.008** |
| Tanner Put-In | | | 1.000 | | | 0.508 |
| Three Forks Park | | | 0.549 | + | | **0.005** |
| Tolt RM 0.5 RB Bar | | + | **0.039** | | + | **< 0.001** |
| Tolt RM 1.8 to 1.9 | | | 1.000 | | | 0.688 |
| Tolt-Snoqualmie Confluence | | | 0.241 | | | 0.696 |
| Above Falls | | | 1.000 | | | 0.092 |
| Below Falls | | + | **< 0.001** | | + | **< 0.001** |
| All Sites | | + | **< 0.001** | | + | **< 0.001** |

Notes:

Bold p-values indicate statistically significant differences at an alpha ($\alpha$) level of 0.05.

"+" indicates time of day with significantly more groups or people

**Table E2. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed Early (11 am to 3 pm) and Late (3 pm to 7 pm) in the Day Based on Remote Camera Observation Data.**

| Site | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Early (11 am - 3 pm) | Late (3 pm - 7 pm) | p-value | Early (11 am - 3 pm) | Late (3 pm - 7 pm) | p-value |
| KC1 - Ricardi North | | + | **< 0.001** | | + | **< 0.001** |
| KC2 - Elliot | | + | **< 0.001** | | + | **< 0.001** |
| KC3 - Fall City Park North | | | 0.614 | | | 0.423 |
| KC4 - Ricardi South | | + | **< 0.001** | | + | **< 0.001** |
| KC5 - Regis | | + | **< 0.001** | | + | **< 0.001** |
| KC6 - Briscoe North | | | 0.832 | | | 0.766 |
| KC7 - Briscoe South | | | 0.267 | | | 0.405 |
| KC8 - Fenster South | | + | **< 0.001** | | + | **< 0.001** |
| KC9 - Fenster North | | + | **< 0.001** | | + | **< 0.001** |
| KC10 - Van Doren | | | 0.093 | | | 0.220 |
| KC11 - Isaac Evans North | | + | **< 0.001** | | + | **< 0.001** |
| KC12 - Isaac Evans South | | + | **< 0.001** | | + | **< 0.001** |
| KC13 - Russel Woods | | | 0.678 | | | 0.551 |
| KC14 - White South | | | 1.000 | | | 0.267 |
| KC15 - White North | | | 0.289 | | | 0.629 |
| KC16 - Cherry Stand East | | + | **< 0.001** | | + | **< 0.001** |
| KC17 - Fall City Park South | | | 0.695 | | | 0.242 |
| KC18 - Cherry Stand West | | + | **< 0.001** | | + | **< 0.001** |
| KC19 - Auburn Black Diamond | | + | **< 0.001** | | + | **< 0.001** |
| KC20 - Whitney Bridge Upstream | | + | **< 0.001** | | + | **< 0.001** |
| KC21 - Whitney Bridge Downstream | | + | **< 0.001** | | + | **< 0.001** |
| ALL CAMERAS | | + | **< 0.001** | | + | **< 0.001** |

Notes:

Bold p-values indicate statistically significant differences at an alpha (a) level of 0.05

"+" indicates time of day with significantly more groups or people

**Table E3. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed on Weekdays and Weekends Based on Snoqualmie River Field Observation Data.**

| Site | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Weekday | Weekend | p-value | Weekday | Weekend | p-value |
| 436th Street Bridge | | | 1.000 | | | 0.204 |
| Aldair Levee | | | 1.000 | | | 0.546 |
| Blue Hole | | | 1.000 | | | 0.607 |
| Fall City (SR202 Bridge) | | + | **< 0.001** | | + | **< 0.001** |
| Fall City (Zurfleuh) Boat Ramp | | + | **< 0.001** | | + | **< 0.001** |
| Gardner-Weeks Memorial Park | | | 0.604 | + | | **0.014** |
| Neal Road Take-Out | | + | **0.020** | | + | **0.041** |
| Plum Creek Boat Ramp | | | 0.135 | | + | **< 0.001** |
| Snoqualmie Trail Bridge | | | 0.688 | | | 1.000 |
| Tanner Put-In | | | 1.000 | | | 0.508 |
| Three Forks Park | | | 0.365 | + | | **< 0.001** |
| Tolt RM 0.5 RB Bar | | + | **0.037** | | + | **< 0.001** |
| Tolt RM 1.8 to 1.9 | | | 1.000 | | | 0.688 |
| Tolt-Snoqualmie Confluence | | + | **< 0.001** | | + | **< 0.001** |
| Above Falls | | | 0.635 | | | 0.166 |
| Below Falls | | + | **< 0.001** | | + | **< 0.001** |
| All Sites | | + | **< 0.001** | | + | **< 0.001** |

Notes:

Bold p-values indicate statistically significant differences at an alpha (a) level of 0.05.

"+" indicates time of week with significantly more groups or people

**Table E4. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed on Weekdays and Weekends Based on Remote Camera Observation Data.**

| Sites | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Weekday | Weekend | p-value | Weekday | Weekend | p-value |
| KC1 - Ricardi North | | + | **< 0.001** | | + | **< 0.001** |
| KC2 - Elliot | | + | **< 0.001** | | + | **< 0.001** |
| KC3 - Fall City Park North | | + | **< 0.001** | | + | **< 0.001** |
| KC4 - Ricardi South | | + | **< 0.001** | | + | **< 0.001** |
| KC5 - Regis | | | 0.175 | | | 0.319 |
| KC6 - Briscoe North | | | 1.000 | | | 0.542 |
| KC7 - Briscoe South | | | 1.000 | | | 0.406 |
| KC8 - Fenster South | | + | **0.003** | | + | **< 0.001** |
| KC9 - Fenster North | | + | **0.007** | | + | **< 0.001** |
| KC10 - Van Doren | | | 0.531 | | | 0.890 |
| KC11 - Isaac Evans North | | + | **< 0.001** | | + | **< 0.001** |
| KC12 - Isaac Evans South | | | 0.520 | | + | **< 0.001** |
| KC13 - Russel Woods | | | 0.682 | | | 1.000 |
| KC14 - White South | | | 1.000 | | | 1.000 |
| KC15 - White North | | | 0.489 | | | 0.463 |
| KC16 - Cherry Stand East | | + | **< 0.001** | | + | **< 0.001** |
| KC17 - Fall City Park South | | + | **0.004** | | + | **< 0.001** |
| KC18 - Cherry Stand West | | + | **< 0.001** | | + | **< 0.001** |
| KC19 - Auburn Black Diamond | | + | **0.005** | | + | **< 0.001** |
| KC20 - Whitney Bridge Upstream | | + | **< 0.001** | | + | **< 0.001** |
| KC21 - Whitney Bridge Downstream | | + | **< 0.001** | | + | **< 0.001** |
| ALL CAMERAS | | + | **< 0.001** | | + | **< 0.001** |

Notes:

Bold p-values indicate statistically significant differences at an alpha (a) level of 0.05

"+" indicates time of week with significantly more groups or people

**Table E5. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed During the Peak (July 4 to September 2)**
**and Off-Peak Days of the Summer Based on Snoqualmie River Field Observation Data.**

| Sites | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Peak | Off Peak | p-value | Peak | Off Peak | p-value |
| 436th Street Bridge | | | NA | | | NA |
| Aldair Levee | | | 0.341 | | | 0.053 |
| Blue Hole | | | 0.727 | | | 0.786 |
| Fall City (SR202 Bridge) | | | 0.369 | + | | < 0.001 |
| Fall City (Zurfleuh) Boat Ramp | | | 0.206 | + | | < 0.001 |
| Gardner-Weeks Memorial Park | | | 1.000 | | | 0.742 |
| Neal Road Take-Out | | | NA | | | NA |
| Plum Creek Boat Ramp | + | | < 0.001 | + | | < 0.001 |
| Snoqualmie Trail Bridge | | | NA | | | NA |
| Tanner Put-In | | | 1.000 | | | 0.508 |
| Three Forks Park | | | NA | | | NA |
| Tolt RM 0.5 RB Bar | | | 0.107 | | + | 0.005 |
| Tolt RM 1.8 to 1.9 | | | 1.000 | | | 0.688 |
| Tolt-Snoqualmie Confluence | | | 0.519 | | + | 0.004 |
| Above Falls | | | 0.393 | + | | 0.044 |
| Below Falls | | | 0.931 | + | | < 0.001 |
| All Sites | | + | < 0.001 | | | 0.798 |

Notes:

Bold p-values indicate statistically significant differences at an alpha (a) level of 0.05.

"+" indicates time of season with significantly more groups or people

NA: insufficient number of observations in one or more group to perform analysis.

**Table E6. Results from Two-Sample Exact Poisson Test Comparing Numbers of Groups and People Observed During the Peak (July 4 to September 2) and Off-Peak Days of the Summer Based on Remote Camera Observation Data.**

| Sites | Number of Groups | | | Number of People | | |
|---|---|---|---|---|---|---|
| | Peak | Off Peak | p-value | Peak | Off Peak | p-value |
| KC1 - Ricardi North | + | | **0.003** | + | | **< 0.001** |
| KC2 - Elliot | + | | **0.028** | | | 0.221 |
| KC3 - Fall City Park North | | | 0.450 | + | | **0.011** |
| KC4 - Ricardi South | | | 0.074 | + | | **0.009** |
| KC5 - Regis | | + | **0.009** | | + | **< 0.001** |
| KC6 - Briscoe North | | | 1.000 | | | 0.838 |
| KC7 - Briscoe South | | | 0.503 | | | 0.802 |
| KC8 - Fenster South | | | 0.187 | | | 0.547 |
| KC9 - Fenster North | | | 0.619 | | | 0.439 |
| KC10 - Van Doren | | | 1.000 | | | 0.402 |
| KC11 - Isaac Evans North | | | 1.000 | | | 0.053 |
| KC12 - Isaac Evans South | + | | **0.003** | + | | **< 0.001** |
| KC13 - Russel Woods | | | 1.000 | | | 0.651 |
| KC14 - White South | | | 1.000 | | | 1.000 |
| KC15 - White North | | | 1.000 | | | 0.224 |
| KC16 - Cherry Stand East | + | | **< 0.001** | + | | **< 0.001** |
| KC17 - Fall City Park South | + | | **0.003** | + | | **< 0.001** |
| KC18 - Cherry Stand West | + | | **< 0.001** | + | | **< 0.001** |
| KC19 - Auburn Black Diamond | | + | **0.020** | | + | **0.008** |
| KC20 - Whitney Bridge Upstream | + | | **< 0.001** | + | | **< 0.001** |
| KC21 - Whitney Bridge Downstream | + | | **0.049** | + | | **0.021** |
| ALL CAMERAS | + | | **< 0.001** | + | | **< 0.001** |

Notes:

Bold p-values indicate statistically significant differences at an alpha (a) level of 0.05

"+" indicates time of season with significantly more groups or people

**Table E7. Results from a Chi-Square Test to Evaluate Relationships Between the Presence of Life Vests and Children in a Group.**

| | Chi-Square Test Statistic | p-value |
|---|---|---|
| 436th Street Bridge | | NA |
| Aldair Levee | | NA |
| Blue Hole | | NA |
| Fall City (SR202 Bridge) | 65.3 | **< 0.001** |
| Fall City (Zurfleuh) Boat Ramp | 32.7 | **< 0.001** |
| Gardner-Weeks Memorial Park | 0.1 | 0.819 |
| Neal Road Take-Out | | NA |
| Plum Creek Boat Ramp | 82.4 | **< 0.001** |
| Snoqualmie Trail Bridge | | NA |
| Tanner Put-In | 0.0 | 1.000 |
| Three Forks Park | 1.1 | 0.300 |
| Tolt RM 0.5 RB Bar | 0.6 | 0.432 |
| Tolt RM 1.8 to 1.9 | | NA |
| Tolt-Snoqualmie Confluence | 0.1 | 0.781 |
| Above Falls | 2.9 | 0.088 |
| Below Falls | 159.9 | **< 0.001** |
| All Sites | 165.1 | **< 0.001** |

Notes:

Bold p-values indicate statistically significant relationship is present at an alpha (a) level of 0.05.

All sites with statistically significant Chi-Square test statistics showed a positive relationship between presence of children and life vests

NA: insufficient number of observations in one or more group to perform analysis.

| | Children and Alcohol | | Youth and Alcohol | | Children and Coolers | | Youth and Coolers | |
|---|---|---|---|---|---|---|---|---|
| | Chi-Squared Statistic | p-value | Chi-Squared Statistic | p-value | Chi-Squared Statistic | p-value | Chi-Squared Statistic | p-value |
| 436th Street Bridge | | NA | | NA | | NA | | NA |
| Aldair Levee | | NA | 0.1 | 0.800 | | NA | 0.3 | 0.596 |
| Blue Hole | | NA | | NA | | NA | 0.0 | 1.000 |
| Fall City (SR202 Bridge) | 0.9 | 0.340 | 3.8 | 0.052 | 1.1 | 0.301 | 0.0 | 1.000 |
| Fall City (Zurfleuh) Boat Ramp | 0.3 | 0.598 | 12.7 | **< 0.001** | 0.0 | 0.845 | 6.6 | **0.010** |
| Gardner-Weeks Memorial Park | 0.0 | 1.000 | 0.0 | 1.000 | | NA | | NA |
| Neal Road Take-Out | | NA | 0.0 | 0.964 | | NA | 0.0 | 1.000 |
| Plum Creek Boat Ramp | 10.9 | **< 0.001** | 9.5 | **0.002** | 0.6 | 0.448 | 1.2 | 0.274 |
| Snoqualmie Trail Bridge | | NA | | NA | | NA | | NA |
| Tanner Put-In | | NA | | NA | | NA | | NA |
| Three Forks Park | | NA | | NA | 0.8 | 0.366 | 1.0 | 0.324 |
| Tolt RM 0.5 RB Bar | | NA | 0.0 | 1.000 | 0.6 | 0.436 | 0.1 | 0.787 |
| Tolt RM 1.8 to 1.9 | | NA | | NA | | NA | 0.0 | 1.000 |
| Tolt-Snoqualmie Confluence | | NA | | NA | 0.0 | 0.834 | 0.0 | 0.842 |
| Above Falls | 0.0 | 1.000 | 0.0 | 1.000 | 1.4 | 0.232 | 0.1 | 0.701 |
| Below Falls | 13.1 | **< 0.001** | 32.6 | **< 0.001** | 0.6 | 0.451 | 12.3 | **< 0.001** |
| All Sites | 13.5 | **< 0.001** | 37.0 | **< 0.001** | 2.0 | 0.163 | 0.0 | 0.966 |

Notes:

Bold p-values indicate statistically significant relationship is present at an alpha (a) level of 0.05.

All sites with statistically significant Chi-Square test statistics showed a negative relationship between presence of children/youths and alcohol/coolers

NA: insufficient number of observations in one or more group to perform analysis.

**Table E9.  Results from a Kendall's Tau Correlation Test to Evaluate Relationships Between the Average Number of Groups/People Observed Across All Sites from Remote Camera Observation Data and the Maximum Daily Temperature on a Given Day.**

|  | Kendall Tau | p-value |
|---|---|---|
| **ALL** | | |
| Groups/Site | 0.42 | **<0.001** |
| People/Site | 0.41 | **<0.001** |
| **WEEKDAY** | | |
| Groups/Site | 0.6 | **<0.001** |
| People/Site | 0.6 | **<0.001** |
| **WEEKEND** | | |
| Groups/Site | 0.47 | **0.001** |
| People/Site | 0.39 | **0.009** |

Notes:

Bold p-values indicate statistically significant relationship is present at an alpha (a) level of 0.05.

**Table E10. Results from Multiple Regression Analyses to Develop Models for Predicting Average Number of People at Each Remote Camera Observation Location.**

| | Regression Models for Predicting Number of People | | | |
| --- | --- | --- | --- | --- |
| | Camera | Intercept | Temp | Weekend | Flow |
| 1 | KC1 - Ricardi North | x | x | x | |
| 2 | KC10 - Van Doren | x | | | |
| 3 | KC11 - Isaac Evans North | x | x | x | |
| 4 | KC12 - Isaac Evans South | x | x | x | x |
| 5 | KC13 - Russel Woods | x | | x | |
| 6 | KC14 - White South | | | | |
| 7 | KC15 - White North | x | x | x | |
| 8 | KC16 - Cherry Stand East | x | x | x | x |
| 9 | KC17 - Fall City Park South | x | x | x | x |
| 10 | KC18 - Cherry Stand West | x | x | x | x |
| 11 | KC19 - Auburn Black Diamond | x | | x | |
| 12 | KC2 - Elliot | x | x | x | x |
| 13 | KC20 - Whitney Bridge Upstream | x | x | x | x |
| 14 | KC21 - Whitney Bridge Downstream | x | x | x | |
| 15 | KC22 - Raindow Bend | x | | | |
| 16 | KC23 - Belmondo | x | x | | |
| 17 | KC3 - Fall City Park North | x | x | x | |
| 18 | KC4 - Ricardi South | x | x | x | x |
| 19 | KC5 - Regis | x | x | x | |
| 20 | KC6 - Briscoe North | x | | | |
| 21 | KC7 - Briscoe South | x | | | |
| 22 | KC8 - Fenster South | x | x | x | |
| 23 | KC9 - Fenster North | x | x | x | |

| | Camera | Intercept | | Temp | | | Weekend | | | Flow | | | R-sq | Adj R-sq | F-sta | Model p-value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | Coef | p-value | Coef | Standardized Coef | p-value | Coef | Standardized Coef | p-value | Coef | Standardized Coef | p-value | | | | |
| 1 | KC1 - Ricardi North | -89.74 | 0.002 | 1.27 | 0.41 | < 0.001 | 20.92 | 0.53 | < 0.001 | | | | 0.40 | 0.37 | 16.22 | < 0.001 |
| 2 | KC10 - Van Doren | 3.18 | < 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 3 | KC11 - Isaac Evans North | -38.28 | 0.013 | 0.55 | 0.36 | 0.005 | 9.72 | 0.58 | < 0.001 | | | | 0.38 | 0.35 | 13.57 | < 0.001 |
| 4 | KC12 - Isaac Evans South | -34.62 | 0.301 | 1.10 | 0.60 | < 0.001 | 13.32 | 0.71 | < 0.001 | -0.15 | -0.33 | 0.030 | 0.45 | 0.39 | 8.17 | < 0.001 |
| 5 | KC13 - Russel Woods | 1.57 | < 0.001 | | | | 0.71 | 0.52 | 0.080 | | | | 0.20 | 0.15 | 3.57 | 0.080 |
| 6 | KC14 - White South | | < 0.001 | | | | | | | | | | | | | |
| 7 | KC15 - White North | -116.98 | 0.005 | 1.50 | 1.04 | 0.005 | 3.70 | 0.55 | 0.018 | | | | 0.99 | 0.98 | 109.31 | 0.009 |
| 8 | KC16 - Cherry Stand East | -808.96 | < 0.001 | 10.66 | 0.40 | < 0.001 | 256.61 | 0.63 | < 0.001 | 0.08 | 0.27 | < 0.001 | 0.57 | 0.55 | 34.31 | < 0.001 |
| 9 | KC17 - Fall City Park South | -32.24 | 0.016 | 0.38 | 0.32 | 0.017 | 7.94 | 0.46 | < 0.001 | 0.01 | 0.29 | 0.029 | 0.34 | 0.30 | 7.02 | < 0.001 |
| 10 | KC18 - Cherry Stand West | -655.12 | < 0.001 | 8.96 | 0.34 | < 0.001 | 256.27 | 0.63 | < 0.001 | 0.05 | 0.19 | 0.016 | 0.55 | 0.53 | 31.62 | < 0.001 |
| 11 | KC19 - Auburn Black Diamond | 4.50 | < 0.001 | | | | 4.06 | 0.36 | 0.039 | | | | 0.15 | 0.12 | 4.73 | 0.039 |
| 12 | KC2 - Elliot | -118.31 | < 0.001 | 1.52 | 0.47 | < 0.001 | 22.91 | 0.54 | < 0.001 | 0.05 | 0.20 | 0.038 | 0.49 | 0.47 | 19.16 | < 0.001 |
| 13 | KC20 - Whitney Bridge Upstream | 22.85 | 0.788 | 2.16 | 0.39 | 0.005 | 42.86 | 0.58 | < 0.001 | -0.56 | -0.39 | 0.007 | 0.44 | 0.39 | 9.04 | < 0.001 |
| 14 | KC21 - Whitney Bridge Downstrea | -137.21 | 0.006 | 1.95 | 0.43 | 0.002 | 26.72 | 0.50 | < 0.001 | | | | 0.32 | 0.29 | 9.81 | < 0.001 |
| 15 | KC22 - Raindow Bend | 2.74 | < 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 16 | KC23 - Belmondo | -31.48 | 0.016 | 0.46 | 0.67 | 0.007 | | | | | | | 0.36 | 0.32 | 9.47 | 0.007 |
| 17 | KC3 - Fall City Park North | -31.91 | 0.024 | 0.51 | 0.34 | 0.005 | 10.56 | 0.47 | < 0.001 | | | | 0.35 | 0.32 | 11.50 | < 0.001 |
| 18 | KC4 - Ricardi South | -99.72 | < 0.001 | 1.23 | 0.40 | < 0.001 | 19.03 | 0.49 | < 0.001 | 0.06 | 0.25 | 0.017 | 0.42 | 0.39 | 13.76 | < 0.001 |
| 19 | KC5 - Regis | -58.35 | 0.002 | 0.78 | 0.58 | < 0.001 | 3.10 | 0.20 | 0.172 | | | | 0.33 | 0.28 | 7.09 | 0.003 |
| 20 | KC6 - Briscoe North | 3.46 | 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 21 | KC7 - Briscoe South | 1.94 | < 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 22 | KC8 - Fenster South | -56.46 | 0.057 | 0.86 | 0.32 | 0.019 | 12.55 | 0.43 | 0.002 | | | | 0.25 | 0.21 | 7.26 | 0.002 |
| 23 | KC9 - Fenster North | -56.70 | 0.064 | 0.86 | 0.31 | 0.023 | 12.30 | 0.40 | 0.004 | | | | 0.23 | 0.19 | 6.67 | 0.003 |

Notes:
Bold if p-value < 0.05

**Table E11. Results from Multiple Regression Analyses to Develop Models for Predicting Average Number of Groups at Each Remote Camera Observation Location.**

| | Regression Models for Predicting Number of Groups | | | |
| --- | --- | --- | --- | --- |
| | Camera | Intercept | Temp | Weekend | Flow |
| 1 | KC1 - Ricardi North | x | x | x | |
| 2 | KC10 - Van Doren | x | | | |
| 3 | KC11 - Isaac Evans North | x | x | x | |
| 4 | KC12 - Isaac Evans South | x | x | x | x |
| 5 | KC13 - Russel Woods | x | | | |
| 6 | KC14 - White South | | | | |
| 7 | KC15 - White North | x | x | x | x |
| 8 | KC16 - Cherry Stand East | x | x | x | x |
| 9 | KC17 - Fall City Park South | x | x | x | x |
| 10 | KC18 - Cherry Stand West | x | x | x | x |
| 11 | KC19 - Auburn Black Diamond | x | | x | x |
| 12 | KC2 - Elliot | x | x | x | x |
| 13 | KC20 - Whitney Bridge Upstream | x | x | x | x |
| 14 | KC21 - Whitney Bridge Downstream | x | x | x | |
| 15 | KC22 - Raindow Bend | x | x | | |
| 16 | KC23 - Belmondo | x | x | | x |
| 17 | KC3 - Fall City Park North | x | x | x | |
| 18 | KC4 - Ricardi South | x | x | x | x |
| 19 | KC5 - Regis | x | x | x | |
| 20 | KC6 - Briscoe North | x | | | |
| 21 | KC7 - Briscoe South | x | | x | |
| 22 | KC8 - Fenster South | x | x | x | |
| 23 | KC9 - Fenster North | x | x | x | |

| | Camera | Intercept | | Temp | | | Weekend | | | Flow | | | R-sq | Adj R-sq | F-sta | Model p-value |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | | Coef | p-value | Coef | Standardized Coef | p-value | Coef | Standardized Coef | p-value | Coef | Standardized Coef | p-value | | | | |
| 1 | KC1 - Ricardi North | -32.44 | 0.003 | 0.46 | 0.40 | < 0.001 | 7.61 | 0.52 | < 0.001 | | | | 0.38 | 0.35 | 14.72 | < 0.001 |
| 2 | KC10 - Van Doren | 1.35 | < 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 3 | KC11 - Isaac Evans North | -13.86 | 0.001 | 0.20 | 0.48 | < 0.001 | 2.26 | 0.51 | < 0.001 | | | | 0.39 | 0.36 | 14.20 | < 0.001 |
| 4 | KC12 - Isaac Evans South | -5.95 | 0.712 | 0.41 | 0.51 | 0.008 | 4.00 | 0.48 | 0.014 | -0.08 | -0.38 | 0.025 | 0.34 | 0.27 | 5.12 | 0.006 |
| 5 | KC13 - Russel Woods | 2.81 | 0.002 | | | | | | | | | | 0.00 | 0.00 | | |
| 6 | KC14 - White South | | | | | | | | | | | | | | | |
| 7 | KC15 - White North | -43.54 | 0.010 | 0.54 | 1.07 | 0.009 | 2.25 | 0.92 | 0.012 | 0.00 | 0.36 | 0.031 | 1.00 | 1.00 | 1908.29 | 0.017 |
| 8 | KC16 - Cherry Stand East | -208.29 | < 0.001 | 2.85 | 0.47 | < 0.001 | 55.31 | 0.60 | < 0.001 | 0.01 | 0.23 | 0.004 | 0.57 | 0.56 | 34.71 | < 0.001 |
| 9 | KC17 - Fall City Park South | -8.07 | 0.100 | 0.11 | 0.26 | 0.072 | 2.41 | 0.40 | 0.006 | 0.00 | 0.24 | 0.093 | 0.24 | 0.19 | 4.31 | 0.010 |
| 10 | KC18 - Cherry Stand West | -160.94 | < 0.001 | 2.28 | 0.40 | < 0.001 | 53.21 | 0.59 | < 0.001 | 0.01 | 0.15 | 0.050 | 0.54 | 0.52 | 30.83 | < 0.001 |
| 11 | KC19 - Auburn Black Diamond | -6.33 | 0.282 | | | | 1.60 | 0.34 | 0.097 | 0.03 | 0.29 | 0.145 | 0.22 | 0.16 | 3.75 | 0.037 |
| 12 | KC2 - Elliot | -47.27 | < 0.001 | 0.63 | 0.48 | < 0.001 | 9.15 | 0.53 | < 0.001 | 0.01 | 0.14 | 0.164 | 0.46 | 0.43 | 16.81 | < 0.001 |
| 13 | KC20 - Whitney Bridge Upstream | -6.96 | 0.791 | 0.70 | 0.42 | 0.003 | 11.53 | 0.53 | < 0.001 | -0.13 | -0.32 | 0.032 | 0.39 | 0.34 | 7.49 | < 0.001 |
| 14 | KC21 - Whitney Bridge Downstrea | -49.99 | < 0.001 | 0.70 | 0.50 | < 0.001 | 8.31 | 0.54 | < 0.001 | | | | 0.39 | 0.36 | 13.30 | < 0.001 |
| 15 | KC22 - Raindow Bend | -0.54 | 0.665 | 0.02 | 0.24 | 0.148 | | | | | | | 0.10 | 0.05 | 2.26 | 0.148 |
| 16 | KC23 - Belmondo | -11.56 | 0.008 | 0.15 | 0.71 | 0.003 | | | | 0.00 | 0.32 | 0.144 | 0.43 | 0.36 | 6.16 | 0.010 |
| 17 | KC3 - Fall City Park North | -10.15 | 0.015 | 0.17 | 0.39 | 0.002 | 3.03 | 0.45 | < 0.001 | | | | 0.37 | 0.34 | 12.44 | < 0.001 |
| 18 | KC4 - Ricardi South | -32.14 | 0.001 | 0.39 | 0.35 | 0.002 | 6.55 | 0.46 | < 0.001 | 0.03 | 0.28 | 0.009 | 0.39 | 0.35 | 11.78 | < 0.001 |
| 19 | KC5 - Regis | -16.83 | 0.003 | 0.23 | 0.57 | < 0.001 | 1.43 | 0.32 | 0.036 | | | | 0.35 | 0.30 | 7.65 | 0.002 |
| 20 | KC6 - Briscoe North | 1.69 | < 0.001 | | | | | | | | | | 0.00 | 0.00 | | |
| 21 | KC7 - Briscoe South | 3.00 | < 0.001 | | | | -1.00 | -1.42 | 0.151 | | | | 0.27 | 0.17 | 2.59 | |
| 22 | KC8 - Fenster South | -22.42 | 0.016 | 0.33 | 0.40 | 0.004 | 2.67 | 0.29 | 0.032 | | | | 0.22 | 0.19 | 6.26 | 0.004 |
| 23 | KC9 - Fenster North | -17.77 | 0.017 | 0.27 | 0.40 | 0.004 | 2.21 | 0.30 | 0.026 | | | | 0.22 | 0.19 | 6.51 | 0.003 |

Notes:
Bold if p-value < 0.05

# Estimate of Number of Floaters on King County Rivers over Study Period

## Methods

Estimates of the total number of users on each of the following rivers were derived based on data obtained from remote field camera observations: Cedar River, Green River, White River, and Snoqualmie River. The remote field cameras captured the total number of recreational river users present each day between 11:00 AM and 7:00 PM over a period that generally extended from late June through mid-September 2013. For this analysis, estimates of the total number users on each river were derived for the peak period of river use that extended from July 4 through September 2, 2013.

A total of 23 remote field cameras were installed across the five rivers identified above. To obtain estimates of the total number of users on each river, a subset of these cameras were selected for use in this analysis based on the following considerations:

- The camera with the most complete data and best view of the river was selected where multiple cameras were co-located on the same river reach.

- To avoid double counting river users, observations from a single camera were taken to represent a river reach between known put-ins and take-outs.

- Where put-in and take-out locations were uncertain, cameras were selected to achieve a minimum distance of 2 miles between each camera on a river reach.

Table E12 lists the cameras selected to cumulatively estimate the number of users on each river.

| Table E12.    Remote Field Cameras Used To Represent River Reach in Total User Count Estimate. ||
|---|---|
| **River** | **Cameras** |
| Cedar River | Ricardi North |
| | Regis |
| | Belmondo |
| | Rainbow Bend |
| Green River | Whitney Bridge Up |
| | Auburn Black Diamond |
| | Fenster South |
| | Isaac Evans North |
| | Van Doren |
| | Briscoe South |
| White River | White North |
| Snoqualmie | Cherry Stand East |

Remote field cameras at two of the sites had significant data gaps due to malfunctions and other operational issues: Belmondo and Van Doren. To fill these data gaps, linear regression models were developed for these sites to predict the average number of daily users as a function of maximum daily temperature and/or period of the week (i.e., weekend or week day). For the Belmondo site, both the maximum daily temperature and period of the week were used to predict the average number of daily users. However, for the Van Doren site, only maximum daily temperature was used for this purpose. Linear regression model coefficients and their associated p-values are documented in Table E13 for each site.

| Table E13. Linear Regression Model Coefficients for Predicting Average Number of Daily Users. | | | | | | | |
|---|---|---|---|---|---|---|---|
| Camera | Intercept | p-value | Max. Daily Temp. Slope Coefficient | p-value | Weekend/Weekday Slope Coefficient | p-value | Multiple R-Squared |
| Belmondo | -9.75 | 0.0005 | 0.14 | 0.0002 | 1.37 | 0.038 | 0.195 |
| Van Doren | -4.38 | 0.0176 | 0.07 | 0.0060 | | | 0.0939 |

## Results and Discussion

The estimated total number of recreational river users by river for the period from July 4, 2013, through September 2, 2013, are presented in Table E14. Also provided are the average number of users observed each day for weekends, weekdays, warm days (greater than or equal to 75°F), and cold days (less than 75°F). When interpreting these results, the following limitation should be noted:

- The remote cameras due not provide complete coverage across all reaches in each river; therefore, the actual number of users may be underestimated.

- There is no way to verify users are not being double counted if they float by multiple cameras used in this analysis; therefore, the actual number of users may be overestimated.

This analysis estimated 1,064 river users were present on the Cedar River between July 4 and September 2, 2013; or an average of 18 people per day. In comparison, the Cedar River Recreation Study (King County 2011) estimated 6,700 river users were present on the same river between May and September 2010; or an average of 44 people per day. The substantial differences between these estimates may be due to the following reasons:

- The Cedar River Study did not account for the likelihood of double counting floaters between observation points.

- The Cedar River Study evaluated river use farther upstream and downstream compared to this analysis, including additional put-in and take-out locations.

| Table E14. | Estimated Total Number of Users on Each River from July 4, 2013, Through September 2, 2013. | | | | | |
|---|---|---|---|---|---|---|
| | **Total River Users[a]** | **Average Users/Day** | **Average Users/ Weekend Day** | **Average Users/ Weekday** | **Average Users/ Warm Day (>= 75°)** | **Average Users/ Cool Day (< 75°)** |
| **Cedar River** | **1,064** | | | | | |
| Ricardi North | 756 | 12 | 25 | 7 | 15 | 6 |
| Regis | 151 | 2 | 2 | 3 | 3 | 1 |
| Belmondo[b] | 109 | 2 | 3 | 1 | 2 | 1 |
| Rainbow Bend | 48 | 1 | 2 | 0 | 1 | 0 |
| **Green River** | **2,360** | | | | | |
| Whitney Bridge Up | 1,131 | 19 | 33 | 13 | 21 | 13 |
| Auburn-Black Diamond | 138 | 2 | 3 | 2 | 3 | 1 |
| Fenster South | 641 | 11 | 17 | 8 | 14 | 2 |
| Isaac Evans North | 368 | 6 | 12 | 3 | 7 | 3 |
| Van Doren[b] | 63 | 1 | 1 | 1 | 1 | 0 |
| Briscoe South | 19 | 0.3 | 0.2 | 0.3 | 0.4 | 0.1 |
| **White River** | **16** | | | | | |
| White North | 16 | 0.3 | 0.7 | 0.1 | 0.4 | 0.0 |
| **Snoqualmie** | **11,198** | | | | | |
| Cherry Stand East | 11,198 | 184 | 387 | 98 | 211 | 108 |

Notes:

[a] Total number of users based on field camera observations between July 4, 2013 and September 2, 2013.

[b] Gaps in observed data were filled with multiple regression estimates of users using daily maximum temperature and/or week day.

## References

King County. 2011. Cedar River Recreation Study – Floating the Cedar River. Department of Natural Resources and Parks, Seattle, WA. November 2011.