2020

# Springfield Reservoir Study of Aquatic Recreation Supply and Demand

## SPRINGFIELD CITY WATER, LIGHT, AND POWER (CWLP) REGIONAL AQUATIC RECREATION SUPPLY AND DEMAND REPORT

Kenneth A. Kriz, Ph.D.
J. Travis Bland, Ph.D.
Laura L. Payne, Ph.D.

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

UNIVERSITY OF ILLINOIS SPRINGFIELD

# CONTENTS

## LIST OF TABLES

## LIST OF FIGURES



**Acknowledgements:** We appreciate the leadership and contributions from the USACE Team comprised of Jim Kelley, Trevor Popkin and Ward Lenz. Many thanks to Angela Love, Bill Elzinga and Karen Boulware from Wood for their input and feedback throughout the process. Many graduate students contributed to this project and we would like to thank Jaesung An, Wonjin Jeong, Miry Chung and Ryan Hancock for their contributions to this project.

# INTRODUCTION

The City of Springfield, Illinois has developed a supplemental water supply project to supplement the city's (and their regional water customers) current water supply during extreme periods of drought. Numerous supplemental water supply alternatives have been evaluated in a Supplemental Environmental Impact Statement (SEIS) being prepared for the City of Springfield by a 3rd party contractor under the direction of the U.S. Army Corps of Engineers (USACE). The project is known as the Springfield Supplemental Water Supply Project.

The City of Springfield requested that aquatic outdoor recreation, specifically for fishing, fishing tournaments, waterfowl bird watching, boating, kayaking, canoeing and water skiing, be included in the project's purpose and need for screening of alternatives. The demand analysis also included swimming and waterfowl hunting. Although waterfowl hunting is not dependent on a flat water reservoir, about 2% of survey participants reported they hunt waterfowl at lakes. Similarly, swimming is not dependent on a flat water reservoir, yet 29% stated they swim in lakes/rivers.

A team of researchers from the University of Illinois was hired under the direction of the USACE, to complete a recreation study to determine the current recreation supply, and the current and the future needs and demands for aquatic recreation to see if they are significant enough for recreation to be added as a screening consideration of alternatives. The methods and results for the assessment of aquatic recreation demand are presented in this report. Chapter one includes the methods and findings for the recreation supply study. Chapter two describes methods and results for aquatic recreation activity use, miles traveled for recreation, satisfaction with existing aquatic recreation, importance of aquatic recreation, latent demand, required acreage, recreation demand, forecasted demand, forecasted required acreage, and calculation of unmet demand.

One area that cannot be forecasted now is the effect that Covid-19 and the associated recession will have on the future demand for aquatic-based recreation in the Springfield area. While we know that Covid-19 has caused a surge in outdoor recreation activity (especially walking and bicycling), it is unclear how these two major events will affect future demand for aquatic-based recreation (Dolesch, 2020; Roth, 2020; Venton et al., 2020). Thus, the effects of Covid-19 and the recession could not be accounted for in the survey analyses and estimations of demand.

# CHAPTER 1: SUPPLY ANALYSIS

## STUDY BACKGROUND

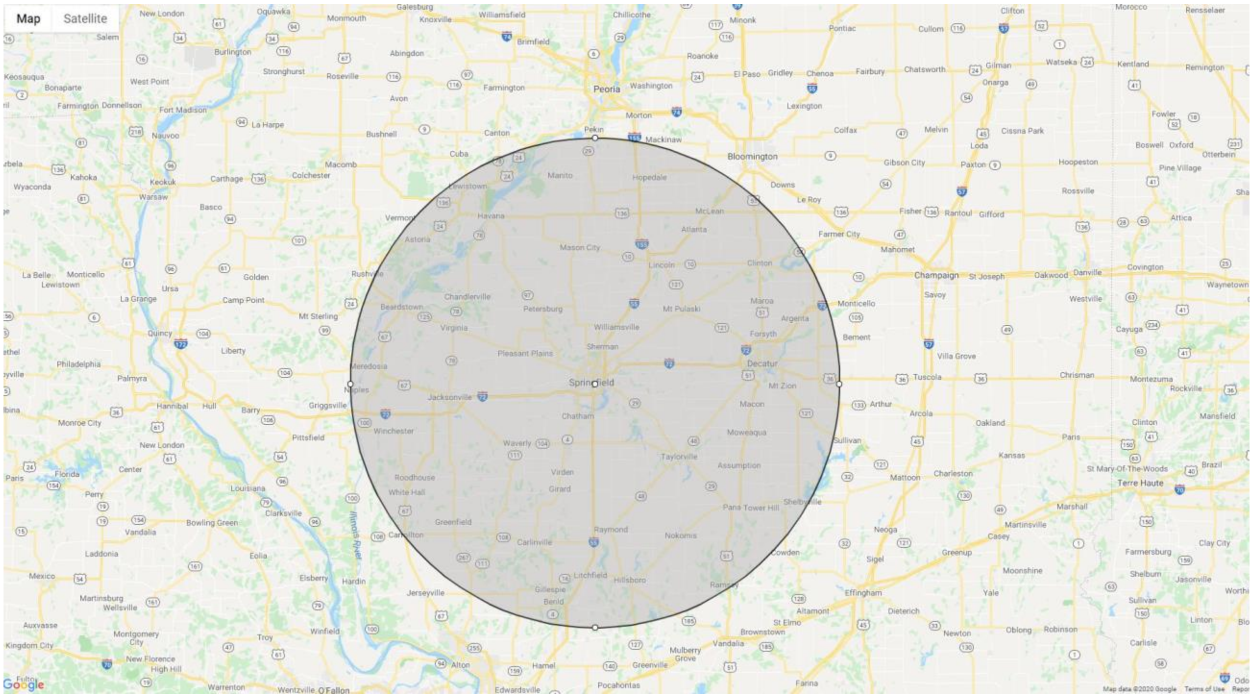
The purpose of this inventory was to assess the availability of water-based recreation opportunities within about a 50-mile radius of Springfield, Illinois. The rationale for establishing the 53-mile radius for the assessment is based upon recreationists' willingness to drive up to one hour from home for a day trip to engage in water-based recreation. Moreover, several key selection criteria were included in researching the availability of lakes and rivers. Selection criteria included:

1. All publicly owned lakes, ponds, and rivers. Private lakes are indicated in the table since they do serve some segments of the population, but are not included in the calculations;
2. Availability of at least one of the following water-based recreation activities: fishing, fishing tournaments, waterfowl bird watching, boating, kayaking, canoeing and water skiing; and
3. In the event a lake was cut-off at the perimeter of the 53-mile radius, a decision was made to include the entire body of water in the supply inventory.

The supply of water-based recreation resources was assessed with a two-pronged approach. An online mapping tool called Map Developers, was used to draw a radius map from the center of Springfield, Illinois that includes the entire area within a 53-mile radius of Springfield. This designated area was used to assess the availability of lakes and rivers for water-based recreation (see Figure 1). Moreover, acreage was not readily available for the rivers (i.e., Sangamon, Illinois, Spoon) and a few smaller lakes. Thus, the acreage for these bodies of water was estimated using the Google Earth measurement tool. Numerous resources were used to identify water resources within the study area. These included the Illinois Department of Natural Resources (IDNR) fishing directory, state park and recreation area listing, websites of municipalities, reports (i.e., Outdoor Recreational Needs and the Hunter Lake Opportunity, State Conservation, Outdoor Recreation Plan), and other fishing and boating websites such as All About Fishing (aa-fishing.com).

## LOCATION

**Figure 1. Map of the Study Area for the Water-Recreation Supply Inventory**




Seven activities were included in this supply inventory: 1) boating, 2) fishing, 3) waterfowl bird viewing, 4) canoeing, 5) kayaking, 6) skiing, and 7) fishing tournaments. Other activities are available at many of these lakes and rivers including picnicking, hiking, camping, and swimming.

The region represented in the water recreation supply inventory includes the following 16 counties. Each county and its corresponding population are outlined in Table 1 below.

### Table 1. Study Area Counties and Populations

| County Name | Population |
|---|---|
| Cass | 12,260 |
| Christian | 32,304 |
| De Witt | 15,769 |
| Fulton | 34,340 |
| Greene | 13,044 |
| Logan | 28,816 |
| Macon | 104,009 |
| Macoupin | 44,926 |
| Mason | 13,565 |
| Menard | 12,196 |
| Montgomery | 28,601 |
| Morgan | 33,658 |
| Sangamon | 194,672 |
| Schuyler | 6,907 |
| Scott | 4,951 |
| Shelby | 21,741 |

## FINDINGS OF THE WATER RECREATION SUPPLY INVENTORY

In developing the supply of water-based recreation, we assessed the acres of water resources for recreation, the county the body of water resides in, and available water-based recreation activities that take place at each site.

Across the 16 county study area, there is at least 57,503 total acres of public lakes and rivers available for water-based recreation (Table 2). Of these, there are at least 45,874 acres of lakes and 11,699 acres of rivers in the study area. Specifically, the 76-mile stretch of the Illinois River within the study area accounts for 7,776 acres and the 120-mile segment of the Sangamon River accounts for 3,840 acres of water. The Spoon River, which is considerably smaller than the Sangamon and Illinois Rivers, accounts for 4.2-miles and 83 acres of water. These lakes and rivers provide numerous aquatic recreation activities including fishing, boating, canoeing, kayaking, waterfowl bird viewing and swimming (Table 2). Other activities at some of these sights include picnicking, camping, wildlife viewing, hunting and hiking. The water-based recreational resources are all located within 53-miles of Springfield, Illinois.

The largest lakes in the study area include Lake Shelbyville (11,100 acres), Clinton Lake (4,900 acres), Lake Springfield (3,866 acres), Lake Chautauqua/Mud Lake (3,200 acres) Sangchris Lake (3,022 acres), and Lake Decatur (2,800 acres). An additional nine lakes each provide between 1,000 and 2,000 acres of water-based recreation (Lake Lou Yaeger, Crain/Chain/Stafford/Stewart, Miserable/Rice, Glen Shoals, Anderson, Swan/Jack/Grass, Big/Goose Lake, Coffeen, Taylorville). The rest of the lakes (N=17) offer between 21 and 840 acres of water usable for recreation.

Four additional private lakes were also noted within the study area that account for a total of 667 acres (Table 3). However, since they are private and not accessible by the public, they were excluded from the total water-based recreation supply calculation. The private lakes were Sunset Lake, Lake Catatoga, Franklin Waverly Outing Club Lake, and Clear Lake Sand and Gravel. Private lakes account for less than one percent of all water resources within the 53-mile radius of the City of Springfield. This indicates that most of these water resources can be accessed and enjoyed by the public. Table 2 below summarizes all of the lakes and rivers in the study area.

### Table 2. Public Lakes and Rivers Available for Recreation within 53 Miles of Springfield, Illinois

| Lake | County | Number of Acres | Activities |
|---|---|---|---|
| **Waverly Lake** | Morgan | 112 | Fishing<br>Boating |
| **Lake Jacksonville** | Morgan | 442 | Fishing<br>Boating<br>Skiing<br>Swimming |
| **Jim Edgar Panther Creek State Fish and Wildlife Area (Prairie, Gridley & Drake Lakes)** | Cass | 270 | Fishing<br>Boating<br>Canoeing<br>Kayaking<br>Waterfowl viewing |
| **Virginia City Reservoir** | Cass | 21 | Fishing<br>No motors<br>Has Boat Ramps |
| **Meyers Pond** | Cass | 384 | Fishing<br>Boating |
| **Treadway Lake** | Cass | 346 | Fishing<br>Boating<br>Waterfowl viewing |
| **Big Lake & Goose Lake** | Cass | 1690 | Electric boating only<br>Fishing |
| **Illinois River** | Multiple | 7,776 acres<br><br>(based on 76 miles of river within study area) | Fishing<br>Boating<br>Skiing<br>Kayaking<br>Canoeing<br>Waterfowl viewing |
| **Curry Lake** | Schuyler | 512 | Fishing<br>No boat ramp |
| **Schuy-Rush Lake** | Schuyler | 191 | Fishing<br>Boating |
| **Crane, Chain, Stafford and Stewart Lake** | Schuyler | 1,700 | Fishing<br>Boating<br>Waterfowl bird viewing |
| **Quiver Lake** | Mason | 154 | Fishing<br>Boating<br>Waterfowl viewing |
| **Jack, Swan & Grass Lake** | Mason | 1,113 | Fishing |
| **Matanzas Lake** | Fulton | 840 | Fishing<br>Boating |

| Lake | County | Number of Acres | Activities |
|---|---|---|---|
| **Anderson Lake** | Fulton | 1,134 | Fishing<br>Boating |
| **Duck Island Lake (main and little lake)** | Fulton | 123 | Fishing<br>Canoe<br>Kayaking |
| **Miserable Lake → Rice Lake** | Fulton | 1,383 | Fishing<br>Waterfowl viewing |
| **Spoon River** | Fulton | 83 | Fishing |
| **Gillespie Lakes Old City and New City Lakes** | Macoupin | 266 | Fishing<br>Boating<br>Swimming |
| **Lake Carlinville** | Macoupin | 355 | Fishing<br>Boating<br>Kayaking<br>Canoeing<br>Waterfowl viewing<br>Swimming |
| **Beaver Lake** | Macoupin | 59 | Fishing<br>Boating<br>Swimming |
| **Mt. Olive Lake** | Macoupin | 36 | Fishing<br>Electric motor boats only |
| **Otter Lake** | Macoupin | 765 | Fishing<br>Boating |
| **Lake Hillsboro** | Montgomery | 100 | Bank Fishing |
| **Lake Lou Yaeger** | Montgomery | 1,400 | Fishing<br>Boating<br>Swimming |
| **Coffeen Lake** | Montgomery | 1,070 | Fishing |
| **Lake Glenn Shoals** | Montgomery | 1,250 | Fishing<br>Boating<br>Canoeing<br>Kayaking<br>Swimming<br>Water skiing |
| **Sangchris Lake State Park** | Christian and Sangamon | 3,022 | Fishing<br>Boating<br>Archery |
| **Taylorville Lake** | Christian | 1,200 | Fishing<br>Boating<br>Water skiing<br>Swimming |

| Lake | County | Number of Acres | Activities |
|---|---|---|---|
| **Lake Shelbyville** | Shelby and Moultrie | 11,100 | Fishing<br>Boating<br>Swimming |
| **Sangamon River** | Multiple | 3,840 acres (based upon 120 miles of river) | Fishing<br>Boating<br>Canoeing<br>Kayaking |
| **Clinton Lake** | DeWitt | 4,900 | Fishing<br>Boating<br>Swimming |
| **Lake Decatur** | Macon | 2,800 | Fishing<br>Boating<br>Sailing<br>Jet skiing<br>Picnicking |
| **Mud Lake/Lake Chautauqua** | Sangamon | 3,200 | No boating ramp<br>Fishing |
| **Lake Springfield** | Sangamon | 3,866 | Fishing<br>Boating<br>Swimming |
| **Total Acres of Water Resources** | | **57,503** | |

### Table 3. Private Lakes within the Study Area

| Lake | County | Number of Acres | Activities |
|---|---|---|---|
| **Sunset Lake** | Macoupin | 173 | Fishing<br>Boating<br>Swimming |
| **Lake Catatoga** | Macoupin | 66 | Fishing<br>Boating<br>Swimming |
| **Franklin Waverly Outing Club Lake** | Morgan | 44 | Fishing<br>Boating |
| **Clear Lake Sand and Gravel** | Sangamon | 384 | Fishing |
| **Total Acres of Water Resources** | | **667** | |

# CHAPTER 2: DEMAND ANALYSIS

## SURVEY ANALYSIS

The Survey Research Office at the University of Illinois at Springfield (SRO-UIS) administered a survey during the period June 8-18, asking respondents questions regarding their usage patterns of aquatic recreation facilities, the desire to use the facilities more often, and barriers to their using the facilities. The SRO utilized a panel of respondents recruited by Marketing Systems Group, taken from a pool of individuals located within 50 miles of Springfield.

The panel consisted of 871 respondents of which 636 of the respondents completed or partially completed the survey. Partially completed responses and responses that appeared to be spurious were removed (e.g., someone claiming to have gone Canoeing with 10,000 other people on a trip). After this removal, 625 survey responses were analyzed for an effective response rate of 71.76%.

Figures 2 through 6 show the descriptive statistics for the socioeconomic and demographic characteristics of the sample. As shown in Figure 2, the sample was somewhat skewed toward females. As we will discuss below, we gathered data on the 50-mile radius surrounding Springfield. The gender split for that population is 50.1% female and 49.9% male. The survey sample is 66.1% female, 33.4% male, and 0.5% other. We will therefore need to make corrections to reported probabilities of engaging in activities if gender appears to affect participation in activities. We discuss those corrections in the section on Visitor and Required Acreage Calculations.

**Figure 2. Percent of Survey Respondents by Gender**

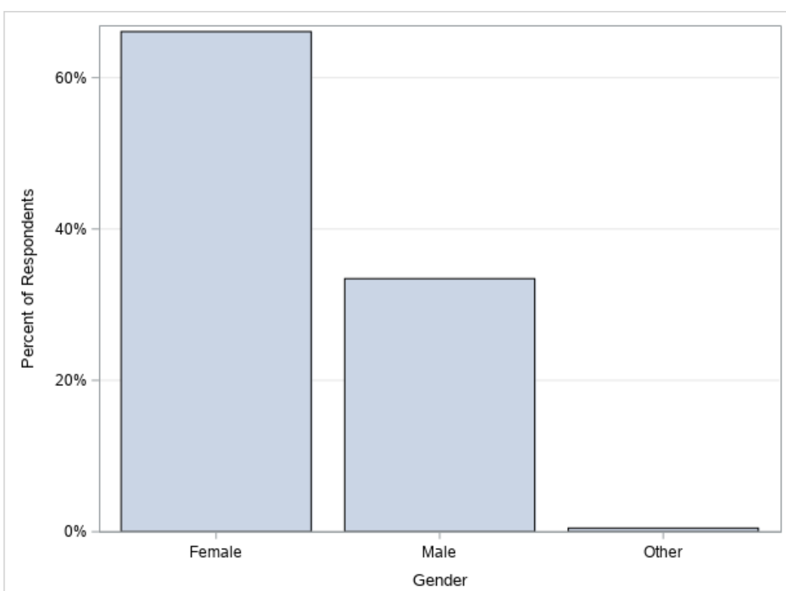


Figure 3 shows the distribution of respondents by age. For this variable, the median age of sample respondents falls into the 35 to 44 age range. This reflects the population very well, as the median age of residents within the 50-mile radius of Springfield is 41.9 years.

**Figure 3. Percent of Survey Respondents by Age**

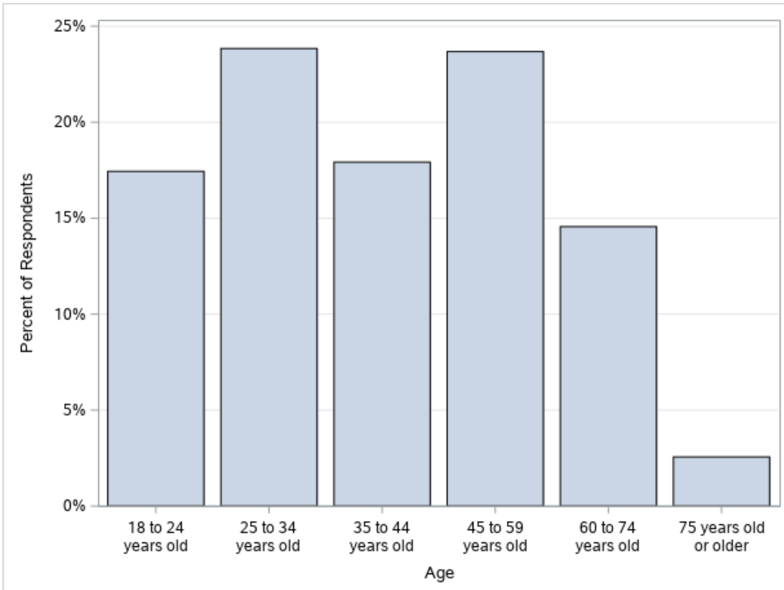



Figure 4 shows the distribution of annual household income. This variable for the sample is slightly less than the population average. The average for households within a 50-mile radius of Springfield is $55,579, whereas the median household income in the sample is in the $30,001 – 45,000 range. This is another variable for which we will be adjusting our results.

**Figure 4. Percent of Survey Respondents by Annual Household Income**

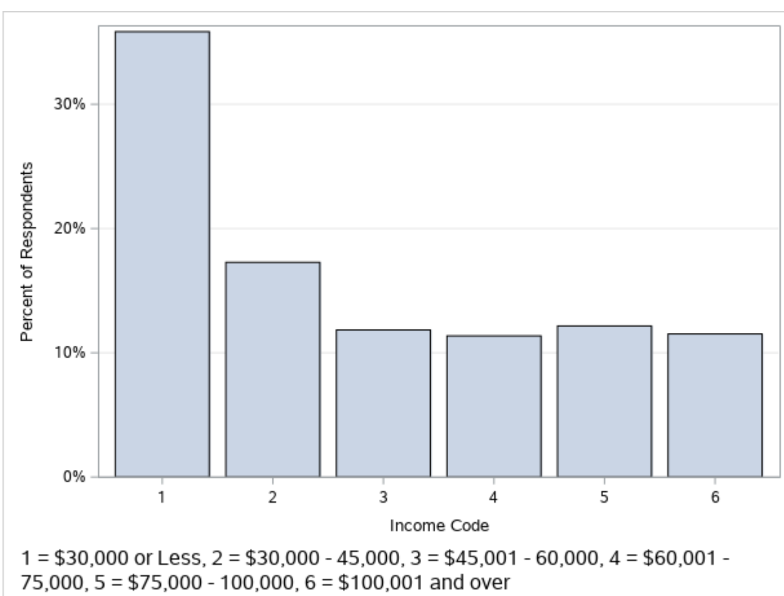


Figure 5 shows the distribution of respondents by parental status. The percentage of survey respondents who are parents is 37.1%, which is slightly higher than the 30.1% of residents in the study area (within a 50-mile radius of Springfield). Adjustments will be made for this variable. Figure 6 shows the number of children for those respondents who reported that they are parents. The median of two children is the same as the population in the 50-mile region.

**Figure 5. Percent of Survey Respondents by Parental Status**

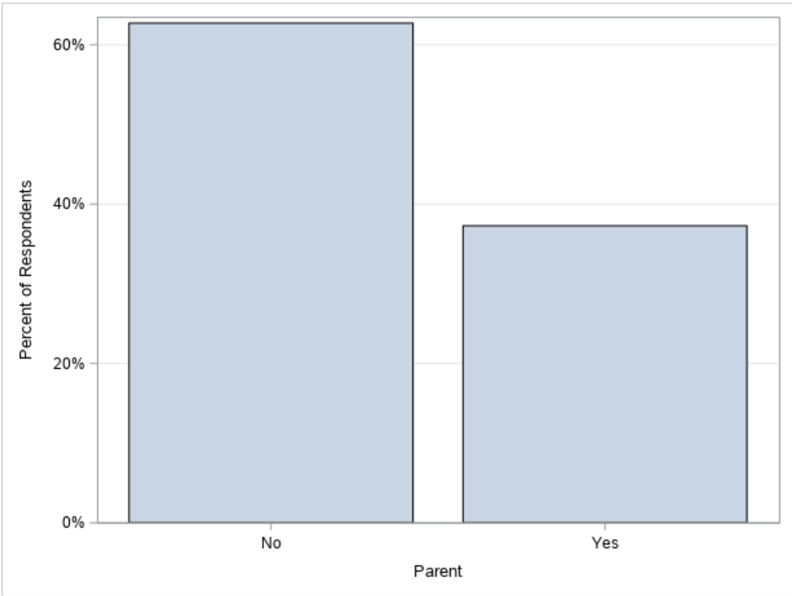
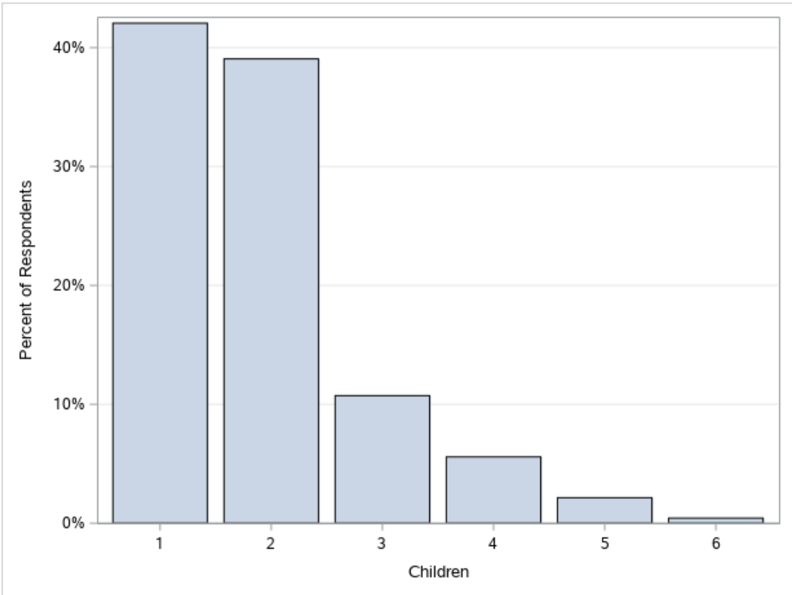


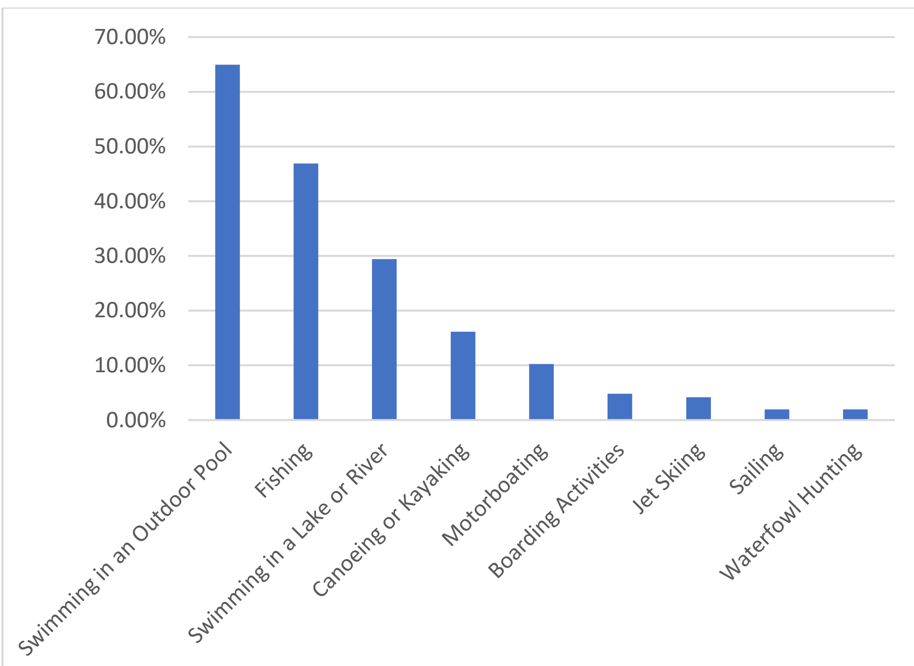

**Figure 6. Percent of Survey Respondents by Number of Children**



## ACTIVITY USAGE ANALYSIS

The survey asked questions about the usage of aquatic facilities for nine categories of activities. The activity with the highest usage, as depicted in Figure 7, was Swimming in an Outdoor Pool. Nearly two-thirds of respondents indicated that they had gone Swimming in an Outdoor Pool in the past 12 months. Similarly, almost half of the respondents indicated that they had engaged in Fishing and over one-quarter indicated that they had gone Swimming in a Lake or River. Canoeing and Motorboating showed significant but lower usage with 16% and 10%, respectively. The respondents indicated usage of less than 5% for the remaining activities. The percentages reported are "base" probabilities and represent the likelihood that a given person in the region (i.e., a 50-mile radius from Springfield) will engage in an activity during a given year. Each percentage, then, is a measure of the demand for using an aquatic facility for said activity when nothing else is known about the population. However, we did collect demographic and socioeconomic information about the respondents. Using this information, we can divide the sample and analyze these data based on specific characteristics.

**Figure 7. Activity Usage by Survey Respondents** (n = 625)




### Activity Split Analysis

Dividing the sample by the socioeconomic and demographic characteristics, we offer an analysis of the activity "splits." For example, Figure 8 depicts the responses of those who reported Canoeing or Kayaking in the last 12 months compared to their age in the form of a heat map. The age categories are as follows: 1 = 18 to 24 years old; 2 = 25 to 34 years old; 3 = 35 to 44 years old; 4 = 45 to 59 years old; 5 = 60 to 74 years old; and 6 = 75 years and older. This heat map shows the relative number of responses in each age category compared to participation in the activity Canoeing or Kayaking. The numbers on the right side indicate the percentage of each age group that had gone Canoeing or Kayaking in the last 12 months. There is a clear pattern in the responses, as younger people are more likely to have gone Canoeing or Kayaking.

**Figure 8. Relationship between Reported Canoeing or Kayaking and Age of Respondent**


*Note: There were no respondents in the 75 years and older category answering that they had gone Canoeing or Kayaking in the last 12 months.*

While the numbers seem clear, an important question remains. To what extent does the observed pattern represent the larger population of people living within 50 miles of Springfield? To answer this question, we need to "test" the data to rule out the possibility that a non-representative sample was the reason for the observed pattern. We use the "chi-squared test" that measures the association between two variables that are coded into categories. Our test for the relationship between age and engaging in Canoeing or Kayaking indicates that it is statistically significantly likely that the observed relationship would exist in the overall population.[1]

We carried out this type of analysis for the five activities that had more than 10% usage (tests for variables with less than 10% are inherently biased due to the low level of "ones" in the sample) and for each socioeconomic/demographic variable. The analysis of the activity "splits" tells us, in general, what socioeconomic and demographic variables affect the probability or likelihood of engaging in an activity. However, it does not tell us how much each variable affects

[1] The Pearson $\chi^2$ test statistic was 14.1077 with 5 degrees of freedom ($p<0.02$). p-values less than .05 indicate statistically significant results at academically acceptable levels. Full results for all split analyses are provided in Appendix 1.

the probability. Further analysis is needed so that we can control for situations where multiple variables affect the probability of engaging in an activity. For example, since both age and income affect the probability of Canoeing and Kayaking, if age and income are related, any individual estimate of age or income will contain noise from the effect of the other variable.

We therefore ran logistic regression analyses to analyze when respondents had engaged in an activity (Table 4).[2] The results from this analysis tells us the increased or decreased probability of engaging in an activity depending on the respondent's characteristics. The figures in italics in the table indicate the change in probability for each unit increase in a variable.

**Table 4. Results from Logistic Regression of Activity Engagement** (n = 622)

| Variable/ Activity | Canoeing/ Kayaking | Motorboating | Fishing | Swimming in an Outdoor Pool | Swimming in a Lake or River |
|---|---|---|---|---|---|
| Constant | -0.898** | -2.986*** | 0.309 | 0.632* | -0.131 |
| | (-2.629) | (-6.379) | (1.180) | (2.291) | (-0.461) |
| Income | 0.223*** | 0.267*** | -0.082 | 0.197*** | 0.110* |
| | (3.581) | (3.603) | (-1.737) | (3.82) | (2.111) |
| | *0.027* | *0.022* | *-0.020* | *0.045* | *0.022* |
| Age | -0.184 | 0.125 | -0.027 | −0.295*** | -0.343*** |
| | (-1.765) | (1.004) | (-0.337) | (-3.512) | (-3.774) |
| | *-0.022* | *0.011* | *-0.007* | *−0.067* | *-0.069* |
| Gender | -0.283 | -0.083 | -0.349* | −0.08 | 0.071 |
| | (-1.22) | (-0.297) | (-2.005) | (−0.436) | (0.364) |
| | *-0.036* | *-0.007* | *-0.087* | *−0.018* | *0.014* |
| Parent | -0.118 | 0.174 | 0.444** | 0.389* | 0.286 |
| | (-0.510) | (0.629) | (2.600) | (2.104) | (1.539) |
| | *-0.014* | *0.015* | *0.110* | *0.086* | *0.058* |
| Psuedo-$R^2$ | 0.066 | 0.042 | 0.016 | 0.04 | 0.057 |
| % Predicted Correctly | 83.90% | 89.70% | 55.30% | 65.10% | 70.90% |

*Notes: The top line for each variable is the logistic regression coefficient. The middle line in parentheses is the z-test statistic for statistical significance. *** - p< .001 (statistically significant at the 0.1% level of significance, ** - p<.01, * - p<.05. The bottom line in italics is the slope of the logistic function with respect to the independent variable,. The constant does not have a slope interpretation. Control variables for the time lived in Central Illinois and county of residence were included but not reported.*

For example, a change from age code 1 to age code 2 would coincide with a decrease in the probability of Canoeing/Kayaking of 2.7%. Income is the variable that affects the most activities, with generally small effects. Age does negatively affect the probability of Swimming activities.

[2] See Wooldridge (2006, Chapter 17) for a description of logistic regression models.

Gender has a negative effect on the probability of Fishing, while being a Parent has a positive effect on both Fishing and Swimming in an Outdoor Pool. The figures at the end of Table 4 are the "goodness of fit" estimates. Our models have a relatively low "R-squared" values, indicating that the variables predict a small percentage of the variation in responses, but they correctly identify the response of the individual with generally good accuracy (Percent Predicted Correctly is generally over 60%). In academic research, percent predicted correctly with this number of observations is in the 50-80% range, thus we feel that this is sufficient to make predictions about behavior of people within a 50-mile radius of Springfield. Separately, we also asked about attendance at Fishing tournaments. The responses to this question were on a 4-point scale, ranging from Very Likely to Very Unlikely. We found that 14.29% of respondents answered that it was Very or Somewhat Likely that they would attend.

## MILES TRAVELED ANALYSIS

We also asked the respondents questions about the number of miles they traveled to engage in each activity or, if they went multiple times, an average of the miles traveled (the first nine rows in Table 5 below). Then, we asked them about the maximum miles that they would travel to engage in an activity for both a day trip and an overnight trip, and the furthest that they have traveled to engage in an activity (the last three rows of the table). The responses indicated that, except for Fishing and Swimming, most people have traveled more than 20 miles to engage in activities (the median indicates the value where half of the sample has traveled or would travel at least that far).

**Table 5. Distribution of Miles Traveled Responses**

| Variable | Mean | Median | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|---|
| **Miles Canoeing** | 83.6100 | 30.00000 | 0.000000 | 1800.000 | 201.1657 |
| **Miles Sailing** | 86.4545 | 40.00000 | 1.000000 | 430.000 | 128.5623 |
| **Miles Motorboating** | 81.0781 | 20.00000 | 1.000000 | 1300.000 | 184.1517 |
| **Miles Boarding** | 70.9667 | 46.50000 | 1.000000 | 700.000 | 128.5150 |
| **Miles Jet Skiing** | 118.8462 | 22.50000 | 1.000000 | 900.000 | 233.7790 |
| **Miles Fishing** | 26.5502 | 15.00000 | 0.000000 | 1000.000 | 77.2802 |
| **Miles Swimming Pool** | 29.3667 | 5.00000 | 0.000000 | 1310.000 | 122.0918 |
| **Miles Swimming Lake River** | 56.3654 | 15.00000 | 0.000000 | 2000.000 | 196.6979 |
| **Miles Waterfowl Hunting** | 31.3636 | 20.00000 | 5.000000 | 125.000 | 36.9710 |
| **Miles Day Trip** | 44.1128 | 30.00000 | 0.000000 | 700.000 | 50.5815 |
| **Miles Overnight Trip** | 83.1559 | 50.00000 | 0.000000 | 1200.000 | 106.9485 |
| **Furthest Miles** | 159.1944 | 58.00000 | 0.000000 | 4000.000 | 334.8314 |

One of the concerns with the above results is whether the 50-mile radius for the analysis is appropriate. To assess whether we need to "condition" our probabilities for an activity by the distance to the proposed lake, we perform another statistical test to determine whether the miles traveled in the population is equal to, more than, or less than 50 miles. The results of this test indicate that we must adjust the probabilities for Fishing and Swimming in an Outdoor Pool as they are significantly less than 50 miles. Additionally, the average Day Trip is 44.1 miles, a distance that is statistically significantly different from 50 and must be adjusted slightly. Finally, the Miles for an Overnight Trip and the Furthest Miles traveled are 83 and 148 miles, significantly greater than 50.

### Miles Traveled Splits and Regression Analysis

We carried out an analysis of the splits for socioeconomic/demographic variables using a different statistical test called an Analysis of Variance test (ANOVA). This test measures differences between multiple groups where the response analyzed is a number like miles versus a Yes/No type of response as with the activity analysis above.[3] Similar to our activity analysis, we then assessed the effect of the response in terms of miles traveled as explained by variables like age or income, using a linear regression model.[4] The results, summarized in Table 6 on the next page, indicate that for most of the activities, there are only one or two variables that significantly affect the willingness to travel.[5] Being a parent reduces substantially the number of miles willing to travel to Swim in an Outdoor Pool, and older age increases the number of miles. Females are likely to travel more miles to go Motorboating, as are the residents of some counties. The Miles Traveled for Day Trips, for Overnight Trips, and the Furthest Miles Traveled are all affected by Income, with Day Trips showing the least amount of effect per dollar increase in income.

## NUMBER OF DAYS ANALYSIS

We further asked respondents how many days in the last 12 months they had engaged in each of the activities that they indicated. The response options were 1 to 3 days, 4 to 6 days, 7 to 9 days, and 10 or more days. Our analysis of this variable, as depicted in Table 7 on page 17, indicates that the modal response is 1 to 3 days for all activities. However, for some activities (i.e, Motorboating, Fishing, Swimming, and Waterfowl Hunting), there is a distinct bimodal distribution, with a significant percentage of respondents answering 10 or more days. To account for this bimodal distribution, we will need to adjust our estimates of expected day trips per person. This will be done in the Visitor and Required Acreage Calculations section below.

---

[3] See Turner and Thayer (2001) for the theory and practice of ANOVA tests.

[4] See Wooldridge (2006, Chapter 3)

[5] Full results of regressions shown in Appendix 1.

### Table 6. Summary Results of Linear Regression of Miles Traveled, by Activity and Overall

| Activity/Measure | Significant Predictor Variables |
|---|---|
| Canoeing/Kayaking | None |
| Motorboating | Gender (+), County (+) |
| Fishing | None |
| Swimming in an Outdoor Pool | Age (+), Parent (-) |
| Swimming in a Lake or River | None |
| Day Trip | Income (+) |
| Overnight Trip | Income (+) |
| Furthest Miles | Income (+) |

### Table 7. Count of Responses, Days Spent in each Activity

| Days/Activity | Canoeing or Kayaking | Sailing | Motorboating | Boarding | Jet Skiing |
|---|---|---|---|---|---|
| 1 to 3 | 59 | 8 | 26 | 20 | 15 |
| 4 to 6 | 23 | 4 | 16 | 3 | 3 |
| 7 to 9 | 8 | 0 | 6 | 4 | 2 |
| 10 or more | 11 | 0 | 16 | 3 | 6 |
| **Days/Activity** | **Fishing** | **Swimming in an Outdoor Pool** | **Swimming in a Lake or River** | **Waterfowl Hunting** | |
| 1 to 3 | 130 | 169 | 72 | 6 | |
| 4 to 6 | 43 | 75 | 52 | 1 | |
| 7 to 9 | 38 | 31 | 20 | 1 | |
| 10 or more | 82 | 131 | 40 | 4 | |

## Number of Days Activity Splits

Next, we examined the relationship between the socioeconomic/demographic variables and the number of days spent doing various activities, using ANOVA and ordered logistic regression as reported in Table 8 on the next page.[6] As with miles traveled, the days spent engaging in most activities are affected by at most one or two variables (most often parental status, gender, and income). The coefficients are generally small, with at most a 1 category increase in

[6] Ordered logistic regression is appropriate for variables in ordered categories, which is the way that we asked the number of days question. See Maddala (1986) for a discussion. Full results of the analysis in Appendix 2.

days spent Canoeing/Kayaking for being a parent and nearly a 1 category decrease in the days spent Fishing for females.

## NUMBER OF PEOPLE INVOLVED ANALYSIS

Among respondents who indicated they had done an activity, we asked how many people on average participated in the activity. This was asked so we could adjust forecasted visits for the forecasted number of visitors. The results indicate that for most activities, the most common number of participants were 4 or less (Table 9 on the next page). The median number of participants in the activities were 2, 3, or 4, although some respondents reported up to 50 participants, possibly as part of an event or gathering.

**Table 8. Summary Results from Ordered Logistic Regression of Number of Days Engaging in an Activity**

| Activity/Measure | Significant Predictor Variables |
|---|---|
| Canoeing/Kayaking | Parent (+) |
| Motorboating | None |
| Fishing | Income (+), Gender (-) |
| Swimming in an Outdoor Pool | Income (+), Parent (+) |
| Swimming in a Lake or River | Gender (+) |

**Table 9. Analysis of Number of People Involved in Activities**

| Variable | Mean | Median | Minimum | Maximum | Standard Deviation |
|---|---|---|---|---|---|
| People Canoeing | 3.970297 | 3.000000 | 1.000000 | 25.00000 | 3.160555 |
| People Sailing | 3.500000 | 3.000000 | 2.000000 | 7.00000 | 1.623688 |
| People Motorboating | 4.828125 | 4.000000 | 2.000000 | 10.00000 | 2.292532 |
| People Boarding | 4.600000 | 4.000000 | 1.000000 | 15.00000 | 3.389639 |
| People Jet Skiing | 3.769231 | 3.000000 | 1.000000 | 10.00000 | 2.178214 |
| People Fishing | 3.006826 | 2.000000 | 1.000000 | 15.00000 | 1.839433 |
| People Swimming Pool | 4.222772 | 4.000000 | 1.000000 | 50.00000 | 3.800859 |
| People Swimming Lake River | 5.157609 | 4.000000 | 1.000000 | 50.00000 | 4.779527 |
| People Waterfowl Hunting | 3.000000 | 2.000000 | 1.000000 | 10.00000 | 2.486326 |

### Number of People Involved Splits and Regression

As with the miles traveled, we analyzed the data using ANOVA and regression analysis (see Table 10). With this variable, there are several important explanatory variables for Fishing. Increased age reduces the number of people involved in Fishing visits, while Gender and being a Parent increases the number involved. The number of people involved in a Swimming visit at an Outdoor Pool is negatively impacted by age and positively impacted by being a parent. Females take more people on average to Swimming visits at a Lake or River.

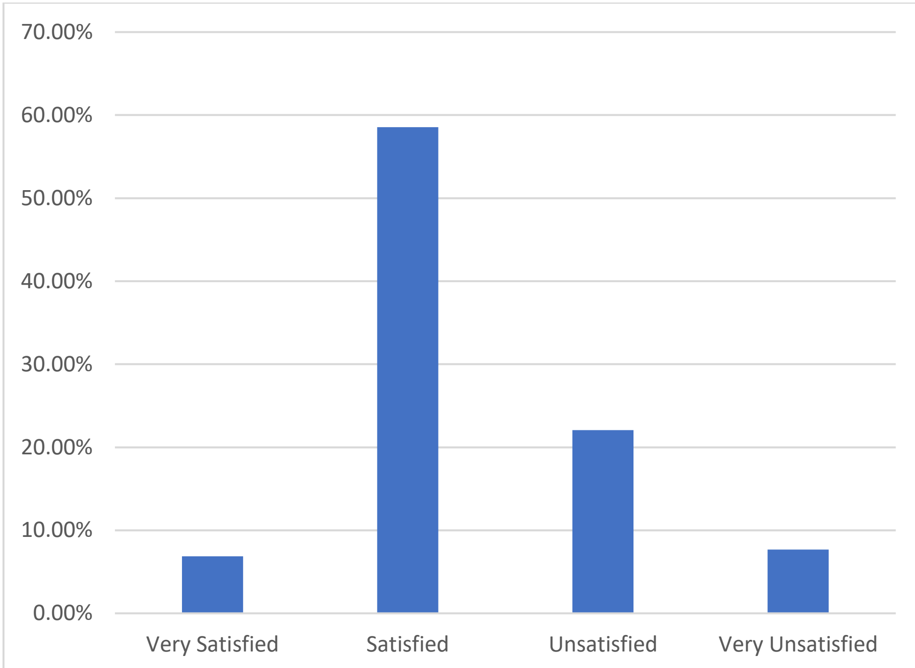
**Table 10. Results of Linear Regression of Number of People Involved in Activities**

| Variable/ Activity | Canoeing/ Kayaking | Motorboating | Fishing | Swimming in an Outdoor Pool | Swimming in a Lake or River |
|---|---|---|---|---|---|
| Constant | 4.010*** | 4.712*** | 2.717*** | 5.540*** | 4.035*** |
| | (4.9) | (4.23) | (8.66) | (6.39) | (4.92) |
| Income | -0.203 | 0.151 | 0.009 | -0.018 | -0.064 |
| | (-1.17) | (0.9) | (0.14) | (-0.17) | (-0.31) |
| Age | 0.208 | -0.135 | -0.202*** | -0.368** | -0.334 |
| | (0.64) | (-0.69) | (-2.97) | (-2.16) | (-1.56) |
| Gender | 0.746 | 0.415 | 0.635*** | -0.557 | 1.105** |
| | (1.04) | (0.73) | (3.2) | (-1.12) | (2.26) |
| Parent | -0.224 | 0.727 | 0.927*** | 0.625* | 1.112 |
| | (-0.32) | (1.22) | (4.34) | (1.93) | (1.33) |
| County | -0.019 | -0.038 | 0.005 | -0.006 | 0.068 |
| | (-0.40) | (-0.93) | (0.32) | (-0.16) | (1.07) |
| Adjusted $R^2$ | 0.032 | 0.067 | 0.134 | 0.029 | 0.045 |
| F | 1.726 | 1.15 | 8.815*** | 4.399*** | 1.521 |

## SATISFIED WITH AQUATIC RECREATION OPTIONS ANALYSIS

We asked respondents how satisfied they are with the current availability of lake and river-based recreation options in central Illinois. The results, as reported in Figure 9, indicated that most respondents were satisfied or very satisfied, although about 30% of respondents were unsatisfied at some level with the available options. Our ordered logistic regression analysis of this question showed that only Income had a significant effect on the level of satisfaction (Table 11).

### Figure 9. Satisfaction with Available Aquatic Recreation Options




### Table 11. Results of Ordered Logistic Regression on Satisfaction with Flatwater Recreation Opportunities

| | Satisfied |
|---|---|
| **Income** | 0.134*** |
| | (2.70) |
| **Age** | 0.071 |
| | (1.15) |
| **Gender** | 0.108 |
| | (0.56) |
| **Parent** | -0.259 |
| | (-1.49) |
| **County** | 0.001 |
| | (0.06) |
| **Psuedo $R^2$** | 0.011 |
| **$\chi^2$** | 12.367** |

## IMPORTANCE IN QUALITY OF LIFE ANALYSIS

We also asked about how important activities are to the quality of respondents' lives. The results of this analysis, as reported in Table 12, indicate that about 1/3 of respondents who engage in an activity feel that it is important or very important to their quality of life. Higher percentages were noted for Waterfowl Hunting and Swimming in an Outdoor Pool, and lower percentages were seen in the categories of Boarding activities and Jet Skiing.

**Table 12. Analysis of Quality of Life Questions**

| Importance/ Activity | Canoeing/ Kayaking | Sailing | Motorboating | Boarding | Jet Skiing |
|---|---|---|---|---|---|
| Very important | 7.22% | 27.27% | 11.11% | 3.45% | 3.85% |
| Important | 22.68% | 9.09% | 23.81% | 13.79% | 15.38% |
| Slightly important | 48.45% | 27.27% | 34.92% | 48.28% | 38.46% |
| Not at all important | 21.65% | 36.36% | 30.16% | 34.48% | 42.31% |
| **Importance/ Activity** | **Fishing** | **Swimming Pool** | **Swimming Lake River** | **Waterfowl Hunting** | |
| Very important | 14.79% | 11.59% | 10.99% | 9.09% | |
| Important | 22.54% | 27.96% | 23.08% | 45.45% | |
| Slightly important | 37.68% | 36.78% | 40.66% | 18.18% | |
| Not at all important | 25.00% | 23.68% | 25.27% | 27.27% | |

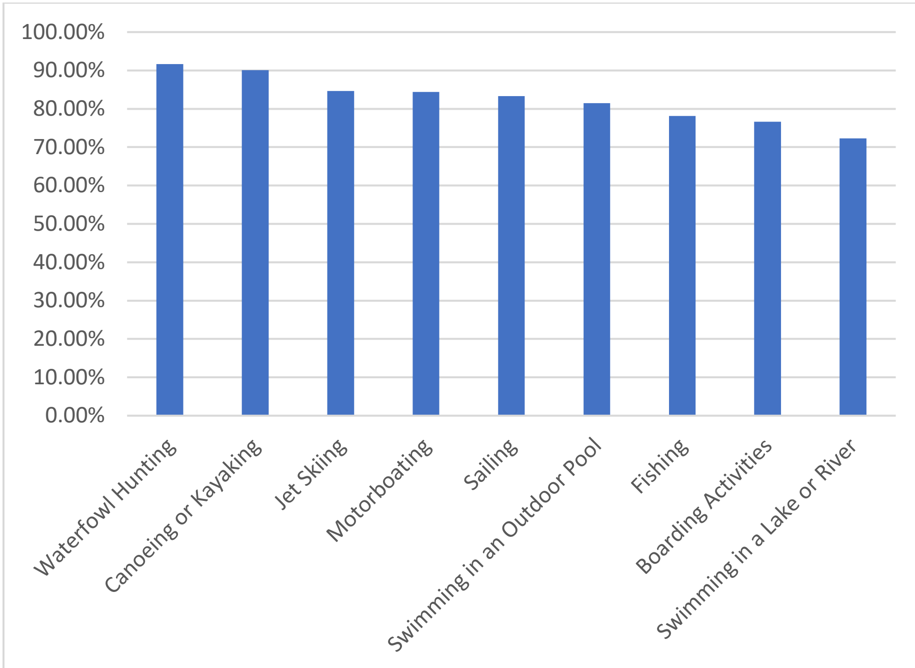
## LATENT DEMAND ANALYSIS

One of the significant issues with demand analysis is what economists call "latent demand." This is the demand that is not being met with current options. As we ask about whether people engage in an activity, how often, etc., we are implicitly assuming that the only group of users for a new aquatic facility will be the existing pool of users behaving as they have in the past. However, those users may use a new facility more than they otherwise would, and new users may be enticed to use a new facility. Potential reasons people use facilities less than they would like or not at all include a perceived lack of ability, lack of proper equipment, a long distance to access facilities, perceived crowding or poor water quality of the facilities, and perceived lack of access to facilities.

### Desire to Engage More Often Analysis

To get at the first source of latent demand (i.e., existing users changing behavior to use the new lake), we asked two questions. The first is whether a respondent who currently engages in each activity would like to do so more often. Then we asked about what factors prevented them from engaging in each activity. The results for the first question are shown below in Figure 10. Perhaps not surprisingly, those who engage in all activities seek to do them more often by large majorities.

**Figure 10. Desire to Engage More Often by Activity.**




## Factors Preventing Greater Usage

In terms of barriers that prevent respondents from engaging in the activities more often, we asked them to make choices from a battery of options, then to add other explanations if necessary. The result of the analysis, as reported in Table 13, indicates that factors related to the availability of options in the area have relatively little to do with the reasons that respondents would like to engage in activities more often. Only Sailing had responses of "no place to go" or "too far away" constituting 1/3 of the overall responses. The modal response for all activities but Swimming in an outdoor pool and Motorboating was that the respondent did not have the time to engage in the activity. For Swimming, the modal response was overcrowding, which may be related to availability. For Motorboating, not having the necessary equipment was the main reason to not engage. Another response that had typically much larger responses than the "lack of access" response was the "too expensive" response. The "other barriers" responses, as provided in the open-ended response block, varied, but very few indicated a lack of an availability to access aquatic facilities. Weather-related responses were the most frequently cited. The coronavirus and COVID-19 disease were the second most often cited reason in the other responses, surely a sign of the times.

## Table 13. Analysis of Factors Preventing Greater Usage of Activities

| Factor Preventing/Activity | Canoeing/Kayaking | Sailing | Motorboating | Boarding | Jet Skiing |
|---|---|---|---|---|---|
| There are no places to go XXXX in central Illinois | 11.96% | 13.33% | 5.88% | 11.43% | 8.00% |
| The places to go XXXX in central Illinois are too far away | 11.96% | 20.00% | 5.88% | 11.43% | 12.00% |
| The places to go XXXX in central Illinois have poor water quality | 6.52% | 0.00% | 2.94% | 2.86% | 8.00% |
| The places to go XXXX in central Illinois are poorly maintained | 6.52% | 0.00% | 8.82% | 11.43% | 4.00% |
| The fees at places to go XXXX in central Illinois are too expensive | 8.70% | 13.33% | 11.76% | 11.43% | 4.00% |
| The places to go XXXX in central Illinois are too crowded | 5.43% | 0.00% | 2.94% | 5.71% | 4.00% |
| Personal health doesn't allow it | 4.35% | 6.67% | 2.94% | 5.71% | 0.00% |
| Do not have the time | 22.83% | 26.67% | 23.53% | 20.00% | 24.00% |
| Do not have access to the necessary equipment | 17.39% | 13.33% | 26.47% | 17.14% | 32.00% |
| Other | 4.35% | 6.67% | 8.82% | 2.86% | 4.00% |

| Factor Preventing/Activity | Fishing | Swimming Pool | Swimming Lake River | Waterfowl Hunting |
|---|---|---|---|---|
| There are no places to go XXXX in central Illinois | 6.90% | 7.46% | 8.59% | 0.00% |
| The places to go XXXX in central Illinois are too far away | 8.97% | 8.96% | 13.28% | 0.00% |
| The places to go XXXX in central Illinois have poor water quality | 12.41% | 4.98% | 14.06% | 0.00% |
| The places to go XXXX in central Illinois are poorly maintained | 13.79% | 7.96% | 13.28% | 0.00% |
| The fees at places to go XXXX in central Illinois are too expensive | 11.72% | 14.43% | 4.69% | 20.00% |
| The places to go XXXX in central Illinois are too crowded | 9.66% | 18.41% | 10.94% | 0.00% |
| Personal health doesn't allow it | 6.21% | 5.47% | 6.25% | 0.00% |
| Do not have the time | 17.24% | 15.42% | 18.75% | 40.00% |
| Do not have access to the necessary equipment | 8.97% | 12.44% | 7.03% | 20.00% |
| Other | 4.14% | 4.48% | 3.13% | 20.00% |

## Reasons for Not Engaging in each activity Analysis

To assess the second source of latent demand, we asked those who did not answer that they had engaged in each activity, why they had not. The responses to this question indicate some latent demand due to inaccessibility for non-users, but there is less latent demand in this group (Table 14). The responses of "no place to go" or "too far away" constitute less than 20% of the responses for all but Sailing and the two Swimming categories. A lack of access to necessary equipment was the modal response for all activities except for Swimming activities and Waterfowl Hunting. Crowding was mentioned most often for Swimming in an outdoor pool, poor maintenance was the modal response for Swimming in a lake or river, and a lack of interest was most often cited by those not going Hunting. Once again, the expense of each activity was also frequently cited. Taken together, the analysis reveals a small, but not overwhelming, amount of latent demand. Minor adjustments to the numbers of projected visitors will have to be made, as discussed in the next section.

**Table 14. Analysis of Reasons for Not Engaging in an Activity**

| Reason for Not Engaging/Activity | Canoeing/ Kayaking | Sailing | Motorboating | Boarding | Jet Skiing |
|---|---|---|---|---|---|
| There are no places to go XXXX in central Illinois | 9.14% | 12.43% | 8.24% | 8.11% | 8.33% |
| The places to go XXXX in central Illinois are too far away | 8.57% | 8.47% | 7.06% | 5.41% | 6.41% |
| The places to go XXXX in central Illinois have poor water quality | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| The places to go XXXX in central Illinois are poorly maintained | 5.14% | 3.39% | 7.65% | 7.43% | 6.41% |
| The fees at places to go XXXX in central Illinois are too expensive | 12.57% | 13.56% | 12.94% | 10.81% | 10.90% |
| The places to go XXXX in central Illinois are too crowded | 5.71% | 5.08% | 10.00% | 5.41% | 5.77% |
| Personal health doesn't allow it | 9.71% | 8.47% | 7.65% | 10.81% | 10.26% |
| Do not have the time | 0.00% | 0.00% | 0.00% | 0.00% | 0.00% |
| Do not have access to the necessary equipment | 23.43% | 23.16% | 23.53% | 25.00% | 26.92% |
| Want to | 8.57% | 9.60% | 10.59% | 8.11% | 9.62% |
| No interest | 13.71% | 12.43% | 10.00% | 15.54% | 12.18% |
| Other | 3.43% | 3.39% | 2.35% | 3.38% | 3.21% |

**Table 15. Analysis of Reasons for Not Engaging in an Activity (Cont.)**

| Reason for Not Engaging/Activity | Fishing | Swimming Pool | Swimming Lake River | Waterfowl Hunting |
|---|---|---|---|---|
| There are no places to go XXXX in central Illinois | 5.41% | 6.59% | 9.91% | 8.70% |
| The places to go XXXX in central Illinois are too far away | 8.11% | 6.59% | 10.81% | 11.59% |
| The places to go XXXX in central Illinois have poor water quality | 0.00% | 0.00% | 0.00% | 0.00% |
| The places to go XXXX in central Illinois are poorly maintained | 8.11% | 9.89% | 18.92% | 4.35% |
| The fees at places to go XXXX in central Illinois are too expensive | 16.22% | 12.09% | 5.41% | 11.59% |
| The places to go XXXX in central Illinois are too crowded | 5.41% | 23.08% | 10.81% | 5.80% |
| Personal health doesn't allow it | 6.76% | 5.49% | 9.91% | 15.94% |
| Do not have the time | 0.00% | 0.00% | 0.00% | 0.00% |
| Do not have access to the necessary equipment | 18.92% | 13.19% | 7.21% | 0.00% |
| Want to | 13.51% | 8.79% | 6.31% | 11.59% |
| No interest | 10.81% | 10.99% | 13.51% | 23.19% |
| Other | 6.76% | 3.30% | 7.21% | 7.25% |

## VISITOR AND REQUIRED ACREAGE CALCULATIONS

Using the survey results, we developed estimates of the number of visitors to flatwater aquatic recreation facilities and the required number of acres of flatwater recreation capacity. We illustrate the calculations using the example of the Canoeing or Kayaking activity. We used similar calculations for each activity in the survey. Table 15 shows the calculations. Full results for each activity are included in Appendix 2.

### Table 16. Canoeing/Kayaking Visitor and Acreage Calculations

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.1616 | |
| Adjust for Significant Variables | | | |
| Age | | 0 | |
| Income | | 0.028 | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.8384 | | |
| Thinks Unavailable | 0.1771 | | |
| Probability of Going | 0.1616 | 0.0240 | |
| Analysis of 30 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.2136 | 278,151 | 59,412 |
| Probability to 50 miles | 0.0210 | 271,744 | 5,709 |
| Total Expected Annual Trips | | | 65,121 |
| Adjust for # People | | | |
| Median - 2 - 1.5 additional boats | | | 97,681 |
| Total Expected Number of Boats | | | 162,802 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.901 | | |
| Thinks Unavailable | 0.2391 | | |
| Probability of Going | 0.1616 | | |
| Number of Extra Trips | 2 | | 11,335 |
| Total Adjusted Number of Boats | | | 174,137 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.6439 | | 112,127 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 1,219 |
| Poisson Distribution 99th Percentile | | | 1,301 |
| Acreage Required | 10 | acres/boat | **13,015** |

The base probability of an individual engaging in Canoeing or Kayaking over a year is 16.16% (see Figure 6). We adjusted that base probability both for the socioeconomic and demographics variables that affected that probability as determined by the logistic regressions referenced earlier and for the differences in our survey sample and the population within the 50-mile radius of Springfield. We gathered data on the population using the ESRI ArcGIS Community Analyst tool. The original data comes from the 2010 US Census and from ESRI forecasts.

The variables that affected the probability of Canoeing/Kayaking in the survey were the Age of the respondent and their Household Income. Regarding age, the median age of the population is 41.9 years. The median response on the survey was 35 to 44 years, so no adjustment to the probability is necessary for age. For income, the median household income of the population in the 50-mile radius is $55,579, the median survey response was $30,001 – 45,000, indicating that most survey respondents had lower household income than the population. Therefore, we adjusted the probability upward by 2.8%, as indicated by the logistic regression results. This produces an estimated probability of 18.96% for an individual engaging in Canoeing or Kayaking over a year.

The next adjustment is for one element of latent demand, as explained in the survey analysis. For those individuals who did not go Canoeing or Kayaking, 17.71% indicated that it was for a reason of perceived lack of availability. Multiplying this by the percentage of respondents that did not Canoe or Kayak, we estimate that 14.85% of the sample did not go because they thought there was insufficient availability. We then multiply that by the base probability, assuming implicitly that only that percentage of respondents would engage in the activity. The net adjustment due to the first element of latent demand is 2.4%, bringing the total estimated probability of Canoeing/Kayaking to 21.36%.

Next, we adjust for the stated willingness to travel a certain distance to Canoe/Kayak. The median of survey responses for this activity is 30 miles. We assume that the entire population in that 30-mile radius would have the probability of Canoeing/Kayaking we calculated above. That population is 278,151, according to ArcGIS Community Analyst. Multiplying that by the estimated probability of 21.36% yields an estimated 59,412 trips (annually) from the population within 30 miles of Springfield. We then adjust the probability for the remaining 20 miles to the edge of the 50-mile radius by examining the probability distribution of responses to the miles traveled calculation. We combine the probability of traveling up to 50 miles with the probability of traveling 30-50 miles and estimate that 2.1% of the population in the 30-50 mile "ring" would engage in Canoeing/Kayaking. That population is 271,744, so our estimate is that an additional 5,709 individuals from that area would potentially engage in Canoeing or Kayaking. Adding the two estimates together, we estimate 65,121 Canoe/Kayak trips a year from residents in the 50-mile radius.

The next step of the analysis is to adjust for the number of people that engage in each trip. We asked respondents how many people, including themselves, went on their trip. The median response to this question was 3, indicating that the trip included 2 additional participants. One difficulty in interpreting this data is to convert this to the required number of boats. Acreage estimates from the Water and Land Recreation Opportunity Spectrum (WALROS) for boating activities are based on the number of boats. The occupancy of a typical Canoe is 2 people, and a Kayak is 1, although variants exist. Taking a conservative approach, from this response, we add 1.5 extra boats per trip to the total, indicating a total of 162,802 boats will be utilized over a year.

Next, we adjust for the second source of latent demand, those who wish to engage more often in the activity but feel that the water needed is inaccessible. Using the same logic as with those who do not go, we multiply the percentage of those who want to go more often (90.1%) by the number of those who want to go more often but thought the facilities were unavailable (23.91%) and the base probability of going (16.16%). We then assume that wanting to go more indicates a one-category increase in the number of trips, which is 2 trips per year. Then we apply the result to the estimated total number of boats from the last step (162,802) to add 11,335 boat-trips per year to the estimate. Our final estimate of the number of boat-trips per year for Canoeing and Kayaking is 174,137.

The final adjustment is for seasonality and peaks. The region does not need water capacity for 174,137 trips. Trips take place in different seasons and on different days. To reflect this, we asked survey respondents what seasons they engaged in Canoeing/Kayaking. The modal response was Summer (June, July, August), with 64.39% of respondents. Therefore, we apply this percentage to the estimated number of boat-trips, producing an estimate of 112,127 boat-trips over the 92-day summer period, an average of 1,219 boat-trips per day. We note that this is an average and not an estimate of the peak capacity that must be planned for. There are a few ways that we can use this average to estimate peak usage. The method that is most appropriate for this data is to simulate the usage with a Poisson distribution. It uses a known distribution of data that consists of counts of activities or outcomes.[7] It is an appropriate distribution to use because it requires only one parameter estimate, the average number of activities, which we have calculated as 1.219. We define the maximum peak as being the 99th percentile of the Poisson distribution with this mean. The resulting peak estimated by simulation is **1,301 visitor-boat trips**. This is the number of Canoes/Kayaks that must be accommodated in the 50-mile radius on a given summer day.

We translate this number of boat-trips to required capacity using capacity guidelines issued by the US Bureau of Reclamation in their *Water and Land Recreation Opportunity Spectrum Users' Handbook*, 2nd edition (WALROS). Using Tables 2.5 and 2.6 from that publication, we estimate required acreage using estimated suburban/rural developed guidelines. For Canoeing or Kayaking, the guidelines in Table 2.6 suggest using the higher capacity guidelines (i.e., smaller boats, less speed, no need to worry about shallows, less use of sensitive resources/impact). This would be 10 acres/boat, according to Table 2.5 in that publication. Applying this to the estimated number of boat-trips at the peak, the required capacity would be **13,015 acres** for Canoeing/Kayaking.

[7] The Poisson probability distribution function is $p(x;\lambda) = \frac{\lambda^x}{x!}e^{-\lambda}\ \forall \lambda > 0, x = 0,1,2,\cdots$. For a description, see Borovkov, A. A. (2013). *Probability Theory* (1st ed. 2013. ed.). London: Springer London, p. 39.

## TOTAL ESTIMATED REQUIRED ACREAGE

We applied the same model to estimate the required acreage for all 9 activities. We followed the survey results and made assumptions only for the adjustment for the number of people and the acreage per boat or user (swimmer, hunter). Table 16 below shows our assumptions for all activities.

**Table 17. Assumptions Used in Required Acreage Calculations**

| Activity | Survey Answer for # of Additional People – Assumption | Required Acreage per Boat or User |
|---|---|---|
| Canoeing/Kayaking | 2 – 1.5 additional boats | 10 |
| Sailing | 2 – 0 additional boats | 40 |
| Motorboating | 3 – 0 additional boats | 50 |
| Boarding | 3 – 1.5 additional boats | 20 |
| Jet Skiing | 2 – 2 additional boats | 20 |
| Fishing | 1 – 0 additional boats | 20 |
| Swimming Outdoor Pool | 3 – 3 additional swimmers | 0.18 |
| Swimming Lake or River | 3 – 3 additional swimmers | 0.18 |
| Waterfowl Hunting | 1 – 1 additional hunters | 18 |

Most of the additional boat assumptions come from estimates of boat capacity. As explained above, with Canoeing/Kayaking, there is a mix of boat types. This also impacts Boarding activities. Without detail as to the kind of board, we cannot tell whether the activity was Wake Boarding (requiring 0 additional boats for 3 additional people) or Paddle Boarding (requiring 3 additional boats for 3 additional people). We again average this and assume that there will be 1.5 additional boat-trips per year.

Acreage assumptions come from the WALROS, again using the suburban/rural developed guidelines. For Boarding activities, we assume that the slower types of activities like Paddle Boarding would require a similar acreage as Canoeing/Kayaking (10 acres/boat). In comparison, Wake Boarding or Water Skiing would require 30 acres (boats must be slower than other motorboats to allow for skiers/boarders to start/end). Again we take the average and assume 20 acres/boat for Boarding activities.

Table 17 shows the final results of our analysis. Our base case estimate is that just under 70,000 acres of flatwater recreation supply would be needed to meet peak demands. Additionally, we performed many sensitivity analyses on the assumptions. The variable that has the most effect on the results is the required acres variable. Therefore, we created two scenarios, with low acreage use per boat for the larger boat types (i.e., activities Sailing, Motorboating, Boarding – accounting for water skiing, Jet Skiing, and Fishing). For the low acreage scenario, we reduced the required acreage by 10 acres/boat, and for the High Acreage scenario, we increased it by 10 acres/boat. This produces a Low Acreage estimate of 59,000 acres and a high acreage estimate of 81,000 acres.

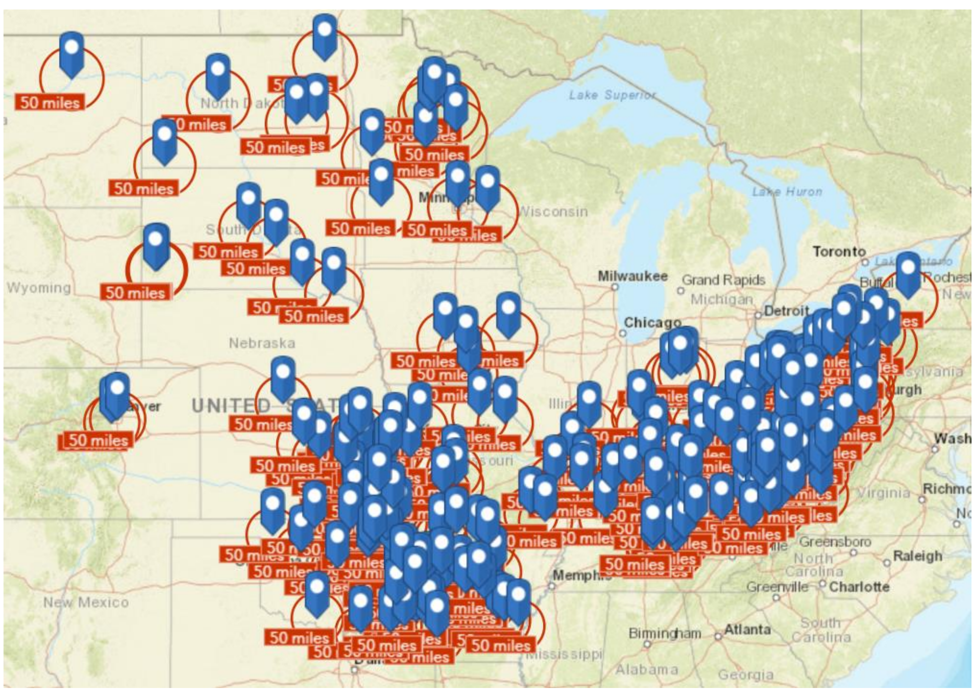
**Table 18. Results of the Survey Analysis Required Acres**

| Activity | Required Acres - Base Estimate | Low Acreage | High Acreage |
|---|---|---|---|
| Canoeing | 13,015 | 13,015 | 13,015 |
| Sailing | 3,040 | 2,660 | 3,420 |
| Motorboating | 14,900 | 13,410 | 16,390 |
| Boarding | 11,940 | 8,955 | 14,925 |
| Jet Skiing | 6,380 | 4,785 | 7,975 |
| Fishing | 17,960 | 13,470 | 22,450 |
| Swimming Outdoor Pool | 428 | 428 | 428 |
| Swimming Lake or River | 721 | 721 | 721 |
| Waterfowl Hunting | 1,566 | 1,566 | 1,566 |
| Total Required Acreage | 69,950 | 59,010 | 80,890 |

## RECREATION DEMAND STATISTICAL MODEL

To assess the demand for flatwater recreation amenities in Central Illinois, independent of the survey results, we built a statistical model using data from USACE lakes throughout the United States. This methodology is consistent with other studies of flatwater recreational demand (U.S. Army Corps of Engineers, Tulsa District, 2013), and a rich stream of research on recreational demand modeling (e.g., Ward and Martin, 1995). First, we gathered data on visitors to USACE lakes from the VERS system at the Corps. This data includes visitor counts by length of stay (i.e., day trip versus overnight) as well as by use. We downloaded data on lakes in the Great Lakes and Ohio River, Northwestern, Southwestern, and Mississippi Corps Divisions. We then mapped the data using the ArcGIS system and created 50-mile rings around the lakes. These 50-mile rings, as depicted in Figure 11, become the population of potential visitors to each lake. We matched this data with data on Corps projects from a database maintained by Duke University's Nicholas Institute to calculate surface acreage for each lake (Patterson, Doyle, and Kuzma, 2018), a key variable in predicting visitation.[8] We then used the ESRI Community Analyst program to download the socio-economic and demographic variables of interest that should affect visitation at the Corps lakes, for the lakes in the VERS database, and a 50-mile radius around Springfield.

**Figure 11. Location of Corps Projects in the Dataset** (n= 194)




---

[8] The Duke University dataset contains data for acre-feet of water storage at Corps projects. We obtained data on surface acreage on a smaller sample of lakes from various sources, including Corps websites and Wikipedia. We found a strong correlation between the acre-feet and surface acreage and used the acre-feet data to impute the surface acreage for the larger sample.

Table 18 and Figures 12 and 13 show summary statistics for the data. There are 194 lakes in the database, although not all have full data available. Figure 13 shows the distribution of lakes by Corps Division. Aside from the socio-economic and demographic variables, we calculated the number of "substitute acres" in the 50-mile radius from each lake, using data in ESRI's system imported from the U.S. Geological Survey on acres of surface water in an area.

**Table 19. Summary Statistics for the Lakes** (n= 194)

| Variable/Statistic | Source | Mean | Median | S.D. | Min | Max |
|---|---|---|---|---|---|---|
| **Surface Area** | Duke U. | 21,821 | 5,606 | 68,694 | 36 | 580,700 |
| **Substitute Acreage** | ESRI | 92,224 | 48,880 | 179,500 | 0 | 1,472,000 |
| **Population** | ESRI | 943,300 | 626,700 | 892,900 | 9,749 | 3,852,000 |
| **Median Household Income** | ESRI | 50,155 | 51,420 | 8,986 | 31,669 | 80,138 |
| **Median Age** | ESRI | 40.71 | 40.50 | 2.89 | 32.40 | 49.10 |
| **Total Day Use** | VERS | 546,700 | 255,500 | 839,100 | 7,313 | 5,613,000 |

**Figure 12. Number of Reservoirs by Total Day Use** (n= 194)

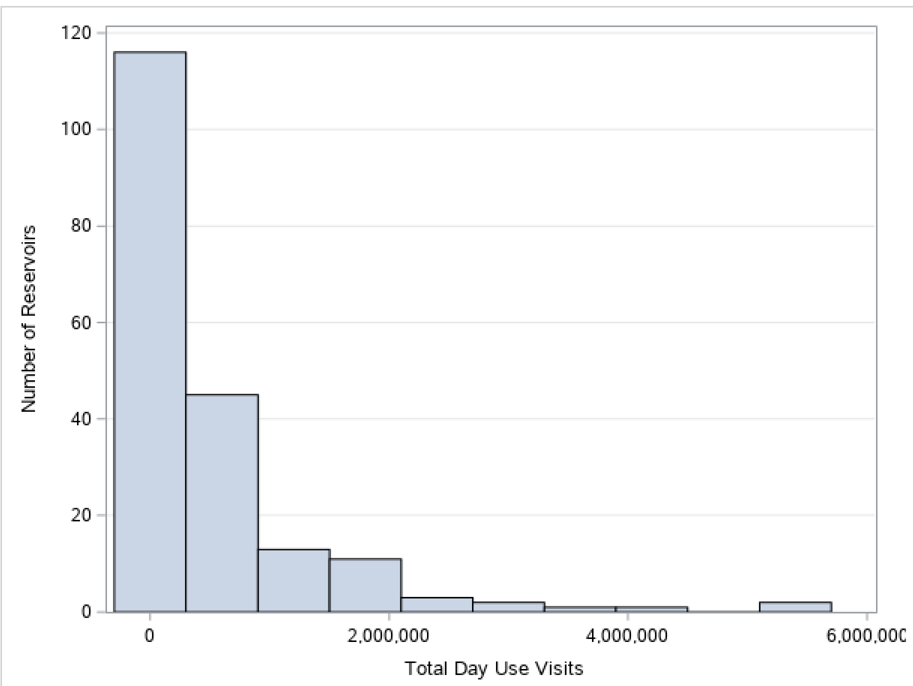
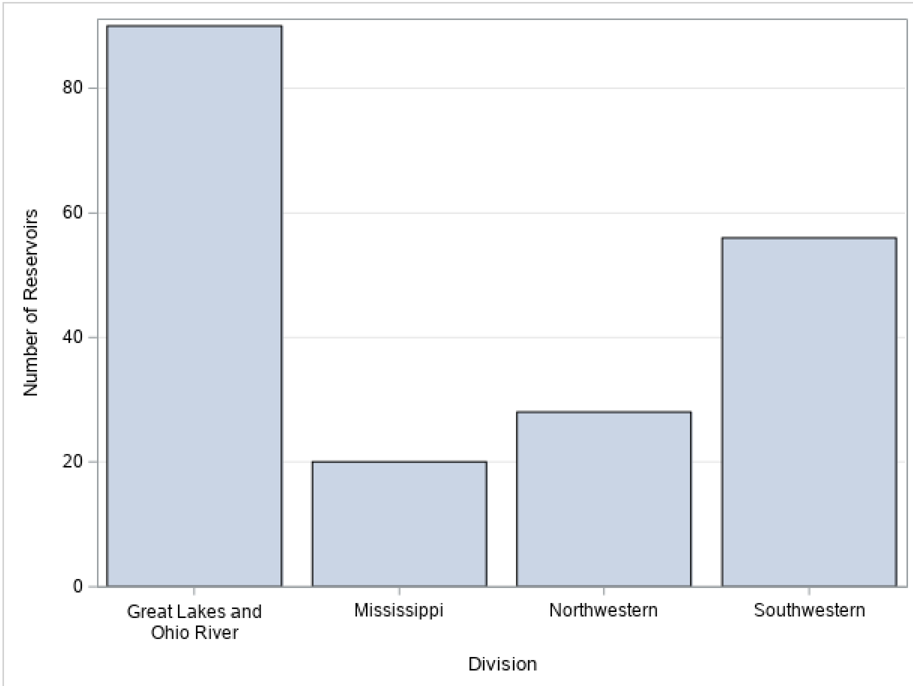


**Figure 13. Number of Reservoirs by Division** (n= 194)




The data have a high level of positive skewness and variation, especially in the surface area, substitute acreage, and day-use variables. The mean is much higher than the median for each of these variables. And the graph of day use, as depicted in Figure 12, shows a definite skew. Given these tendencies, we will employ a natural logarithm transformation to the dependent variable and independent variables of interest.[9]

Table 19 shows the results of the regression of total day use counts on the variables of interest. We also include a control variable for Division, which will capture "fixed effects" of each lake's region, such as climate and its effect on seasonal access. All variables except the Division indicator variable were entered into the models as natural logarithms. The coefficients for these variables signify an increase in the percentage of day-use visitors created by a 1% increase in the modeled variable. For example, a 1% increase in the surface area of a project coincides with an increase in day-use visitors by 0.6%.

[9] A regression model is a standard predictive model for assessing a variable that is continuous in nature (see, e.g., Wooldridge, 2006). Although the data here is in counts and therefore technically discrete, discrete variable models such as Poisson or negative binomial regressions collapse toward continuous variable models as the number of counts becomes large. There are still typically issues with skewness in the data, but those are controlled for through using transformations of variables such as the natural logarithm.

**Table 20. Results from Regression Analysis of Log (Day Use Total Visits)** (n= 183)

| Variable | Coefficient | Standard Error | t-ratio | |
|---|---|---|---|---|
| **Constant** | 26.69 | 7.78 | 3.43 | *** |
| **Division** | 0.30 | 0.11 | 2.78 | *** |
| **Log (Surface Area)** | 0.60 | 0.05 | 10.97 | *** |
| **Log (Substitute Acreage)** | -0.15 | 0.07 | -2.00 | ** |
| **Log (Population)** | 0.48 | 0.10 | 4.59 | *** |
| **Log (Median Household Income)** | -1.33 | 0.56 | -2.38 | ** |
| **Log (Median Age)** | -2.81 | 1.07 | -2.63 | *** |
| **Model $R^2$** | 0.44 | | | |
| **F( 6, 176)** | 26.95 | *** | | |

*Note: *** - p < .01, ** - p < .05. Heteroscedastic-consistent standard errors used in the analysis.*

We then used the results in Table 19 to calculate the expected visitors to a lake in Central Illinois, using data from the 50-mile radius from our survey analysis. We performed a Monte Carlo simulation of the results and evaluated 100,000 possible outcomes using the distribution of the variable coefficients and standard errors from the regression.[10] Median estimates, as reported in Table 20, of the number of annual day-use visitors varies by the size of the lake to be built, from just under 120,000 for a 1,000-acre lake to 230,000 for a 3,000-acre lake. These numbers are comparable to the lakes in the Corps dataset. For each lake in the dataset with surface areas from 1,000 to 3,000 acres, the mean annual day visits are 212,000, with a median of 160,000. This analysis indicates that there will be a reasonable amount of demand for flatwater recreation opportunities served by a lake in Central Illinois, confirming the results of the survey analysis.

**Table 21. Results from Monte Carlo Estimation of the Annual Number of Day Use Visits, 100,000 iterations**

| Measure/Acreage | 1,000 | 1,500 | 2,000 | 2,500 | 3,000 |
|---|---|---|---|---|---|
| **Median Visits** | 119,683.55 | 152,760.19 | 180,442.77 | 206,362.40 | 229,742.24 |
| **Prob. > 100,000** | 50.67% | 51.54% | 52.21% | 52.68% | 53.08% |
| **Prob. > 50,000** | 53.23% | 54.07% | 54.70% | 55.18% | 55.59% |

[10] Monte Carlo simulation is a methodology for estimating the value of variables given uncertainty in the distribution of possible values. In this methodology, random values of variables are generated from a known mean and standard deviation using known distributions of the variable (in this case, the coefficients of the variables in Table 2 are assumed to be normally distributed with a mean equal to the coefficient and a standard deviation equal to the standard error of the estimated coefficient). Then the randomly generated values of the coefficients, representing 100,000 possible future outcomes, are applied to the data for the 50-mile radius from Springfield, generating estimates of visitors. For more on this technique see Mooney (1997) and Kriz (2001).

## FORECAST OF FUTURE DEMAND

We develop forecasts of future needs through forecasting the important variables used in our models. The important predictor variables in the survey and statistical models are age, income, gender, and parental status, as well as total population in the area.

We gathered estimates of county population forecasts from Hauer (2019). The forecasts were generated using a variant of the cohort-comparison method (CCM), which is also used by the US Census Bureau in developing their official population forecasts at the national and state levels. This Hauer data is more disaggregated (to the county level) and is much more detailed, including forecasts by 5-year age group (0-4 years, 5-9, etc.) and gender. This gives us forecasts of three important variables. We use data from the counties in the 50-mile radius used in the survey and statistical models. We also compare this data to projections provided by ESRI, whose data we used in the survey analysis (Table 21). ESRI data is only available to 2025. Neither the Hauer data nor the ESRI database contains projections of the number of families – which implies parental status.

**Table 22. Projected Values of Variables Impacting Aquatic Recreation Demand, 2020-2035**

| | Population Growth Rate (Annual) | | Median Age: Current Value 41.7 | | Gender (% Female) Current Value 50.80% | |
|---|---|---|---|---|---|---|
| **Period** | Hauer | ESRI | Hauer | ESRI | Hauer | ESRI |
| **2020-2025** | -0.34% | -0.49% | 40-44 | 42.8 | 50.50% | 50.70% |
| **2025-2030** | -0.45% | | 40-44 | | 50.45% | |
| **2030-2035** | -0.55% | | 40-44 | | 50.39% | |

The data in Table 21 suggest that only total population will change much over the next ten years. Therefore, we build a time series forecast model of personal income using population as a predictor variable. We gathered data from the U.S. Bureau of Economic Analysis on personal income and population by county (2020). We then analyzed the historical patterns of the relationship between the two variables using an autoregressive-distributed lag model (ARDL – see Wooldridge, 2006). The ARDL model simultaneously considers how median income has evolved over time and how it has been affected over time by population. We did not enter values for the median age or gender into the model as they will not change much over time.[11]

[11] Formally, the ARDL model can be expressed as $Income_t = \alpha_0 + \lambda_0 Population_t + \rho_1 Income_{t-1} + \lambda_1 Population_{t-1} + \cdots + \lambda_n Population_{t-n} + \rho_n Income_{t-n} + \nu_t$, where $\nu_t = u_t - \rho u_{t-1}$. The λ's are coefficients on the current (time t) and lagged (t-1, t-2, and so on up to t-n) values of Population and the ρ's are coefficients on the lagged values of Income.

The results of the analysis are shown in Table 22 and Figure 14. The regression results in Table 19 can be difficult to understand, but the basic logic can be shown in the first row of the main body of the table. The coefficient on the first lag of income has a positive and “statistically significant” effect on the current value of income. Statistical significance simply means that it is not likely that the observed relationship is due to chance. We see this because the probability in the last column (Prob.) is very small (while it seems to be 0 it really is just incredibly small). This is the probability that we got the results due to a sample that would not be expected (what we call a “strange” sample). The coefficient of 0.68 means that each 1% increase in personal income in the past year (for example, 2019) increases the predicted value of personal income by 0.68% this year. This is an example of what one might call persistence (the technical term is serial correlation). There is a positive effect from year to year. This is amplified by the second term, which is the second lag (so 2018 in our example). Population has a strange pattern, bouncing back and forth between positive and negative values over time, but there is an overall positive effect of population on income.[12] Arguably, for our purpose, the most important metric is the “Adjusted $R^2$” measure reported in the summary statistics at the bottom of the table. This metric ranges from 0, indicating a poorly fit model, to 1, indicating a perfect fit. The fit of the model to the actual data is extremely good.[13]

**Table 23. Results from ARDL Regression of Personal Income on Population, 1972-2018.**

| Variable | Coefficient | Std. Error | t-Statistic | |
|---|---|---|---|---|
| Constant (α) | -0.128 | 3.728 | -0.034 | |
| Personal Income (t-1) | 0.574 | 0.144 | 3.972 | *** |
| Personal Income (t-2) | 0.228 | 0.166 | 1.370 | |
| Personal Income (t-3) | 0.148 | 0.140 | 1.059 | |
| Population (t) | -1.225 | 1.172 | -1.045 | |
| Population (t-1) | 4.427 | 2.046 | 2.163 | ** |
| Population (t-2) | -3.126 | 1.103 | -2.834 | *** |
| Adjusted $R^2$ | 0.998761 | | | |
| F(6, 40) | 6180.223 | *** | | |

***Note: All Variables in Natural Logarithms. *** - p < .01, ** - p < .05, * - p <0.1.***

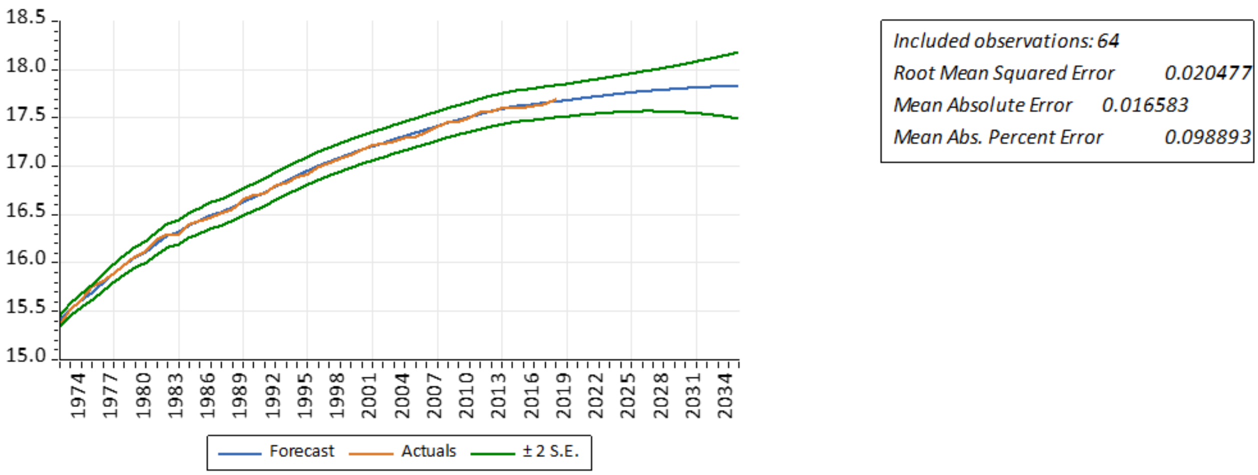
The strong fit of the model is shown on the left side of Figure 14. The divergence between the actual data (the orange line) and the forecast data (blue) is difficult to see because of the

[12] This is easier to see if one is interested in what is called the Error Correction formulation of the model, which factors out the longer run terms of the model and focuses on how the two variables relate over time. Full results are available from the authors.

[13] With results this strong, researchers often suspect model “overfitting”. To test this, we estimated the model over various timeframes (this process is called cross-validation). Model fit was very similar over all timeframes, indicating no overfitting.

overlap between them. This is further reflected in the forecast evaluation statistics in the box at the right of the figure. The Root Mean Squared Error is a measure in the units of the dependent variable (so natural log of Personal Income) of how large on average a forecast error is likely to be. Therefore, on average we would expect an error of 0.0205% each year. This is obviously a very small error. The results of the forecast model suggest that personal income in the 50-mile radius from Springfield can be expected to grow at an average annual rate of 1.3% for 2020-2025, at a slightly slower rate of 0.91% in 2025-2030, and at an even slower 0.54%. The 2020-2025 rate is slightly higher than the ESRI forecast of 1.06% growth in income but is of a similar magnitude.[14]

**Figure 14. Results of ARDL Regression and Forecast through 2030**




## FORECASTS OF REQUIRED ACREAGE

We used the forecasted changes in the key variables in the calculations for required acreage established in the survey analysis portion of the report. We substituted the forecast income and population numbers into our calculations and obtained results for required acreage (Table 23). We converted the estimates from the income regression forecast into categories to match the way that was measured in the survey analysis. For the 2025 forecasts we increased the income category by one, as the median income is forecast to move one category higher. As age and gender did not change markedly over the forecast period, we did not analyze impacts of those forecast values. The results suggest that required acreage will rise in 2025 as median household

[14] The results of this forecast may be affected by the SARS-CoV2/COVID-19 pandemic and associated economic contraction. However, at the time of this report, the ultimate path of the recovery from the pandemic, and the pandemic itself, are unknown and have a high degree of uncertainty. While we acknowledge the potential effects of this event for our forecasts, there is little way of knowing how much the forecasts will have to be adjusted.

income rises, but then fall through 2035 as the population decline begins to outweigh the income increase.[15]

### Table 24. Forecasts of Required Acreage, 2020-2035

| Activity | Required Acres - 2020 | Required Acres - 2025 | Required Acres - 2030 | Required Acres - 2035 |
|---|---|---|---|---|
| Canoeing | 13,015 | 14,423 | 14,100 | 13,740 |
| Sailing | 3,040 | 3,000 | 2,920 | 2,880 |
| Motorboating | 14,900 | 16,900 | 16,550 | 16,100 |
| Boarding | 11,940 | 11,740 | 11,500 | 11,200 |
| Jet Skiing | 6,380 | 7,080 | 6,940 | 6,760 |
| Fishing | 17,960 | 17,660 | 17,280 | 16,840 |
| Swimming Outdoor Pool | 428 | 446 | 437 | 425 |
| Swimming Lake or River | 721 | 709 | 694 | 675 |
| Waterfowl Hunting | 1,566 | 1,728 | 1,692 | 1,656 |
| Total Required Acreage | 69,950 | 73,686 | 72,113 | 70,276 |

[15] Due to the level of uncertainty in the time path of the economy, amplified by the SARS-CoV2/COVID-19 pandemic, we are not comfortable with forecasting past 2035.

## CALCULATION OF UNMET DEMAND

In the first section of this report, we estimated the supply of water appropriate for flatwater recreation at 57,503 acres. In the second section, demand for flatwater recreation was estimated at between 59,010 and 80,890 acres in 2020, with a base estimate of 69,950 acres. Demand is expected to grow to 73,686 acres in 2025, 72,113 acres in 2030, and 70,276 in 2035.

Given these figures, Table 1 shows the calculation of unmet demand, assuming that there are no other projects undertaken during the next 10 years. The lowest of the range of unmet demand estimates is 1,507 acres currently, which is expected to grow in the future as indicated in the table.

**Table 25. Estimates of Unmet Demand, 2020-2030**

| Year | Unmet Demand – Point Estimate | Unmet Demand – Range |
|---|---|---|
| **2020** | 12,447 | 1,507 – 23,387 |
| **2025** | 16,183 | 5,191 – 27,394 |
| **2030** | 14,610 | 3,597 – 26,010 |
| **2035** | 12,773 | 1,778-24,424 |

## References


Borovkov, A. A. (2013). *Probability Theory* (1st ed. 2013.). Springer London.

Dolesch, R. J. & Colman, A. (2020, March 16). Keeping a safe physical distance in parks and on trails during the COVID-19 pandemic. *National Recreation and Park Association*. https://www.nrpa.org/blog/keeping-a-safe-social-distance-in-parks-and-on-trails-during-the-covid-19-pandemic/

Hauer, M. E. (2019). Population projections for U.S. counties by age, sex, and race controlled to shared socioeconomic pathway. *Scientific Data*, *6*(1), 190005.

Kriz, K. A. (2001). The Effect of Tax Increment Finance on Local Government Financial Condition. *Municipal Finance Journal*, *22*(1), 41.

Maddala, G. S. (1986). *Limited-Dependent and Qualitative Variables in Econometrics* (First Paperback Edition). Cambridge University Press.

Mooney, C.Z. (1997). *Monte Carlo Simulation*. Thousand Oaks, CA: Sage Publications.

Patterson, L., Doyle, M., & Kuzma, S. (2018). *Creating Data as a Service for U.S. Army Corps of Engineers Reservoirs*. Durham, NC: Duke University. http://nicholasinstitute.duke.edu/publications

Roth, K. (2020, May). How COVID-19 impacts park and recreation funding. *Parks and Recreation, 55*(5), 18-19.

Turner, J. Rick. (2001). *Introduction to Analysis of Variance: Design, Analysis, & Interpretation*. Sage Publications.

U.S. Army Corps of Engineers Tulsa District. (2013). *Sunflower H20 Report*. Tulsa, OK: U.S. Army Corps of Engineers, Tulsa District.

U.S. Bureau of Economic Analysis. (2020, August 8). *GDP & Personal Income, Regional*. Interactive Data. https://apps.bea.gov/iTable/index_regional.cfm

Venton, Z. S., Barton, D. N., Gunderson, V., Figari, H., & Nowell, M. (in press). Urban nature in the time of crisis: Recreational use of green space increases during the Covid-19 outbreak in Oslo, Norway. *Environmental Research Letters*. https://doi.org/10.1088/1748-9326/abb396

Ward, F. & Martin, K. (1995). *Regional Recreation Demand Model for Large Reservoirs: User's Guide and Model for Documentation, Version 1.0*. Washington, DC: U.S. Army Corps of Engineers.

Wooldridge, J. M. (2006). *Introductory Econometrics: A Modern Approach* (3rd edition). Mason, OH: Thomson Higher Education.

## ACTIVITY COUNTS

| Activity Canoeing | | | | |
|---|---|---|---|---|
| Activity_Canoeing | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 524 | 83.84 | 524 | 83.84 |
| 1 | 101 | 16.16 | 625 | 100.00 |

| Activity Sailing | | | | |
|---|---|---|---|---|
| Activity_Sailing | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 613 | 98.08 | 613 | 98.08 |
| 1 | 12 | 1.92 | 625 | 100.00 |

| Activity Motorboating | | | | |
|---|---|---|---|---|
| Activity_ Motorboating | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 561 | 89.76 | 561 | 89.76 |
| 1 | 64 | 10.24 | 625 | 100.00 |

| Activity Boarding | | | | |
|---|---|---|---|---|
| Activity_ Boarding | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 595 | 95.20 | 595 | 95.20 |
| 1 | 30 | 4.80 | 625 | 100.00 |

| Activity Jet Skiing | | | | |
|---|---|---|---|---|
| Activity_ Jet Skiing | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 599 | 95.84 | 599 | 95.84 |
| 1 | 26 | 4.16 | 625 | 100.00 |

| Activity Fishing | | | | |
|---|---|---|---|---|
| Activity_ Fishing | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 332 | 53.12 | 332 | 53.12 |
| 1 | 293 | 46.88 | 625 | 100.00 |

| Activity Swimming Pool | | | | |
|---|---|---|---|---|
| Activity_ Swimming Pool | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 219 | 35.04 | 219 | 35.04 |
| 1 | 406 | 64.96 | 625 | 100.00 |

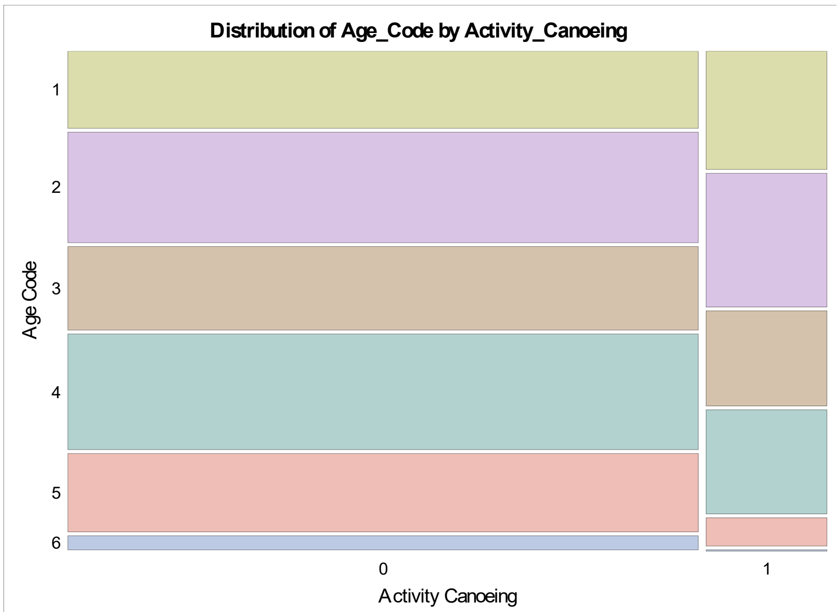
| Activity Swimming Lake River | | | | |
|---|---|---|---|---|
| Activity_ Swimming Lake River | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 441 | 70.56 | 441 | 70.56 |
| 1 | 184 | 29.44 | 625 | 100.00 |

| Activity Waterfowl Hunting | | | | |
|---|---|---|---|---|
| Activity_ Waterfowl Hunting | Frequency | Percent | Cumulative Frequency | Cumulative Percent |
| 0 | 613 | 98.08 | 613 | 98.08 |
| 1 | 12 | 1.92 | 625 | 100.00 |

# ACTIVITY ANALYSIS BY AGE GROUP

## Table of Age_Code by Activity_Canoeing

| Age_Code | Activity_Canoeing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 84 | 25 | 109 |
| 2 | 121 | 28 | 149 |
| 3 | 92 | 20 | 112 |
| 4 | 126 | 22 | 148 |
| 5 | 85 | 6 | 91 |
| 6 | 16 | 0 | 16 |
| Total | 524 | 101 | 625 |

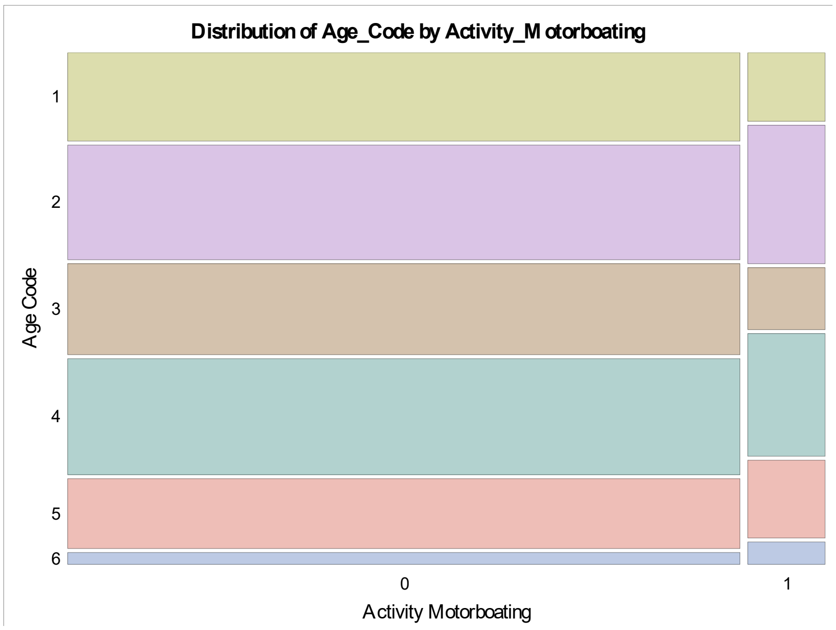



## Statistics for Table of Age_Code by Activity_Canoeing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 14.1077 | 0.0149 |
| Likelihood Ratio Chi-Square | 5 | 17.7520 | 0.0033 |
| Mantel-Haenszel Chi-Square | 1 | 12.4455 | 0.0004 |
| Phi Coefficient | | 0.1502 | |
| Contingency Coefficient | | 0.1486 | |
| Cramer's V | | 0.1502 | |

## Table of Age_Code by Activity_Motorboating

| Age_Code | Activity_ Motorboating | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 100 | 9 | 109 |
| 2 | 131 | 18 | 149 |
| 3 | 104 | 8 | 112 |
| 4 | 132 | 16 | 148 |
| 5 | 81 | 10 | 91 |
| 6 | 13 | 3 | 16 |
| Total | 561 | 64 | 625 |

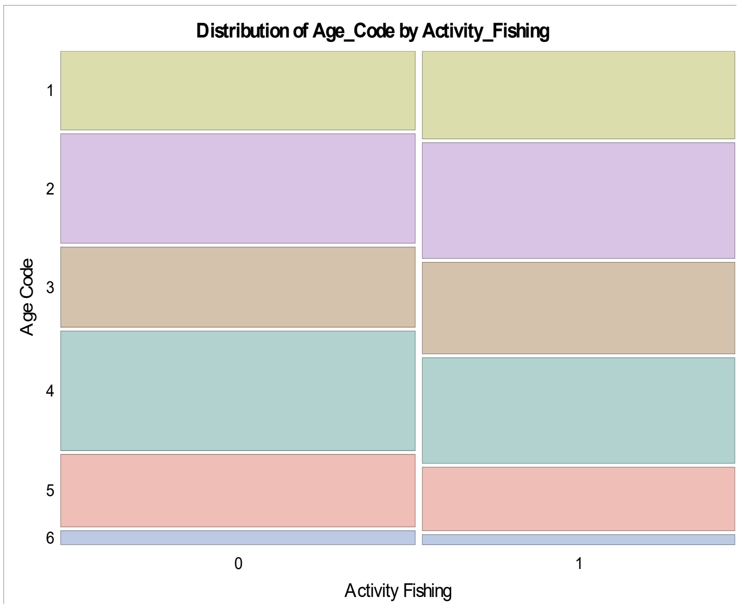



## Statistics for Table of Age_Code by Activity_ Motorboating (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 3.5530 | 0.6154 |
| Likelihood Ratio Chi-Square | 5 | 3.4569 | 0.6299 |
| Mantel-Haenszel Chi-Square | 1 | 0.5427 | 0.4613 |
| Phi Coefficient | | 0.0754 | |
| Contingency Coefficient | | 0.0752 | |
| Cramer's V | | 0.0754 | |

### Table of Age_Code by Activity_Fishing

| Age_Code | Activity_ Fishing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 55 | 54 | 109 |
| 2 | 77 | 72 | 149 |
| 3 | 56 | 56 | 112 |
| 4 | 83 | 65 | 148 |
| 5 | 51 | 40 | 91 |
| 6 | 10 | 6 | 16 |
| Total | 332 | 293 | 625 |

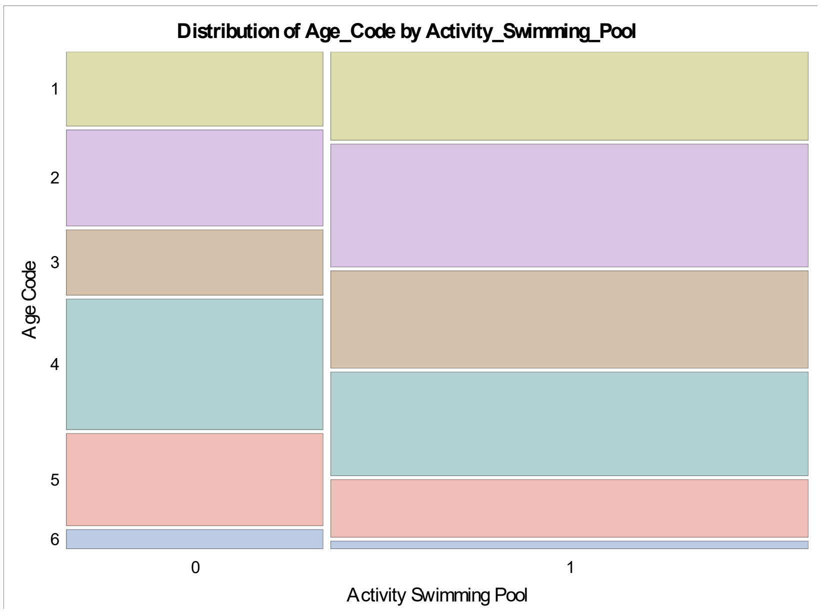



### Statistics for Table of Age_Code by Activity_ Fishing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 2.2711 | 0.8105 |
| Likelihood Ratio Chi-Square | 5 | 2.2800 | 0.8092 |
| Mantel-Haenszel Chi-Square | 1 | 1.5862 | 0.2079 |
| Phi Coefficient | | 0.0603 | |
| Contingency Coefficient | | 0.0602 | |
| Cramer's V | | 0.0603 | |

### Table of Age_Code by Activity_Swimming Pool

| Age_Code | Activity_ Swimming Pool | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 34 | 75 | 109 |
| 2 | 44 | 105 | 149 |
| 3 | 30 | 82 | 112 |
| 4 | 60 | 88 | 148 |
| 5 | 42 | 49 | 91 |
| 6 | 9 | 7 | 16 |
| Total | 219 | 406 | 625 |

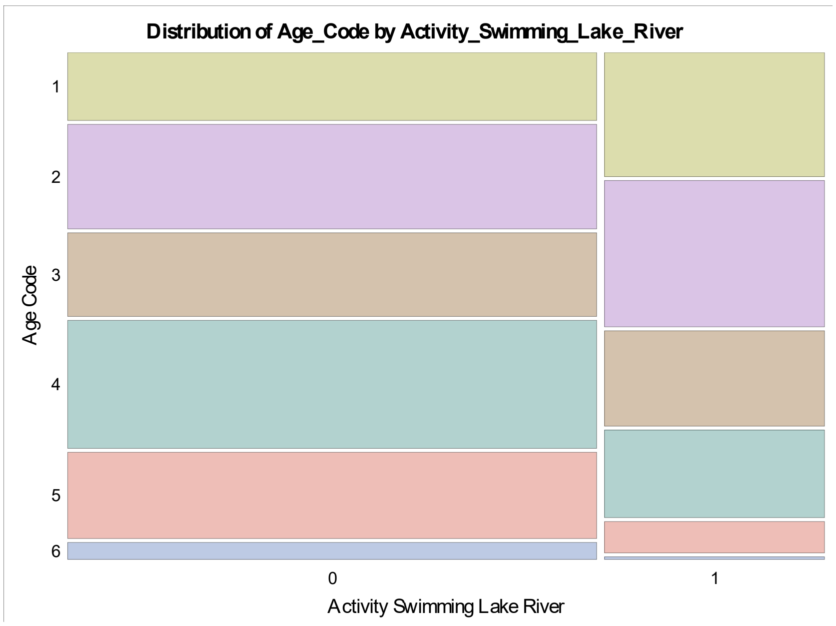



### Statistics for Table of Age_Code by Activity_ Swimming Pool (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 16.1161 | 0.0065 |
| Likelihood Ratio Chi-Square | 5 | 15.9276 | 0.0071 |
| Mantel-Haenszel Chi-Square | 1 | 10.7501 | 0.0010 |
| Phi Coefficient | | 0.1606 | |
| Contingency Coefficient | | 0.1585 | |
| Cramer's V | | 0.1606 | |

### Table of Age_Code by Activity_Swimming Lake River

| Age_Code | Activity_ Swimming Lake River | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 62 | 47 | 109 |
| 2 | 94 | 55 | 149 |
| 3 | 76 | 36 | 112 |
| 4 | 115 | 33 | 148 |
| 5 | 79 | 12 | 91 |
| 6 | 15 | 1 | 16 |
| Total | 441 | 184 | 625 |



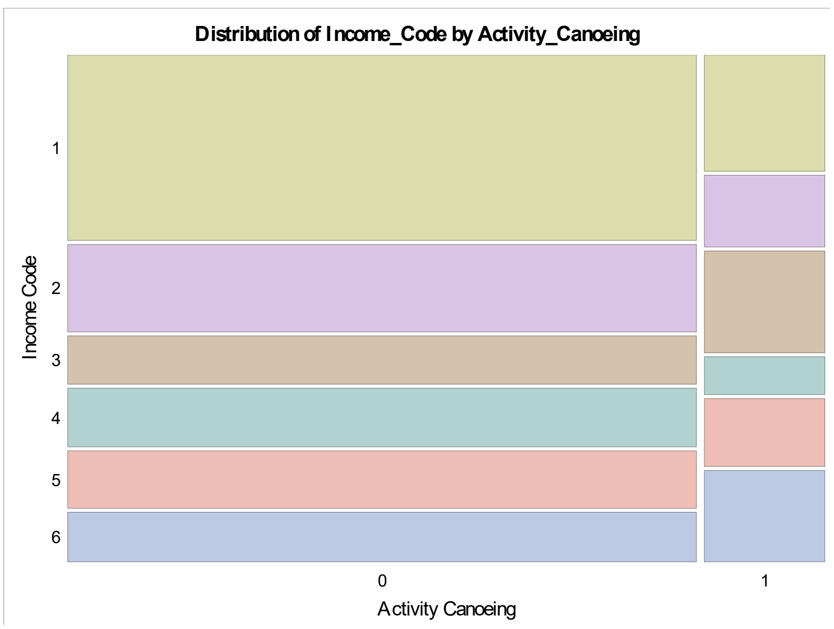

### Statistics for Table of Age_Code by Activity_ Swimming Lake River (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 33.5675 | <.0001 |
| Likelihood Ratio Chi-Square | 5 | 36.1133 | <.0001 |
| Mantel-Haenszel Chi-Square | 1 | 32.9555 | <.0001 |
| Phi Coefficient | | 0.2317 | |
| Contingency Coefficient | | 0.2258 | |
| Cramer's V | | 0.2317 | |

## ACTIVITY ANALYSIS BY INCOME GROUP

### Table of Income_Code by Activity_Canoeing

| Income_Code | Activity_ Canoeing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 200 | 24 | 224 |
| 2 | 93 | 15 | 108 |
| 3 | 53 | 21 | 74 |
| 4 | 63 | 8 | 71 |
| 5 | 62 | 14 | 76 |
| 6 | 53 | 19 | 72 |
| Total | 524 | 101 | 625 |

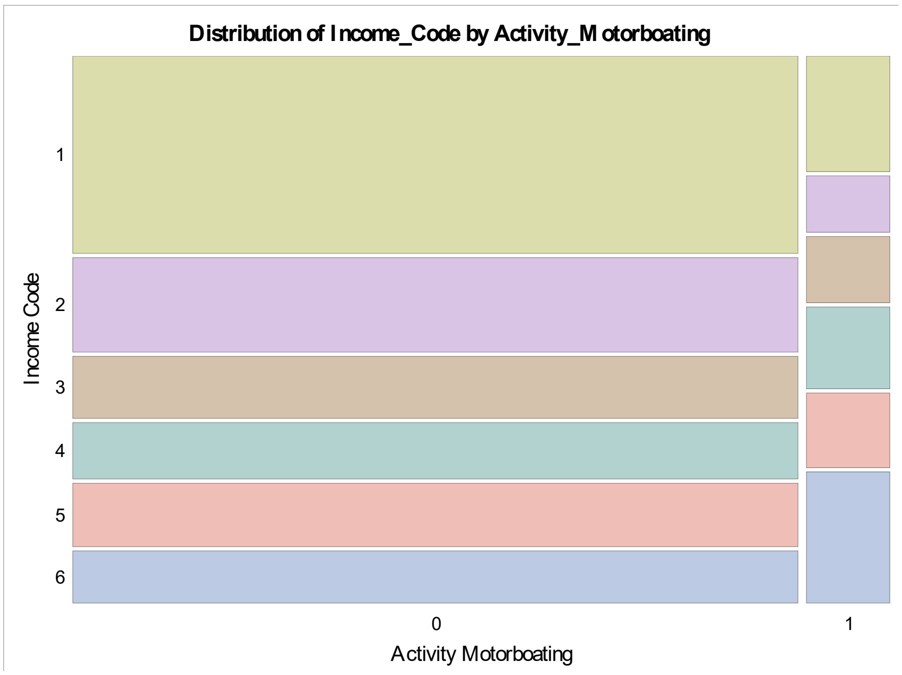



### Statistics for Table of Income_Code by Activity_ Canoeing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 20.5695 | 0.0010 |
| Likelihood Ratio Chi-Square | 5 | 19.3240 | 0.0017 |
| Mantel-Haenszel Chi-Square | 1 | 8.7907 | 0.0030 |
| Phi Coefficient | | 0.1814 | |
| Contingency Coefficient | | 0.1785 | |
| Cramer's V | | 0.1814 | |

### Table of Income_Code by Activity_Motorboating

| Income_Code | Activity_ Motorboating | | |
|---|---|---|---|
| **Frequency** | **0** | **1** | **Total** |
| **1** | 210 | 14 | 224 |
| **2** | 101 | 7 | 108 |
| **3** | 66 | 8 | 74 |
| **4** | 61 | 10 | 71 |
| **5** | 67 | 9 | 76 |
| **6** | 56 | 16 | 72 |
| **Total** | 561 | 64 | 625 |

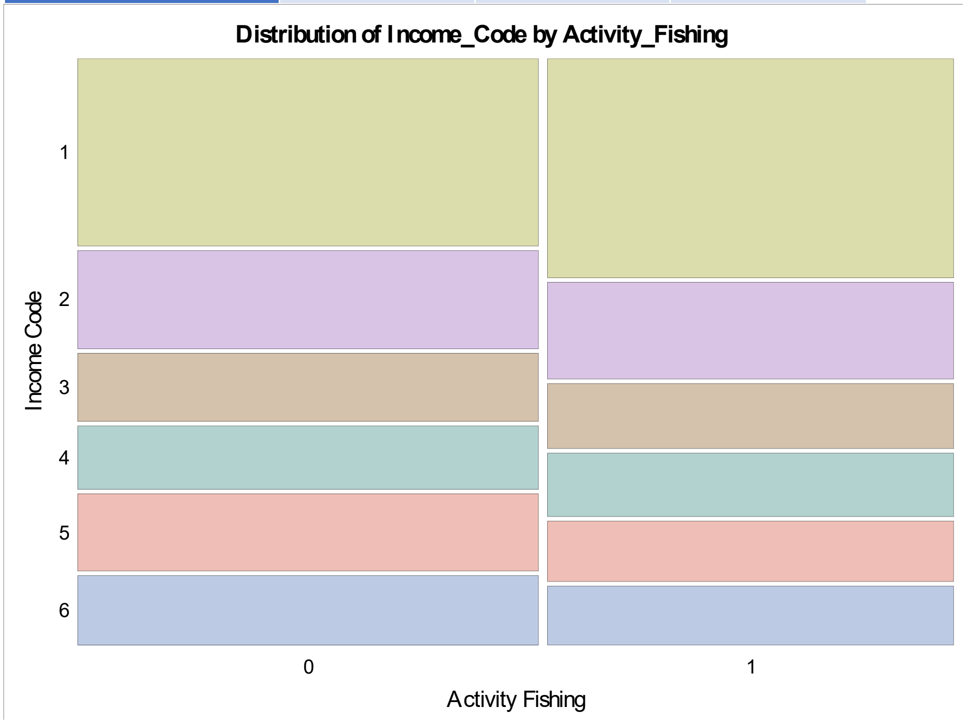



### Statistics for Table of Income_Code by Activity_ Motorboating (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| **Chi-Square** | 5 | 18.1665 | 0.0027 |
| **Likelihood Ratio Chi-Square** | 5 | 16.3351 | 0.0059 |
| **Mantel-Haenszel Chi-Square** | 1 | 15.2063 | <.0001 |
| **Phi Coefficient** | | 0.1705 | |
| **Contingency Coefficient** | | 0.1681 | |
| **Cramer's V** | | 0.1705 | |

### Table of Income_Code by Activity_Fishing

| Income_Code | Activity_ Fishing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 110 | 114 | 224 |
| 2 | 58 | 50 | 108 |
| 3 | 40 | 34 | 74 |
| 4 | 38 | 33 | 71 |
| 5 | 45 | 31 | 76 |
| 6 | 41 | 31 | 72 |
| Total | 332 | 293 | 625 |

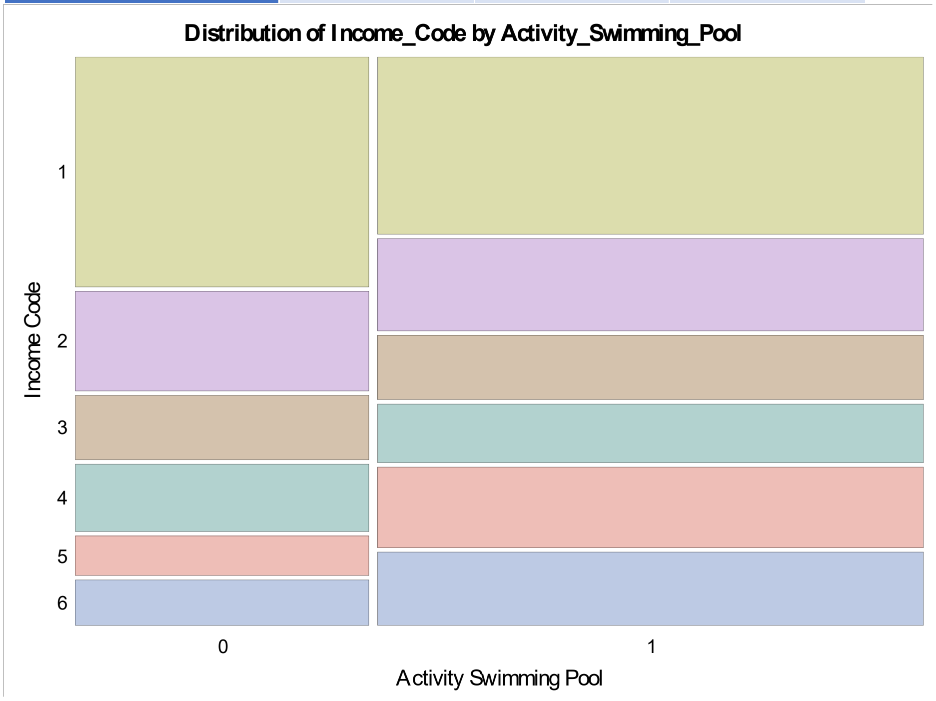



### Statistics for Table of Income_Code by Activity_ Fishing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 3.0487 | 0.6925 |
| Likelihood Ratio Chi-Square | 5 | 3.0559 | 0.6914 |
| Mantel-Haenszel Chi-Square | 1 | 2.4705 | 0.1160 |
| Phi Coefficient | | 0.0698 | |
| Contingency Coefficient | | 0.0697 | |
| Cramer's V | | 0.0698 | |

### Table of Income_Code by Activity_Swimming Pool

| Income_Code | Activity_ Swimming Pool | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 92 | 132 | 224 |
| 2 | 40 | 68 | 108 |
| 3 | 26 | 48 | 74 |
| 4 | 27 | 44 | 71 |
| 5 | 16 | 60 | 76 |
| 6 | 18 | 54 | 72 |
| Total | 219 | 406 | 625 |

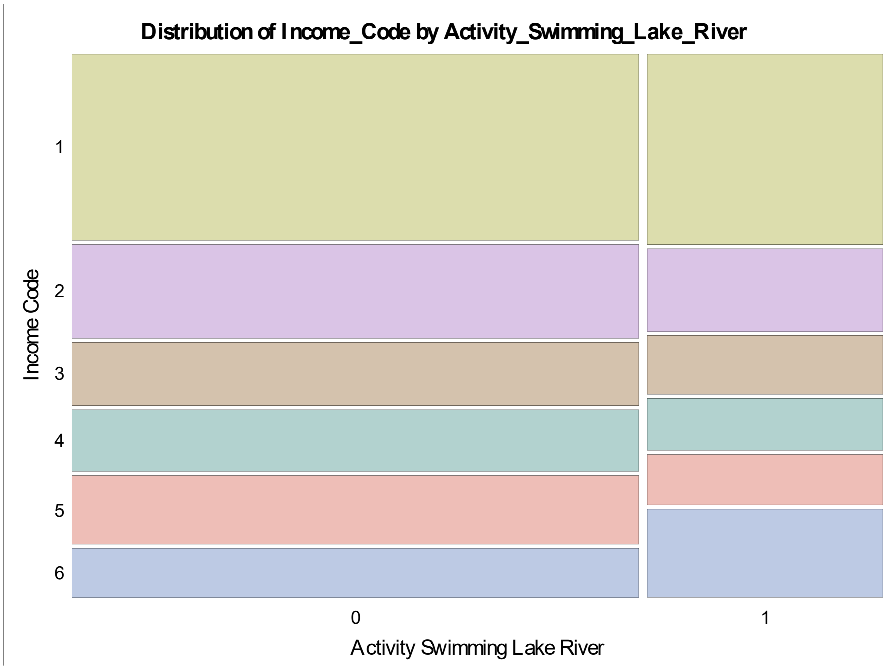



### Statistics for Table of Income_Code by Activity_ Swimming Pool (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 13.7690 | 0.0171 |
| Likelihood Ratio Chi-Square | 5 | 14.4263 | 0.0131 |
| Mantel-Haenszel Chi-Square | 1 | 10.7200 | 0.0011 |
| Phi Coefficient | | 0.1484 | |
| Contingency Coefficient | | 0.1468 | |
| Cramer's V | | 0.1484 | |

## Table of Income_Code by Activity_Swimming Lake River

| Income_Code | Activity_ Swimming Lake River | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| 1 | 157 | 67 | 224 |
| 2 | 79 | 29 | 108 |
| 3 | 53 | 21 | 74 |
| 4 | 53 | 18 | 71 |
| 5 | 58 | 18 | 76 |
| 6 | 41 | 31 | 72 |
| Total | 441 | 184 | 625 |



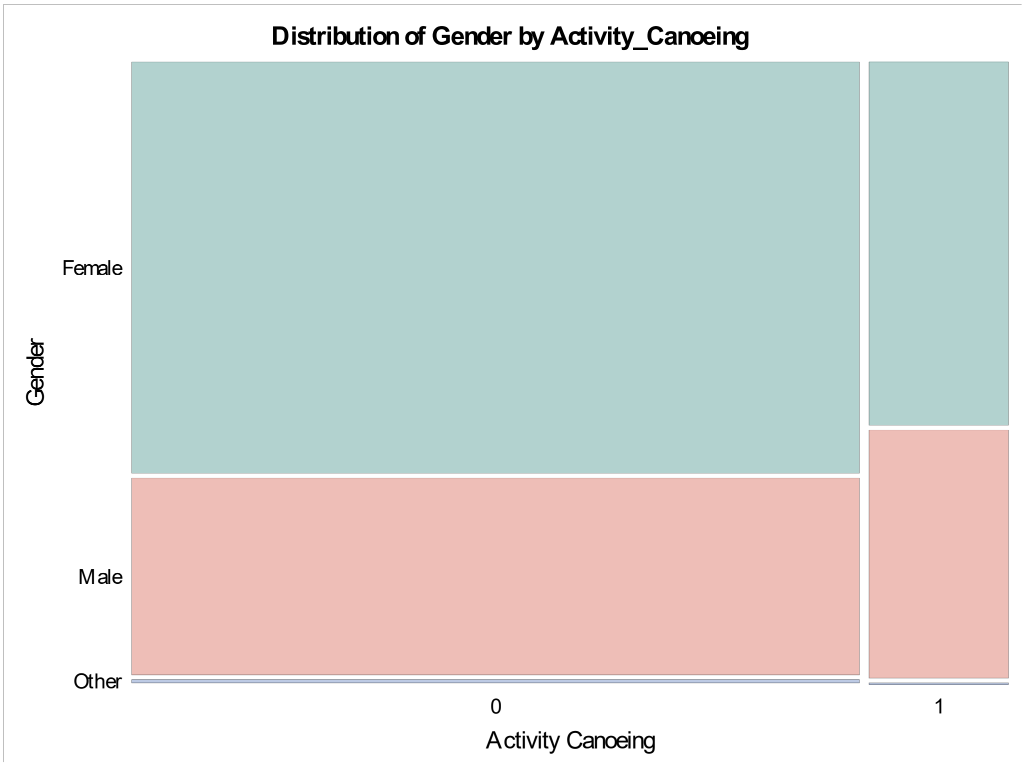

## Statistics for Table of Income_Code by Activity_ Swimming Lake River (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 5 | 8.6210 | 0.1252 |
| Likelihood Ratio Chi-Square | 5 | 8.2603 | 0.1425 |
| Mantel-Haenszel Chi-Square | 1 | 0.8155 | 0.3665 |
| Phi Coefficient | | 0.1174 | |
| Contingency Coefficient | | 0.1166 | |
| Cramer's V | | 0.1174 | |

## ACTIVITY ANALYSIS BY GENDER

### Table of Gender_Code by Activity_Canoeing

| Gender_Code | Activity_ Canoeing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| Female | 353 | 60 | 413 |
| Male | 168 | 41 | 209 |
| Other | 3 | 0 | 3 |
| Total | 524 | 101 | 625 |

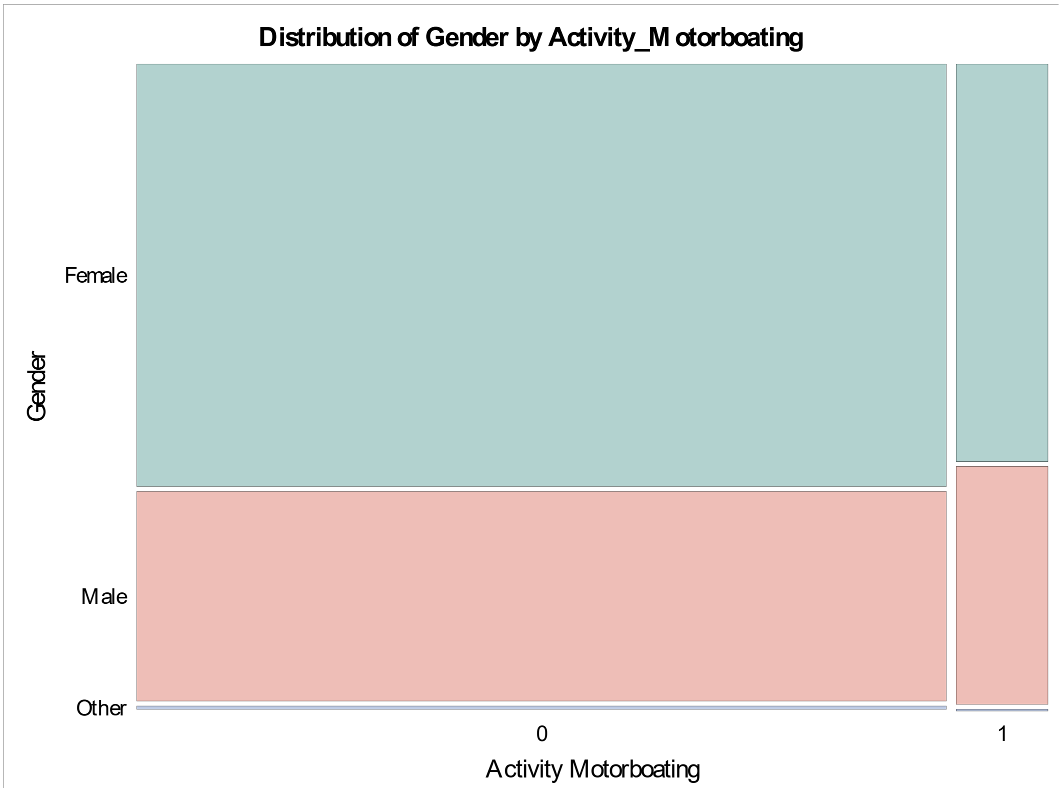



### Statistics for Table of Gender_Code by Activity_ Canoeing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 2 | 3.2341 | 0.1985 |
| Likelihood Ratio Chi-Square | 2 | 3.6411 | 0.1619 |
| Mantel-Haenszel Chi-Square | 1 | 1.9614 | 0.1614 |
| Phi Coefficient | | 0.0719 | |
| Contingency Coefficient | | 0.0717 | |
| Cramer's V | | 0.0719 | |

### Table of Gender_Code by Activity_Motorboating

| Gender_Code | Activity_ Motorboating | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| Female | 373 | 40 | 413 |
| Male | 185 | 24 | 209 |
| Other | 3 | 0 | 3 |
| Total | 561 | 64 | 625 |

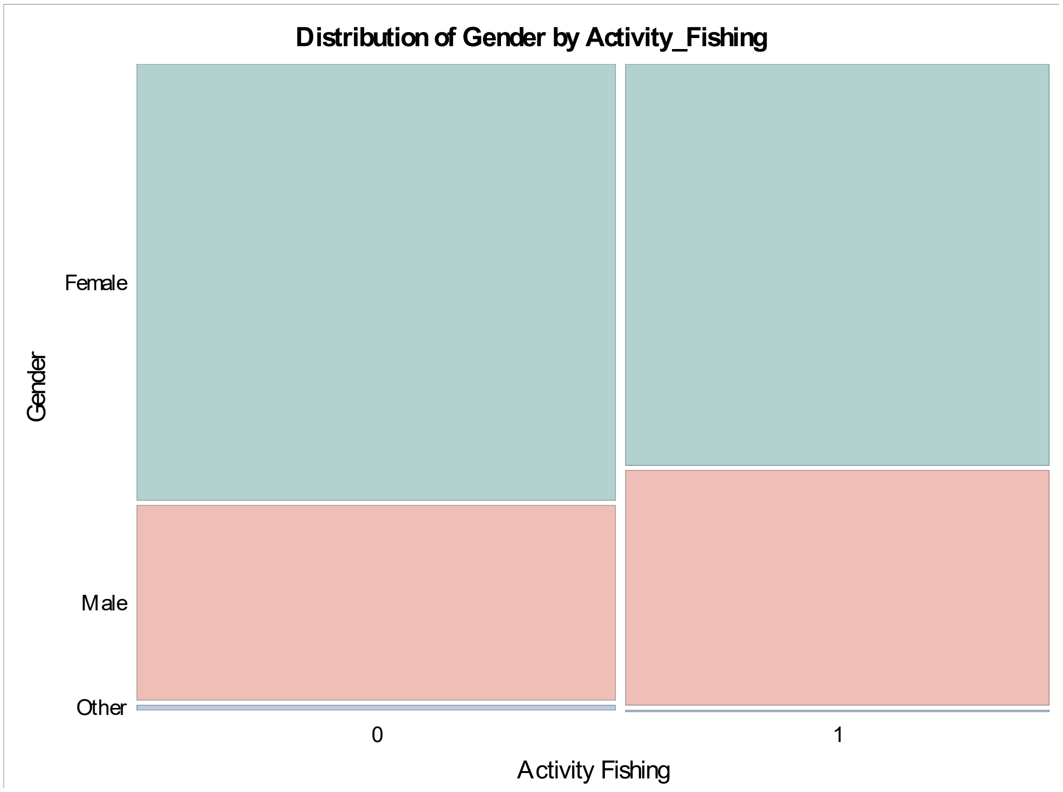



### Statistics for Table of Gender_Code by Activity_ Motorboating (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 2 | 0.8320 | 0.6597 |
| Likelihood Ratio Chi-Square | 2 | 1.1283 | 0.5688 |
| Mantel-Haenszel Chi-Square | 1 | 0.2908 | 0.5897 |
| Phi Coefficient | | 0.0365 | |
| Contingency Coefficient | | 0.0365 | |
| Cramer's V | | 0.0365 | |

### Table of Gender_Code by Activity_Fishing

| Gender_Code | Activity_ Fishing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| Female | 228 | 185 | 413 |
| Male | 101 | 108 | 209 |
| Other | 3 | 0 | 3 |
| Total | 332 | 293 | 625 |

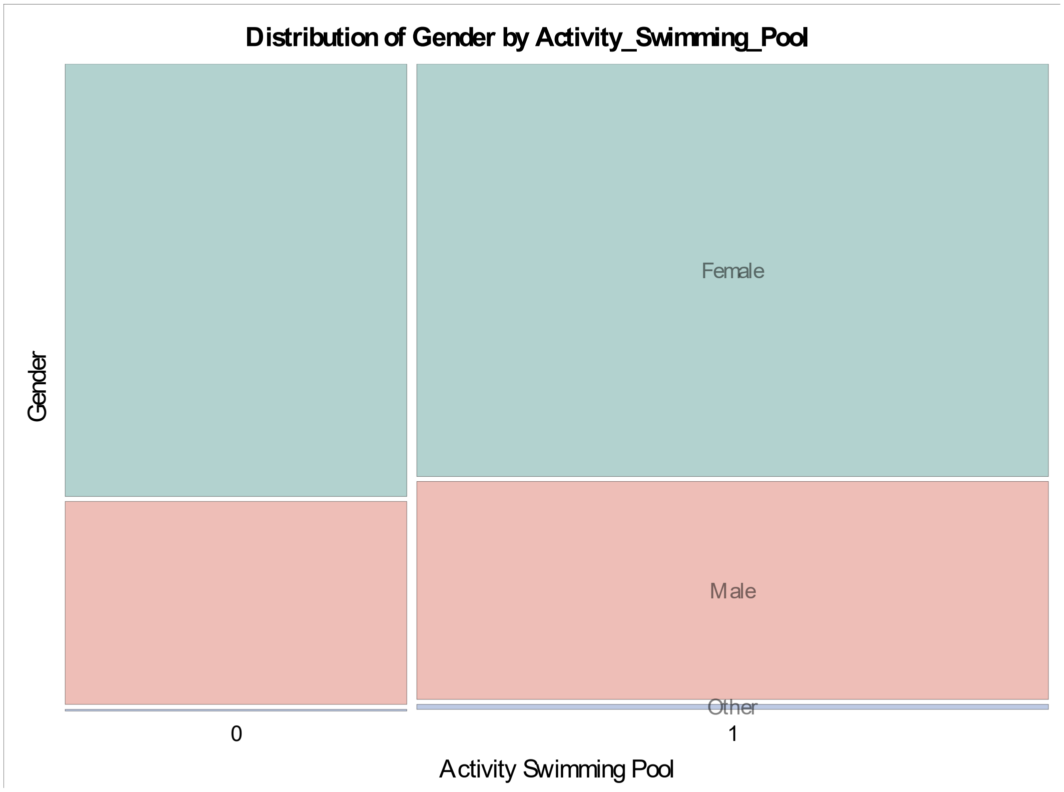



### Statistics for Table of Gender_Code by Activity_ Fishing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 2 | 5.2985 | 0.0707 |
| Likelihood Ratio Chi-Square | 2 | 6.4433 | 0.0399 |
| Mantel-Haenszel Chi-Square | 1 | 1.4166 | 0.2340 |
| Phi Coefficient | | 0.0921 | |
| Contingency Coefficient | | 0.0917 | |
| Cramer's V | | 0.0921 | |

## Table of Gender_Code by Activity_Swimming Pool

| Gender_Code | Activity_ Swimming Pool | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| Female | 149 | 264 | 413 |
| Male | 70 | 139 | 209 |
| Other | 0 | 3 | 3 |
| Total | 219 | 406 | 625 |

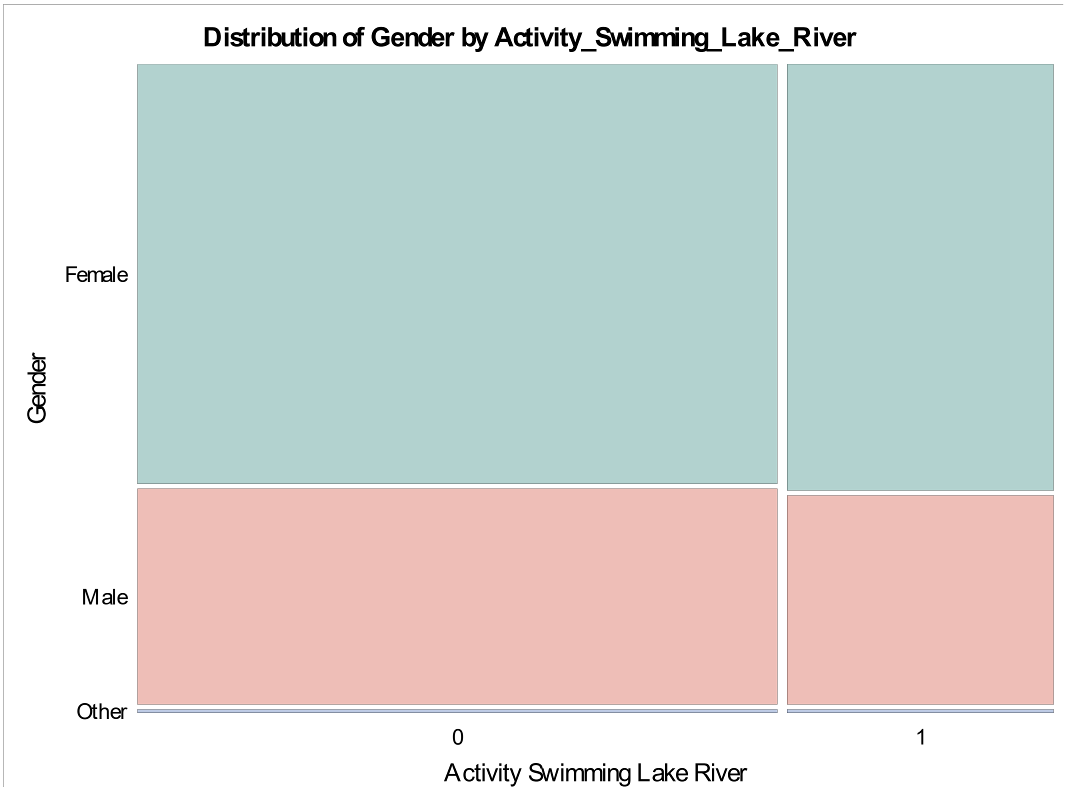



## Statistics for Table of Gender_Code by Activity_ Swimming Pool (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 2 | 2.0333 | 0.3618 |
| Likelihood Ratio Chi-Square | 2 | 3.0042 | 0.2227 |
| Mantel-Haenszel Chi-Square | 1 | 0.8494 | 0.3567 |
| Phi Coefficient | | 0.0570 | |
| Contingency Coefficient | | 0.0569 | |
| Cramer's V | | 0.0570 | |

### Table of Gender_Code by Activity_Swimming Lake River

| Gender_Code | Activity_ Swimming Pool | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| Female | 290 | 123 | 413 |
| Male | 149 | 60 | 209 |
| Other | 2 | 1 | 3 |
| Total | 441 | 184 | 625 |



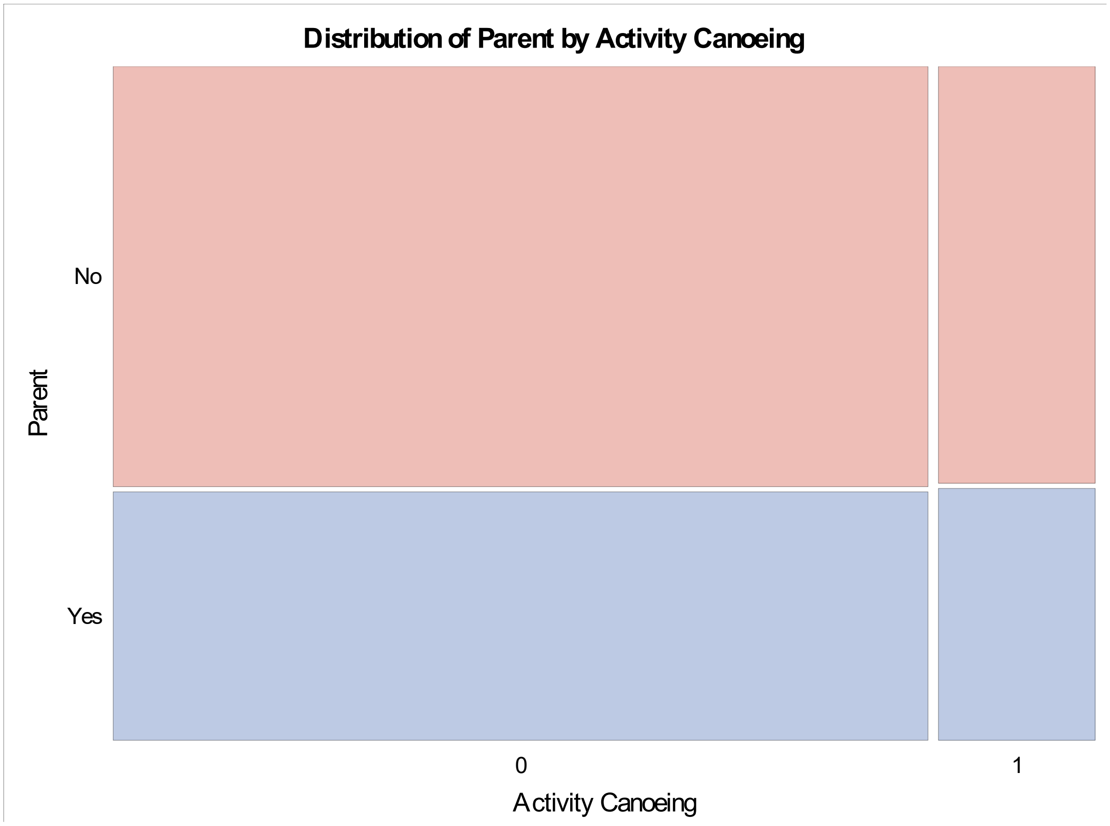

### Statistics for Table of Gender_Code by Activity_ Swimming Lake River (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 2 | 0.0990 | 0.9517 |
| Likelihood Ratio Chi-Square | 2 | 0.0987 | 0.9518 |
| Mantel-Haenszel Chi-Square | 1 | 0.0549 | 0.8147 |
| Phi Coefficient | | 0.0126 | |
| Contingency Coefficient | | 0.0126 | |
| Cramer's V | | 0.0126 | |

# ACTIVITY ANALYSIS BY PARENTAL STATUS

### Table of Parent by Activity_Canoeing

| Parent | Activity_ Canoeing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| No | 329 | 63 | 392 |
| Yes | 195 | 38 | 233 |
| Total | 524 | 101 | 625 |

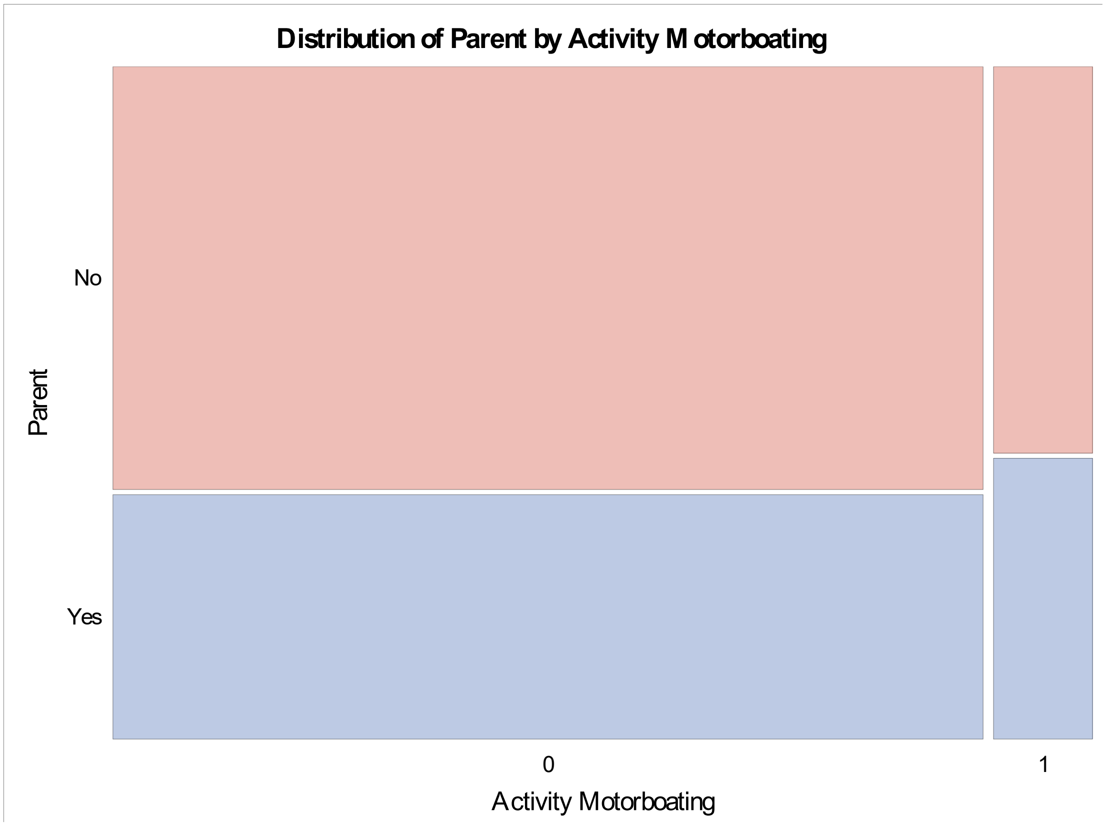



### Statistics for Table of Parent by Activity_ Canoeing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 1 | 0.0061 | 0.9378 |
| Likelihood Ratio Chi-Square | 1 | 0.0061 | 0.9378 |
| Mantel-Haenszel Chi-Square | 1 | 0.0000 | 1.0000 |
| Phi Coefficient | 1 | 0.0061 | 0.9379 |
| Contingency Coefficient | | 0.0031 | |
| Cramer's V | | 0.0031 | |

### Table of Parent by Activity_Motorboating

| Parent | Activity_ Motorboating | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| No | 355 | 37 | 392 |
| Yes | 206 | 27 | 233 |
| Total | 561 | 64 | 625 |

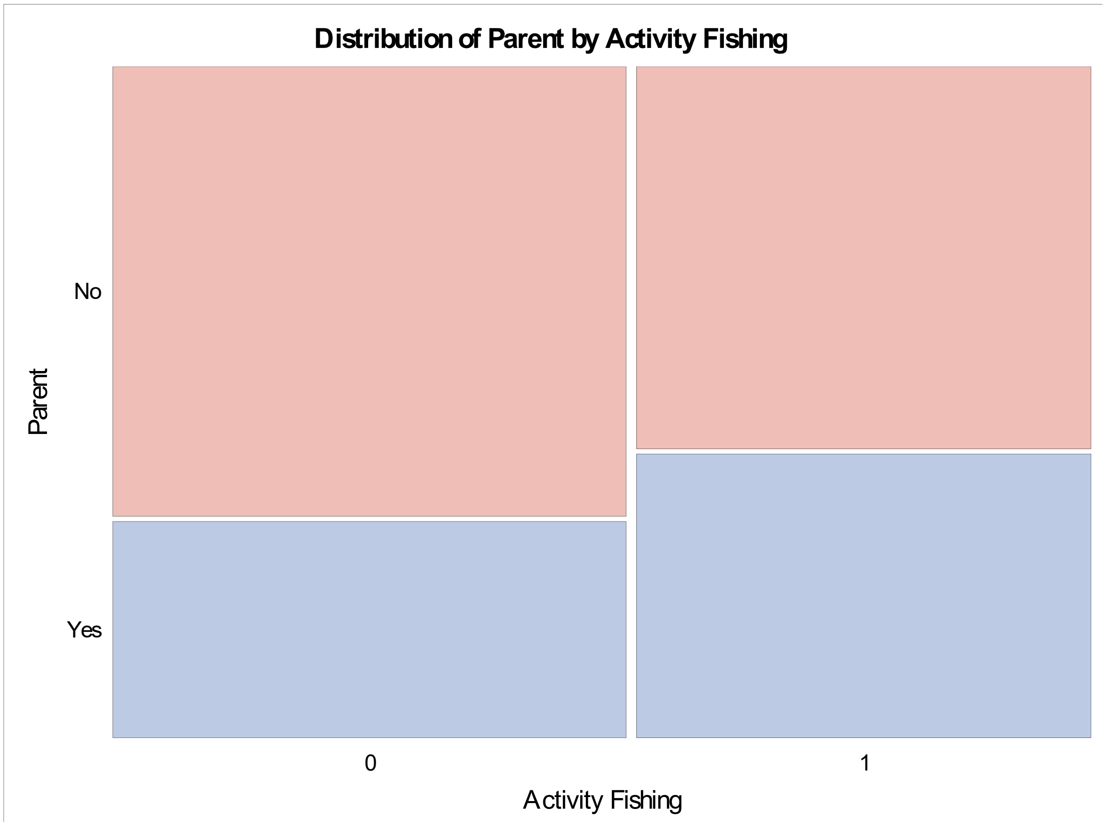



### Statistics for Table of Parent by Activity_ Motorboating (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 1 | 0.7344 | 0.3915 |
| Likelihood Ratio Chi-Square | 1 | 0.7242 | 0.3948 |
| Mantel-Haenszel Chi-Square | 1 | 0.5192 | 0.4712 |
| Phi Coefficient | 1 | 0.7332 | 0.3918 |
| Contingency Coefficient | | 0.0343 | |
| Cramer's V | | 0.0343 | |

### Table of Parent by Activity_Fishing

| Parent | Activity_ Fishing | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| No | 224 | 168 | 392 |
| Yes | 108 | 125 | 233 |
| Total | 332 | 293 | 625 |

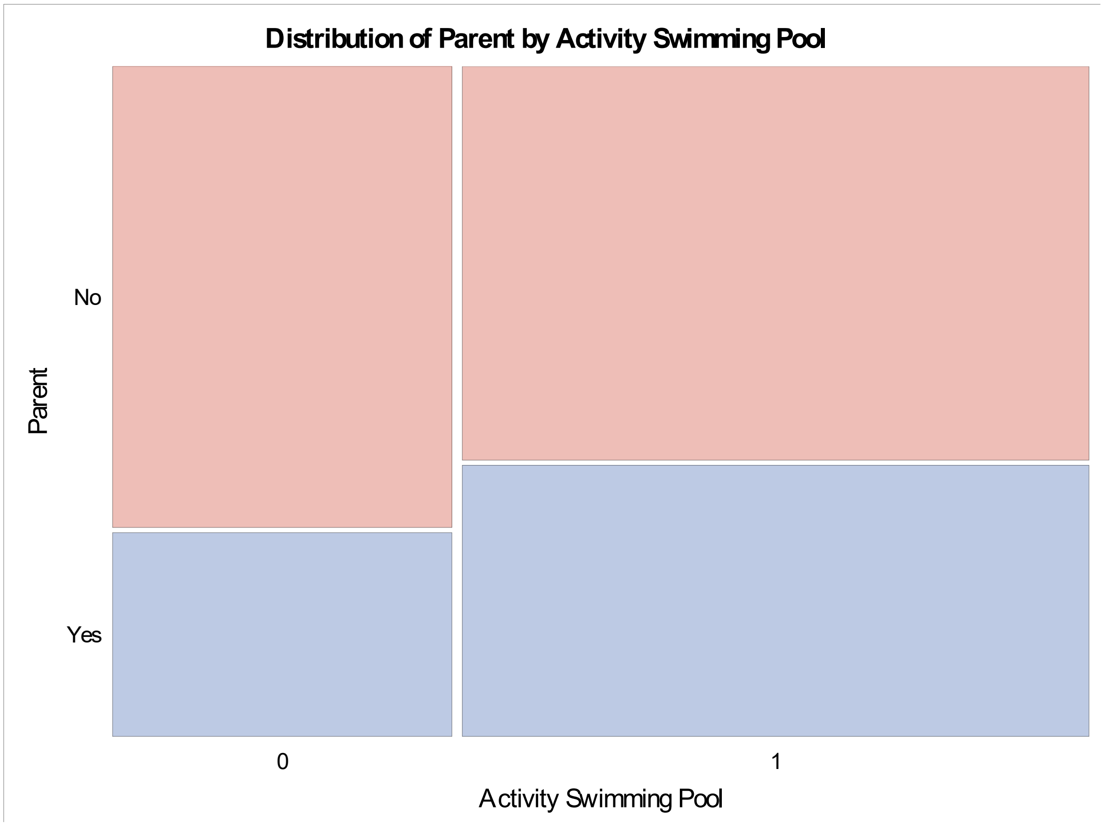



### Statistics for Table of Parent by Activity_ Fishing (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 1 | 6.8334 | 0.0089 |
| Likelihood Ratio Chi-Square | 1 | 6.8337 | 0.0089 |
| Mantel-Haenszel Chi-Square | 1 | 6.4069 | 0.0114 |
| Phi Coefficient | 1 | 6.8224 | 0.0090 |
| Contingency Coefficient | | 0.1046 | |
| Cramer's V | | 0.1040 | |

### Table of Parent by Activity_Swimming Pool

| Parent | Activity_ Swimming Pool | | |
|---|---|---|---|
| Frequency | 0 | 1 | Total |
| No | 152 | 240 | 392 |
| Yes | 67 | 166 | 233 |
| Total | 219 | 406 | 625 |

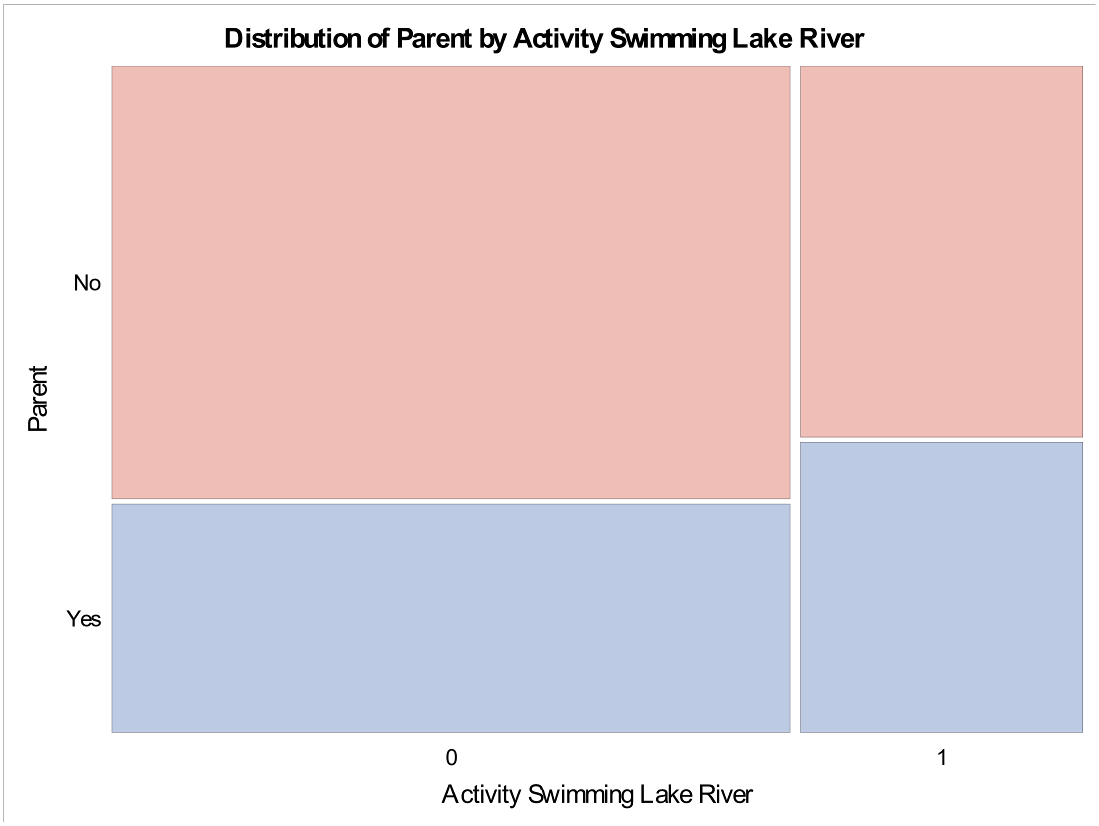



### Statistics for Table of Parent by Activity_ Swimming Pool (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| Chi-Square | 1 | 6.4461 | 0.0111 |
| Likelihood Ratio Chi-Square | 1 | 6.5393 | 0.0106 |
| Mantel-Haenszel Chi-Square | 1 | 6.0134 | 0.0142 |
| Phi Coefficient | 1 | 6.4358 | 0.0112 |
| Contingency Coefficient | | 0.1016 | |
| Cramer's V | | 0.1010 | |

### Table of Parent by Activity_Swimming Lake River

| Parent | Activity_ Swimming Lake River | | |
|---|---|---|---|
| **Frequency** | **0** | **1** | **Total** |
| **No** | 289 | 103 | 392 |
| **Yes** | 152 | 81 | 233 |
| **Total** | 441 | 184 | 625 |




### Statistics for Table of Parent by Activity_ Swimming Lake River (n = 625)

| Statistic | DF | Value | Prob |
|---|---|---|---|
| **Chi-Square** | 1 | 5.0690 | 0.0244 |
| **Likelihood Ratio Chi-Square** | 1 | 5.0117 | 0.0252 |
| **Mantel-Haenszel Chi-Square** | 1 | 4.6686 | 0.0307 |
| **Phi Coefficient** | 1 | 5.0609 | 0.0245 |
| **Contingency Coefficient** | | 0.0901 | |
| **Cramer's V** | | 0.0897 | |

## APPENDIX 2: REGRESSION ANALYSIS RESULTS FOR MILES TRAVELED AND DAYS INVOLVED IN ACTIVITIES

### MILES TRAVELED

| Variable/Activity | Canoeing/ Kayaking | Motorboating | Fishing | Swimming in an Outdoor Pool |
|---|---|---|---|---|
| Constant | -47.207 | 7.862 | 14.826 | 18.194 |
| | (-0.37) | (0.13) | (0.47) | (0.73) |
| Income | 4.495 | -17.99 | 2.668 | 1.362 |
| | (0.39) | (-1.12) | (0.93) | (0.58) |
| Age | 31.739 | -9.805 | 0.48 | 11.752* |
| | (1.2) | (-0.70) | (0.12) | (1.79) |
| Gender | 34.511 | 58.036* | 3.386 | -0.057 |
| | (0.86) | (1.86) | (0.33) | (-0.00) |
| Parent | -56.458 | -41.663 | -2.441 | -21.637** |
| | (-1.03) | (-0.88) | (-0.30) | (-2.35) |
| County | 2.496 | 10.075** | 0.149 | -1.227 |
| | (0.73) | (2.07) | (0.21) | (-1.57) |
| Adjusted R2 | 0.065 | 0.191 | 0.005 | 0.031 |
| F | 0.354 | 1.734 | 0.306 | 1.282 |
| **Variable/Activity** | **Swimming in a Lake or River** | **Miles Day Trip** | **Miles Overnight Trip** | **Furthest Miles** |
| Constant | 64.798 | 49.043*** | 39.399* | 75.431 |
| | (1.29) | (3.41) | (1.9) | (1.6) |
| Income | 6.496 | 1.976* | 10.379*** | 14.304* |
| | (1.14) | (1.95) | (4.43) | (1.93) |
| Age | -10.922 | -1.131 | 3.516 | -1.624 |
| | (-1.32) | (-0.68) | (0.94) | (-0.16) |
| Gender | -18.088 | -4.443 | 4.786 | 38.22 |
| | (-0.60) | (-0.93) | (0.54) | (0.88) |
| Parent | 2.985 | 1.479 | -2.081 | -25.856 |
| | (0.11) | (0.37) | (-0.26) | (-0.92) |
| County | 0.823 | -0.327 | 0.121 | 2.284 |
| | (0.67) | (-0.77) | (0.17) | (1) |
| Adjusted R2 | 0.01 | 0.009 | 0.036 | 0.011 |
| F | 0.665 | 1.43 | 4.248*** | 1.667 |

*Notes: The top line for each variable in rows is the linear regression coefficient. The second line is the t-test statistic for significant relationships. *** - p< .001 (statistically significant at the 0.1% level of significance, ** - p<.01, * - p<.05.*

## DAYS INVOLVED

| Variable/ Activity | Canoeing/ Kayaking | Motorboating | Fishing | Swimming in an Outdoor Pool | Swimming in a Lake or River |
|---|---|---|---|---|---|
| Income | 0.029 | 0.273 | 0.162* | 0.196*** | 0.117 |
| | (0.13) | (0.14) | (0.07) | (0.05) | (0.08) |
| Age | 0.207 | 0.045 | 0.025 | -0.110 | 0.005 |
| | (0.2) | (0.17) | (0.08) | (-0.07) | (0.11) |
| Parent | 1.153** | 0.179 | 0.438 | 0.684*** | 0.514 |
| | (0.41) | (0.46) | (0.23) | (0.19) | (0.29) |
| Gender | -0.437 | 0.162 | -0.971*** | -0.143 | 0.636* |
| | (-0.42) | (0.51) | (-0.24) | (-0.19) | (0.31) |
| County | -0.014 | -0.044 | -0.007 | -0.026 | -0.006 |
| | (-0.03) | (-0.04) | (-0.02) | (-0.02) | (-0.02) |
| Pseudo $R^2$ | 0.055 | 0.031 | 0.041 | 0.030 | 0.023 |
| $\chi^2$ | 10.992 | 4.019 | 27.378*** | 27.536*** | 10.666 |

## SAILING

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.0192 | |
| Adjust for Significant Variables | | | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.9808 | | |
| Thinks Unavailable | 0.209 | | |
| Probability of Going | 0.0192 | 0.0039 | |
| Analysis of 40 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.0231 | 421,275 | 9,747 |
| Probability to 50 miles | 0.0000 | | 0 |
| Total Expected Annual Trips | | | 9,747 |
| Adjust for # People | | | |
| Median - 2 - same boat | | | 0 |
| Total Expected Number of Boats | | | 9,747 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.8333 | | |
| Thinks Unavailable | 0.3333 | | |
| Probability of Going | 0.0192 | | |
| Number of Extra Trips | 2 | | 104 |
| Total Adjusted Number of Boats | | | 9,850 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.5385 | | 5,304 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 58 |
| Poisson Distribution 99th Percentile | | | 76 |
| Acreage Required | 40 | acres/boat | **3,040** |

## MOTORBOATING

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.1024 | |
| Adjust for Significant Variables | | | |
| Not Go Adjustment | | 0.023 | |
| Doesn't Go | | | |
| Thinks Unavailable | 0.8976 | | |
| Probability of Going | 0.1526 | | |
| Analysis of 40 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.1394 | 212,419 | 29,617 |
| Probability to 50 miles | 0.0415 | 337,476 | 14,016 |
| Total Expected Annual Trips | | | 43,633 |
| Adjust for # People | | | |
| Median - 2 - same boat | | | 0 |
| Total Expected Number of Boats | | | 43,633 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.8438 | | |
| Thinks Unavailable | 0.1176 | | |
| Probability of Going | 0.1024 | | |
| Number of Extra Trips | 2 | | 887 |
| Total Adjusted Number of Boats | | | 44,519 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.5361 | | 23,867 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 259 |
| Poisson Distribution 99th Percentile | | | 298 |
| Acreage Required | 50 | acres/boat | **14,900** |

## BOARDING ACTIVITIES

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.048 | |
| Adjust for Significant Variables | | | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.952 | | |
| Thinks Unavailable | 0.1351 | | |
| Probability of Going | 0.048 | 0.0062 | |
| Analysis of 40 mile median trip | **Probability** | **Population** | **Total #** |
| Probability within median trip (Sum of Column C above) | 0.0542 | 549,895 | 29,790 |
| Probability to 50 miles | 0.0000 | | 0 |
| Total Expected Annual Trips | | | 29,790 |
| Adjust for # People | | | |
| Median - 2 - same boat | | | 44,685 |
| Total Expected Number of Boats | | | 74,474 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.7667 | | |
| Thinks Unavailable | 0.2286 | | |
| Probability of Going | 0.048 | | |
| Number of Extra Trips | 2 | | 1,253 |
| Total Adjusted Number of Boats | | | 75,727 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.6585 | | 49,867 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 542 |
| Poisson Distribution 99th Percentile | | | 597 |
| Acreage Required | 20 | acres/boat | **11,940** |

## JET SKIING ACTIVITIES

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.0416 | |
| Adjust for Significant Variables | | | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.9584 | | |
| Thinks Unavailable | 0.1474 | | |
| Probability of Going | 0.0416 | 0.0059 | |
| Analysis of 40 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.0475 | 212,419 | 10,085 |
| Probability to 50 miles | 0.0089 | 271,744 | 2,419 |
| Total Expected Annual Trips | | | 12,504 |
| Adjust for # People | | | |
| Median - 2 - same boat | | | 25,008 |
| Total Expected Number of Boats | | | 37,512 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.8462 | | |
| Thinks Unavailable | 0.2 | | |
| Probability of Going | 0.0416 | | |
| Number of Extra Trips | 2 | | 528 |
| Total Adjusted Number of Boats | | | 38,040 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.6765 | | 25,734 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 280 |
| Poisson Distribution 99th Percentile | | | 319 |
| Acreage Required | 20 | acres/boat | **6,380** |

## FISHING

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.4688 | |
| Adjust for Significant Variables | | | |
| Gender | | 0.0148 | |
| Parent | | -0.0083 | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.5312 | | |
| Thinks Unavailable | 0.1351 | | |
| Probability of Going | 0.4688 | 0.0336 | |
| Analysis of 15 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.5089 | 192,675 | 98,060 |
| Probability to 50 miles | 0.1742 | 357,220 | 62,214 |
| Total Expected Annual Trips | | | 160,274 |
| Adjust for # People | | | |
| Median - 1 - same boat | | | 0 |
| Total Expected Number of Boats | | | 160,274 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.7808 | | |
| Thinks Unavailable | 0.1586 | | |
| Probability of Going | 0.4688 | | |
| Number of Extra Trips | 2 | | 18,609 |
| Total Adjusted Number of Boats | | | 178,883 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.427 | | 76,383 |
| Number of Days | | | 92 |
| Peak Average Boats per Day | | | 830 |
| Poisson Distribution 99th Percentile | | | 898 |
| Acreage Required | 20 | acres/boat | **17,960** |

## SWIMMING IN AN OUTDOOR POOL

| Step in Calculation | | Calculation | |
|---|---|---|---|
| Base Probability | | 0.6496 | |
| Adjust for Significant Variables | | | |
| Age | | 0 | |
| Income | | 0.0440 | |
| Parent | | -0.0055 | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.3504 | | |
| Thinks Unavailable | 0.1319 | | |
| Probability of Going | 0.6496 | 0.0300 | |
| Probability of Swimming | | 0.7181 | |
| Adjust for Imperfect Substitute | 0.2931 | 0.2105 | |
| **Analysis of 5 mile median trip** | **Probability** | **Population** | **Total #** |
| Probability within median trip (Sum of Column C above) | 0.2105 | 120,305 | 25,321 |
| Probability to 50 miles | 0.0858 | 429,560 | 36,844 |
| Total Expected Annual Trips | | | 62,165 |
| Adjust for # People | | | |
| Median - 3 - 3 additional people | | | 186,494 |
| Total Expected Number of People | | | 248,659 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.8144 | | |
| Thinks Unavailable | 0.1642 | | |
| Probability of Going | 0.6496 | | |
| Number of Extra Trips | 2 | | 43,201 |
| Total Adjusted Number of People | | | 291,860 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.7148 | | 208,622 |
| Number of Days | | | 92 |
| Peak Average Swimmers per Day | | | 2,268 |
| Poisson Distribution 99th Percentile | | | 2,379 |
| Acreage Required | 0.18 | acres/swimmer | **428** |

## SWIMMING IN A LAKE OR RIVER

| Step in Calculation | Calculation | | |
|---|---|---|---|
| Base Probability | | 0.2944 | |
| Adjust for Significant Variables | | | |
| Age | | 0.0000 | |
| Parent | | -0.0016 | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.7056 | | |
| Thinks Unavailable | 0.2072 | | |
| Probability of Going | 0.2944 | 0.0430 | |
| Analysis of 15 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.3359 | 192,675 | 64,712 |
| Probability to 50 miles | 0.1150 | 357,220 | 41,066 |
| Total Expected Annual Trips | | | 105,778 |
| Adjust for # People | | | |
| Median - 3 - 3 additional people | | | 317,334 |
| Total Expected Number of People | | | 423,112 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.7228 | | |
| Thinks Unavailable | 0.2188 | | |
| Probability of Going | 0.2944 | | |
| Number of Extra Trips | 2 | | 39,399 |
| Total Adjusted Number of People | | | 462,511 |
| Calculate Peak Required Acreage | | | |
| Summer Peak | 0.7679 | | 355,162 |
| Number of Days | | | 92 |
| Peak Average People per Day | | | 3,860 |
| Poisson Distribution 99th Percentile | | | 4,006 |
| Acreage Required | 0.18 | acres/swimmer | **721** |

## WATERFOWL HUNTING

| Step in Calculation | | Calculation | |
|---|---|---|---|
| Base Probability | | 0.0192 | |
| Adjust for Significant Variables | | | |
| Not Go Adjustment | | | |
| Doesn't Go | 0.9808 | | |
| Thinks Unavailable | 0.2029 | | |
| Probability of Going | 0.0192 | 0.0038 | |
| Analysis of 20 mile median trip | Probability | Population | Total # |
| Probability within median trip (Sum of Column C above) | 0.0230 | 212,419 | 4,890 |
| Probability to 50 miles | 0.0086 | 271,744 | 2,346 |
| Total Expected Annual Trips | | | 7,236 |
| Adjust for # People | | | |
| Median - 1 - 1 additional hunter | | | 7,236 |
| Total Expected Number of Hunters | | | 14,472 |
| Adjust for Wanting to Go More Often | | | |
| Wants to go more often | 0.9167 | | |
| Thinks Unavailable | 0 | | |
| Probability of Going | 0.0192 | | |
| Number of Extra Trips | 2 | | 0 |
| Total Adjusted Number of Hunters | | | 14,472 |
| Calculate Peak Required Acreage | | | |
| Fall/Winter Peak | 0.4167 | | 6,030 |
| Number of Days | | | 90 |
| Peak Average Hunters per Day | | | 67 |
| Poisson Distribution 99th Percentile | | | 87 |
| Acreage Required | 18 | acres/hunter | **1,566** |