Chapter 2

Economic Value of Recreation on the Sacramento River

Results of a Year-Long Survey of Recreational Visitors at all Public Access Sites on the Sacramento River

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All errors are the responsibility of the authors.

1. Introduction

The objective of this report is to present the results of a year-long survey of recreational visitors to the Sacramento River. To the best of our knowledge this was the most extensive effort to collect data on all recreational visitors, and activities on the Sacramento River. Therefore, this report presents the first comprehensive account of the use of the Sacramento River by recreational visitors. In this report, we document the survey development, site selection, and survey implementation process. We also present the main trends and summary statistics in the data as well as estimates of the economic value of recreational use of the River using the individual travel cost method.

This report is the second in a series of two reports, titled Chapter 1 and Chapter 2 respectively, documenting the economic value of recreational use of the Sacramento River. Chapter 1, titled 'Economic Value of the Sacramento River to Freshwater Anglers: A Zonal Travel Cost Approach', presented the estimates of the direct use benefits of the Sacramento River in northern California to recreational anglers, utilizing California Department of Fish and Wildlife (CDFW) Creel Survey data and data from secondary sources (primarily US Census / American Community Survey Data).

In this Chapter we broaden the scope of our study by collecting and analyzing data on all recreational activities on the River, such as hunting, wildlife viewing, boating, bicycling, photography etc. in addition to fishing. The year-long survey conducted by the research team, referred to as the Forum Survey from here onwards, elicited information on the duration and purpose of the trip, any related spending by the visitor, as well as characteristics of the visitor. These data complement the information in the creel survey data. We also present a comparison of the estimates of the economic value from Chapter 1.

2. Survey Development, Site Selection, and Logistics of Survey Implementation

2.1. Survey Development

The research team prepared a draft copy of the survey in Summer 2014 and pre tested it several times at Tehama County River Park, a popular boat launch and picnic area also commonly referred to as "Woodson Bridge". The survey instrument was revised as a result of these pretests to keep it simple, short, and concise while still obtaining a wide array of information. Rather than asking survey participants to fill out the form, it was decided that surveyors should hold the survey on a clipboard and administer the survey verbally. On average, each survey was completed in 5-7 minutes depending on the nature of the responses. A complete text of the survey is included in Appendix B.

We also developed a survey log form, which each survey team member was to fill out on each survey trip. The survey log form collected information on number of cars parked in the parking lot of the site, the time of the survey team's arrival and departure, and the number of survey contacts made along with numbers of refusals. This information, in conjunction with the information gathered via the survey, was used to estimate the total number of visitors to each

site, as discussed in section 3.2. A complete text of the survey log form is also included in Appendix B.

2.2. Study Area

This study was conducted across 26 sites across six counties, which together account for nearly all public access sites along the Sacramento River within the Sacramento River Forum's service area of the confluence with the Feather River at Verona to the foot of Keswick Dam. The 26 sites include 13 boat launches, and 13 general recreation sites with parking areas. Users of public recreational sites without parking areas, such as those "boat-in-only" sites of the Sacramento National Wildlife Refuge, are intercepted at the nearest boat launch.

We decided to survey all 26 sites, randomly distributing our survey trips to each site over weekend-weekdays and am-pm hours. The goal was to get as accurate and complete a picture as possible of the nature and extent of recreational activities and recreational visitors visiting all these sites. The 26 different sites included 13 sites that had a boat ramp therefore a large fraction of the survey includes fishermen. Table 1 shows the county each site is within, and the agency responsible for managing the site. Figure 1 shows the location of each site, along with the corresponding Site ID designated by the research team.

2.3. Survey Implementation

A total of 25 students from California State University, Chico participated in the survey implementation that began on 18 September 2014 and ended on 11 October 2015. Overall 3,120 hours were spent on the survey implementation over the year-long survey process, or 260 hours per month on average. Students were primarily Economics majors, but the survey team also included members from Agriculture, Environmental Science, and Geography and Planning[2]. We will refer to our student team members as surveyors from now onwards. Appendix A lists the names of all surveyors by the semester during which they participated with the project.

In the field, surveyors surveyed a specific site or site cluster (area of two or more sites in close proximity that could be surveyed at one time) for increments of 3-4 hours at a time. Two survey shifts were designated for each survey day: AM shifts occurred between 9:00 and 13:00 during spring and summer months and between 10:00 and 14:00 during fall and winter months, while PM shifts occurred between 16:00 and 20:00 during spring and summer months and between 15:00 and 19:00 during fall and winter months. Due to various circumstance encountered in the field, some survey trips deviated from this schedule. For instance, for the sake of maximizing the travel budgets, some teams opted combine two shifts at one site or site cluster into one eight-hour shift. All deviations from the standard survey schedule are recorded in a log document completed by each surveyor.

We surveyed more heavily on the weekends when the recreational sites receive more visitors. A total of 797 recreational visitor surveys were collected during a year-long survey period of which

[2] Of the 25 student interns, 4 were hired as paid interns for all or part of their participation with the survey. The remaining 21 interns were compensated in the form of course credit either in Economics or within their own major.

169 surveys were collected between September 2014 and December 2014, 249 surveys were collected between January 2015 and May 2015, and 379 surveys were collected between June 2015 and September 2015. Overall, 225 surveys were collected on weekdays, and 572 surveys were collected on weekends.

3. Summary Statistics and Key Trends

Individuals were asked about the distance traveled, travel time, the expenses they incurred traveling, the length of their trip, how much time they spent at the site, the quality of their recreation experience at the site, their perception of the site's environmental quality, and characteristics of the site and residence.

Table 2 shows the distribution of primary recreational activities amongst the visitors. The most common recreational activities surveyed were boat fishing at 304 surveys (38.1%), followed by shore fishing at 148 surveys (18.6%). The next-most common activities were dog walking at 84 surveys (10.5%), picnicking at 41 surveys (5.1%), and hunting at 34 surveys (4.3%). The remaining listed activities – wildlife viewing, bird-watching, photography, camping, and boating - accounted for just 71 surveys in total (less than 9% cumulatively). 82 surveys (10.3%) were from respondents choosing "Other" as their primary recreational activity, a category that included write-in responses such as swimming, horseback riding, tubing, live-action role-playing, cycling, and 'hanging out'.

These recreational activities may be broadly grouped into those activities, which involve removing something from the natural environment – a 'consumptive activity' such as fishing or hunting[3], and those do not – a 'non-consumptive activity'. Table 2 shows that of 797 total surveys collected, 486 (61%) were from visitors engaged in a consumptive recreational activity activity while 311 were from visitors engaged in a non-consumptive activity. The amount of visitors engaging in consumptive activities as a percentage of overall visitors varied greatly across sites, see Figure 2 for a look at consumptive vs. con-consumptive uses across sites.

Overall, visitors were pleased with their recreational experience – the average level of satisfaction reported by visitors was 7.6 out of 10. As shown in Fig. 3, consumptive users reported lower satisfaction – 7.4 out of 10, versus their non-consumptive counterparts, whose average satisfaction was 8.8. This fact may be explained by the poor salmon run of the 2014-2015 season in the Sacramento River, as a large percentage of consumptive visitors were engaged in salmon fishing.

Fig. 4 shows that the vast majority (98.2%) of survey respondents reached the site via motor vehicle. For those who did, the average one-way travel distance was 31.7 miles. For those who reached the site on foot, bicycle, or by other means, the average travel distance was 7.1 miles.

A large majority (631 of 793, or 79.6%) of survey respondents were male. As shown in Fig. 5, males and females differed in the overall types of recreational uses they were engaged in – while

[3] The consumptive category includes recreationists that practice catch and release fishing, which precludes the consumption of fish.

436 of 631 males surveyed (69.1 percent) were engaged in consumptive activities, only 47 of 162 (29.0 percent) of females were engaged in such consumptive activities**.**

Visitors varied in age from 14 to 81, with a plurality (188 of 785) of respondents being in the 50-59 year-old age group. Respondents in the 40-49 year-old age group were the most likely to be engaged in consumptive activities (66.4 percent), while those in the 14-19 year-old group were the least likely to be engaged in such an activity (44.8 percent.) The overall median age for all survey participants was 44 (See Fig. 6).

Visitors were asked to indicate the level of formal education they have completed according to six categories ranging from "some school" to "post-graduate". A plurality of respondents (214 of 788 or 27.2 percent) indicated that a high school diploma was the highest level of formal education they received. This education group was also the most likely to be engaged in a consumptive activity (69.6 percent), while those who had completed some type of post-graduate education were the least likely (47.4 percent) to be engaged in a consumptive activity. Overall, 94.5 percent of visitors had obtained *at least* a high school diploma, while 43.6 percent of visitors had completed some type of post-secondary degree whether it be trade school, an associate's degree, or a bachelor's degree (See Fig. 7).

Visitors were asked to identify their household incomes according to twenty ranges each consisting of $10,000 increments. A plurality of visitors (75 of 648, or 11.6 percent of visitors reporting their income) indicated a household income of between $40,000 and $49,999. In general, visitors with lower household incomes were less likely to be engaged in consumptive activities than those with the highest incomes. Of the 164 visitors surveyed who reported a household income of less than $40,000 annually, 79 (48.2 percent) were engaged in consumptive activities, while among the 180 visitors surveyed who reported a household income of at least $100,000 annually, 121 (67.2%) were engaged in a consumptive activity (See Fig. 8).

4. Estimation of Total Annual Visitor Counts

We assume that the distribution of visitors to a site was uniform throughout the daylight hours and therefore the number of visitors counted at the site, from the count of number of cars parked at the time when our survey team took the count, can be linearly projected to the total number of daylight hours. We account for the higher number of visitors on weekends and estimate the total number of visitors to each site for weekends and weekdays separately. We also account for the ebb and flow of different recreational activities in different seasons by estimating separate estimates for each season. We estimate the total visitor count V_{isw} at a site *i* in season *s* for weekends/weekdays as follows:

$$V_{isw} = Cars_{isw} \times \frac{daylight\ hours_s}{mean\ duration\ of\ stay_{is}} \times days_{sw} \times mean\ party\ size \qquad (1)$$

where $Cars_{isw}$ refers to mean number of cars parked and counted by our survey team at site *i* in season s for weekend/weekdays, $daylight\ hours_s$ refers to the number of daylight hours in season s; we assume 12 daylight hours in Fall, and Spring,10 in Winter and 14 in Summer; $mean\ duration\ of\ stay_{is}$ refers to the mean duration of stay reported by all visitors surveyed at

that site i in season s, and $days_{sw}$ refers to the weekend or weekday days in seasons. Seasons are of course Fall (September, October and November), Winter (December, January, and February), Spring (March, April and May) and Summer (June, July and August).
Mean party size refers to number of adults per car. We aggregate the estimate of equation (1) for 4 seasons and all weekends and weekdays in each season to arrive at an annual estimate of total visitors to each site as follows:

$$V_i = \sum_{s,w} V_{isw} \quad (2)$$

Once we obtained the total number of visitors at each site, we calculated the ratio of visitors who reported they were there for fishing and hunting (consumptive use) or other activities such as hiking or dog walking (non consumptive uses). We assumed that ratio stayed constant throughout the season and calculated the number of visitors at each site by use as follows:

$$V_{iuse} = prop\ of\ cons\ use\ surveys_s \times V_i \quad (3)$$

The resulting estimates are given below in Tables 4 and 5. Our estimate of annual visitors at all sites for hunting and fishing is 77,538 visitors and for all other activities is 61,879 visitors with a total of 139,417.

5. Economic Value of Recreation on the Sacramento River

5.1. Count Data Model for Number of Trips Taken

We use answers to the question in the survey (Q#9) "How many times do you expect to visit this recreational site in the next 12 months?" The mean number of trips is 32 and the median is 12 indicating that most visitors do not take a large number of annual trips. Figure 9 shows the histogram of number of trips reported by our survey participants, which reveals that most visitors do not take a large number of annual trips and is proportionate to a model using a Poisson distribution.

We choose count data models to estimate recreational demand in the Sacramento River, explicitly recognizing that the number of visits (the dependent variable), is distributed discretely. Count data models are designed for handling non-negative integers, truncation, large number of single annual trips in the data, and preference heterogeneity. Count data models are therefore quite useful for single-site demand function estimation (Parson, 2013). Ordinary least square (OLS) models were better-suited for analyzing recreational demand from the creel data (Chapter 1) because the dependent variable was visitation rate from a zip code-- a continuous variable. Use of OLS methods for discrete data, however, can lead to biased estimation, although the difference in our choice of estimation models between the creel data and the Forum survey can make the WTP estimates more different rather than similar, as we will see in the results section.

We choose the Poisson model, the simplest and the most commonly used count data model to estimate recreational demand.[4] The number of annual trips is denoted as Y, which takes values

[4]Overdispersion occurs when the variance in the number of trips is much greater than the mean which may occur when few visitors take many trips while most visitors make only a few. We investigated the presence of

1, 2, 3,…. An individual's probability of making *Y* trips to a site in a given year in the Poisson Model is expressed as:

$$Prob(Y = y, y = 1,2, \ldots.) = \frac{exp(-\lambda)\lambda^y}{y!} \quad (4)$$

where the parameter λ is the expected number of trips and is a function of independent variables specified in the model as $\lambda = f(P, Z; \beta)$ where P, Z are travel cost to site (P) and demand shift variables (Z), such as income, age, and education, and β is a vector of coefficients to be estimated. In a Poisson model, the expect value and variance of Y are equal to λ. To ensure nonnegative probabilities, λ takes a log-linear form and yield the following estimate equation:

$$\lambda = exp(P, Z; \beta) \quad (5)$$

Following the creel survey analysis conducted in the previous chapter, travel cost, income, education attainment, gender, and age. We once again expect visitation and travel cost to be negatively related, and both education and age to be positively related to visitation. Income is also included but the relationship between income and visitation may be negatively or positively related depending on whether the recreation activity is an inferior or normal good. Also, as we can see from the summary statistics in section 2, we have too few observations for some recreational activities to conduct a separate regression for each activity. However, tastes and preferences across anglers and hunters are likely to be similar and therefore we group fishermen (or anglers) with hunters and refer to these two activities 'consumptive' recreational activity. Both are highly seasonal and entail removal or consumption of a biological resource from the site. All other activities, bird watching, wildlife viewing, photography, picnicking, camping boating/kayaking/canoeing, hiking or walking, dog walking etc. are referred to as consumptive use activities.[5] We create a Consumptive Use dummy variable that takes a value of 1 if the visitor was surveyed while pursuing consumptive use activities, and 0 otherwise. This allows us to estimate the following equation:

$$\lambda_i = exp(\alpha + \beta_1 TC_i + \beta_2\, Income_i + \beta_3 Degree_i + \beta_4\, Male_i + \beta_5 Age_i + \beta_6 Consumptive_i) \quad (6)$$

for i = 1,…., n individuals.

where the definition of the variables is given below:

λ_i = is the number of annual trips to the Sacramento River site where survey took place for individual *i*;
TC_i = is the cost of traveling from the origin of individual *i* to the specified site = (AAA cost per

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overdispersion by using a negative binomial model and found that the likelihood-ratio test of alpha which compares the negative binomial model to the Poisson model does not reject the null hypothesis that overdispersion does not exist, suggesting that the Poisson model is more appropriate than the negative binomial model. Furthermore, the negative model performed poorly overall. We have therefore not reported the results of the negative binomial model but they are available upon request.

[5] Another way to refer to these two activities are passive use versus non-passive use activities.

mile*round trip distance in miles + 0.33(hourly wage rate*round trip travel time);
$Income_i$ = is the income of individual *i*;
$Degree_i$ = 0 or 1 and is a dummy variable defining a visitor as having earned trade school, bachelor, or post grad degree or (0) if no college or advanced degree.
$Male_i$ = 0 or 1 and is a dummy variable defining if the visitor is Male (1) or Female (0);
Age_i = Age of individual, *i*;
$Consumptive_i$ = 0 or 1 and is a dummy variable defining the activity as shore fishing, boat fishing or hunting (1) or (0) if any other recreational activity.

The next sub-section presents results of the model in equation (6). We first present results of the model when applied to all data, and then separately by consumptive and non consumptive use activities (Table 6), followed by results for visitors interviewed at each river section (Table 7), and finally to enable direct comparison with creel data we restrict our sample to only fishermen and present results for fishermen interviewed at each river section (Table 8).

5.2. Results of the Count Model

Table 6 shows that all explanatory variables are significant at 1% significance level. There is a negative and significant relationship between the number of annual visits and travel cost. The travel cost coefficient is -0.0028557. This means that $1 increase in travel cost is associated with about 0.3% decrease in the number of visits. Age and income of the recreational visitor are positively associated with number of trips taken. Summary statistics indicate that 82% of all visitors are male but the regression results show that males visit the Sacramento River less frequently annually than females. Individuals with college degrees visit less than individuals without a college degree. Visitors pursuing consumptive activities (i.e. fishing or hunting) are expected to visit less often than those visiting for non-consumptive activities (hiking, picnicking etc.). The expected difference in the log annual visit counts between consumptive recreationist and non-consumptive recreationists is 0.241.

As Haab and McConnell (2002) have shown Willingness to pay per visit (WTP) for the Poisson model demand equation defined in (6) is equal to:

$$WTP = \frac{1}{-\beta_1} \qquad (7)$$

The average WTP per visit during the 2014-2015 period is $350 per trip, which exceeds the highest the WTP estimates, $290, determined in chapter one, for section 7. We will comment on the comparison of estimates between the creel and the Forum survey in the Discussion section below.

Creel survey analysis indicated that the six sections differ significantly in terms of angler origin, species targeted, seasonality, method of fishing, and average travel time and distance to site and willingness to pay for anglers. Following the analysis in Chapter 1, we next considered separate regressions for each section, utilizing visitation data for all recreational users. Table 7 shows that sectional results are consistent with the pooled data analysis in Table 6, in that all variables are significant and have the same sign in the pooled regression and all sections. We do find that willingness to pay varies significantly across sections. The willingness to pay in sections 4, 5, 6,

and 7 are $1896.45, $339.42, $287.51 and $571.79 respectively. We no longer observe willingness to pay to be strictly increasing as we move to sections further north as we did in the creel analysis. In fact, the site furthest south, Section 4, displays by far the highest willingness to pay.

We next investigate whether willingness to pay differs across activities to examine whether the inclusion of all types of recreationists explains why the pattern of WTP across sections differs between chapter one and two.

While results from the regression analysis in chapter 1 provide evidence that visitation and willingness to pay is significantly different from site to site, the lack of observations in some sections prevents us from once again conducting cross-section analysis for each section. As previously stated, there were too few observation for some recreational pursuits listed in the survey for each activity to be assessed separately and thus activities were aggregated. Based on our belief that tastes and preferences across anglers and hunters are likely to be similar, we chose to investigate whether willingness to pay varied across consumptive and non-consumptive recreationists. The separate regressions for consumptive and non-consumptive were once again consistent in terms of the sign and significance of the explanatory variables with each other and the pooled data regression. Results indicate that willingness to pay varies significantly across consumptive and non-consumptive recreationists.

The willingness to pay for anglers and hunters is $1944 per trip while the willingness to pay is only $86.70 for non-consumptive recreationists. As shown in Figure 2, consumptive use visitors dominate Section 4 (sites U01 and Y01). Of the 13, 945 total visits estimated, only 517 visits were by non-consumptive recreationist while consumptive recreationist were estimated to visit 13,427 times. This may explain why the willingness to pay for section 4 is so much higher than sections 5,6, and 7. The number of visits estimated was much more evenly distributed across consumptive and non-consumptive visitors in sections 5,6, and 7. We will next revisit regressions by section but will consider anglers only. This specification is most similar the analysis in chapter one, given that only anglers are surveyed in CDFW Creel Survey.

The separate regressions for each section were once again consistent in terms of the sign and significance of the explanatory variables with each other and the pooled data regression. Results of the regression once again show that the willingness to pay does vary by the section. The willingness to pay per visit for section 4, 5, 6, and 7 are $749.63, $515.17, $3675.12 and $1005.53 respectively. While we still do not observe strictly increasing willingness to pay across sections as we move north, the willingness to pay of the two northern sections, section 6 and 7, is substantially larger than the willingness to pay for the two southern sections, section 4 and 5.

When analyzing the data across activities, we observe that the willingness to pay is lower for non-consumptive visitors but they are likely to visit more often, all else constant, than consumptive users. Total annual value to visitors is dominated by the value to consumptive users that have significantly higher willingness to pay and slightly more estimated visits.

5.3. Economic Value of the Sacramento River to the Recreational Visitors

Using the statistical results from the model and the visitor day use estimated in section 4, allows for the estimation of the current value of all recreation opportunities at the Sacramento River as follows:

$$Total\ annual\ value = WTP \times V \quad (8)$$

In estimating the average total annual value to recreations of the Sacramento River, we will use the willingness to pay estimates derived from the pooled regression and the consumptive and non-consumptive use regressions, since the anglers-only estimates are only derived for a subsample and do not represent the entire sample of the survey. For the pooled data analysis, the total annual value to recreationists of the Sacramento River for the 2014-2015 period is the product of the estimated annual visitation, 139,417, and the estimated WTP per visit $350, which is $48,795,950.

For the analysis that distinguished between consumptive and non-consumptive visitors, the average total annual value to recreationists of the Sacramento River for the 2014-2015 period, is the sum of the product of the estimated annual visitation of consumptive visitors and the estimated WTP of consumptive users and the product of estimated annual visitation of non-consumptive visitors and the estimated WTP of non-consumptive users.

The estimated annual visitation of consumptive visitors 77,538, and the estimated WTP of consumptive users, $1944.39 yields a product of $150,764,111 while the product of estimated annual visitation of non-consumptive visitors 61,879, and the estimated WTP of non-consumptive users, $86.70 yields $5,364,909. The sum of the products and total annul value to recreationists of the Sacramento River is estimated to be $156,129,020

5.4. Comparison of the Creel and Forum Data Estimates of WTP

Table 9 lists the results of the creel survey analysis of Chapter 1 and the results derived in this chapter. The comparison reveals, as expected, that willingness to pay estimates vary across data sources and model specification. The willingness to pay estimates from the Forum survey are larger than those derived from the creel survey data. The estimates from the creel survey ranged between $100 to $290 per trip, while the Forum survey estimates range between the lowest estimate of $287 to the highest value of $1,896. Restricting the Forum survey data to only anglers (since the creel data only surveys anglers) to allow a more apples-to-apples comparison with creel data, the estimates from the Forum survey are even higher. For anglers only, they range from $515 to $3,675.

So, this difference in estimates raises the question: which estimates are to be believed? Below, we will go into the reasons for expecting different estimates, which will help us assess which estimates are closer to the true values. The Creel Survey analysis in Chapter 1 and the currently presented Forum Survey analysis has three main differences.

First, the data collection processes used in the two data sources are vastly different. The Creel Survey is a result of the California Department of Fish and Wildlife (CDFW) conducting a very short survey of only anglers on a very vast stretch of the river. Given the lack of demographic

information in the creel data, we assumed that each person interviewed by the CDFW was like the median person from her zip code. This was a necessary assumption to conduct the economic analysis, but one that significantly dampened the estimates of WTP. The Forum Survey, in contrast, collected demographic information of each visitor surveyed and a key discovery for the research team was that the income of the average person interviewed on the river was *higher* than the median income in her home zip code. In other words, likelihood to engage in outdoor recreation is higher as income increases and hence the average person recreating (and surveyed by our surveyors) has a *higher* income than the average person in her respective zip code. Higher income translates directly into higher WTP estimates. So, a partial explanation of higher estimates obtained from the Forum Survey is that the Forum Survey has more precise information on income of recreational visitors. This suggests that the Forum Survey estimates are closer to the true value.

Second, the time period under study is different for both data sets. The Creel Survey covered the years 2007 to 2011 while the Forum Survey was conducted from September 2014 to October 2015. The Chinook population collapsed in 2007 and was in the early stages of the recovery in the later years. Moreover, this is also the period of the most severe downturn in the macroeconomy, which may also lower recreational visits and spending. Analysis of multiple years of the Creel Survey in Chapter 1 has shown the annual swings in the visitation rates are likely to result form weather changes, crash or boom in the salmon or other fish population, or the overall macroeconomic situation. This also suggests that if we were to undertake the Forum Survey next year, the estimates will be very likely different. After all, 2014-15, one of the most severe drought years experienced in recent memory, was not a typical year. So, this discussion suggests that the differences in the years sampled in the two data sets may make the comparison across two studies very difficult.

Third, the empirical models used to arrive at the WTP estimates in both chapters are also different: the Creel Survey examined visitation rate from a zip code, defined as the ratio of number of visitors from a zip code to the population of that zip code while the Poisson model used the number of trips each person reported they take in a year to that site.[6] The former utilized the zonal travel cost, and the latter used the individual travel cost method. The individual travel cost method is similar to the zonal travel cost method, but uses survey data from individual visitors (rather than average data from each zone or zip code) to estimate the recreational value of the Sacramento River. The individual travel cost method requires more data and possibly more complicated analysis, but is more precise. Moreover, we arrived at the estimated count of the visitors to each site by counting the number of cars parked in the lot at weekend, weekdays, am and pm times throughout the year. So, this again suggests that the Forum Survey results are a more precisely capturing the value of the Sacramento River.

A benefit of arriving at the WTP estimates from two different data sources and methodologies is that we are able to uncover the sources of sensitivities of the estimates. Clearly, demographic information, particularly income data, is very important. Also, we are able to estimate the value that non-fishermen place on the river, which would have been entirely missed if we had not

[6] While this variable, number of annual trips to the site, may have some hypothetical or recall bias, we think that this information is more accurately reflecting the use of the recreational sites by each person interviewed than the visitation rate.

conducted the Forum Survey. Also, a key similarity in the nature of results from both surveys is that when we considered only anglers in our survey we determined that anglers have a higher willingness to pay for northern sections than southern sections, similar to the creel analysis. We therefore think that both studies complement each other.

6. Conclusion

We presented the results of the Forum Survey analysis. The estimated annual visitation of consumptive visitors 77,538, and the estimated WTP of consumptive users, $1944.39 yields a productive of $150,764,111 while the product of estimated annual visitation of non-consumptive visitors 61,879, and the estimated WTP of non-consumptive users, $86.70 yields $5,364,909. The sum of the products and total annul value to recreationists of the Sacramento River is estimated to be $156,129,020

To conclude, the incremental change in value to recreationist of the Sacramento River, due to conservation efforts along the river could not be determined given that neither data set analyzed contained observations of recreational activity prior to conservation efforts. To fully understand how recreationists value an increase in access, quantity, or quality of recreational sites along Sacramento River detailed surveys must administered on an annual basis. What is unmistakable though, is that the willingness to pay and total annual value to recreationists of the Sacramento River is significant regardless of sample and specification in Chapters 1 and 2.

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Table 1: Survey Sites

SiteID	Site Name	County	Agency Name
C01	Colusa / Sacramento River State Park	Colusa	California Department of Parks and Recreation
U01	Tisdale Weir Boat Launch	Sutter	County of Sutter
Y01	Knight's Landing Boat Launch	Yolo	County of Yolo
B01	Pine Creek Unit	Butte	United States Fish and Wildlife Service
B02	Pine Creek Boat Launch	Butte	California Department of Parks and Recreation
B03	Indian Fishery / Bidwell State Park	Butte	California Department of Parks and Recreation
B04	Big Chico Creek Day Use Area	Butte	California Department of Parks and Recreation
G01	Irvine Finch River Access	Glenn	California Department of Parks and Recreation
G02	Ordbend Park	Glenn	County of Glenn
G03	Ord Bend Unit	Glenn	United States Fish and Wildlife Service
G04	Butte City Launch Facility	Glenn	County of Glenn
G05	Sul Norte Unit	Glenn	United States Fish and Wildlife Service
G06	Packer Unit	Glenn	United States Fish and Wildlife Service
G07	Drumheller Unit	Glenn	United States Fish and Wildlife Service
T01	Jelly's Ferry Launch Area	Tehama	United State Bureau of Land Management
T02	Perry Riffle	Tehama	United State Bureau of Land Management
T03	Paynes Creek	Tehama	United State Bureau of Land Management
T04	Bass Pond	Tehama	United State Bureau of Land Management
T05	Bend Bridge Boat Launch	Tehama	County of Tehama
T06	Sam Ayer / Dog Island Park	Tehama	County of Tehama
T07	Red Bluff Recreation Area	Tehama	Mendocino National Forest
T08	Mill Creek Boat Launch	Tehama	County of Tehama
T09	Woodson Bridge SRA	Tehama	California Department of Parks and Recreation
T10	Tehama County River Park	Tehama	County of Tehama
T11	Rio Vista Unit	Tehama	United States Fish and Wildlife Service
S01	Balls Ferry Boat Ramp	Shasta	County of Shasta

Table 2: Activities Summary

Recreational Activities	# of Surveys	Percent	Consumptive
Shore Fishing	148	18.6%	Yes
Boat Fishing	304	38.1%	Yes
Hunting	34	4.3%	Yes
Wildlife Viewing	10	1.3%	No
Bird Watching	5	0.6%	No
Photography	4	0.5%	No
Picnicking	41	5.1%	No
Camping	23	2.9%	No
Boating/Kayaking/Canoeing	29	3.6%	No
Hiking/Walking	33	4.1%	No
Dog Walking	84	10.5%	No
Other (Swimming, Horseback Riding, Tubing, "Hanging Out")	82	10.3%	No
All Activities	**797**		

Table 3: Summary Statistics

Variable	Mean	Standard Deviation	Min	Max
Visitation	34.43	50.566	0	300
Travel Cost	112.02	429.379	1.449	9752.51
Income	75807.21	49574.47	10000	200000
Degree	.4267516	.4949209	0	1
Male	.8271447	.4170478	0	1
Age	44.19146	15.31904	14	82
Consumptive	.611465	.487728	0	1

Table 4: Total Annual Estimated Visitor Counts by Site

Site ID	River Section Number	Visitors for Consumptive Use (Fishing and Hunting)	Visitors for Non-consumptive Use
C01	4	79	317
U01	4	4,733	-
Y01	4	8,615	200
B01	5	37	185
B02	5	2,409	1,506
B03	5	13,122	16,093
B04	5	-	3,888
G01	5	7,700	1,120
G02	5	7,593	1,350
G03	5	1,591	3,713
G04	5	3,600	220
G05	5	1,020	-
G07	5	444	-
T07	6	4,671	6,072
T08	6	2,312	2,312
T09	6	140	913
T10	6	6,227	6,756
T11	6	-	3,840
S01	7	5,922	846
T01	7	1,641	3,282
T02	7	714	2,142
T03	7	1,003	501
T04	7	738	5,169
T05	7	3,227	1,452
Total Visitors		77,538	61,879
			139,417

Table 5: Total Annual Estimated Visitor Count by River Section

River Section number	Visitors for Consumptive Use (Fishing and Hunting)	Visitors for Non-consumptive Use	Total
4	13,427	517	13,945
5	37,516	28,076	65,592
6	13,350	19,893	33,243
7	13,245	13,393	26,638
Total	77,538	61,879	139,417

Table 6: Results of Poisson Model, by Activity

	Dependent variable: Number of trips in a year		
	(1)	(2)	(3)
Explanatory Variables	All Data	Non-Consumptive Activities	Consumptive Activities
Travel Cost	-0.00286***	-0.000514***	-0.0115***
	(0.000101)	(7.47e-05)	(0.000393)
Income	1.85e-06***	-3.18e-06***	7.02e-06***
	(1.72e-07)	(2.46e-07)	(2.36e-07)
Degree	-0.304***	-0.310***	-0.335***
	(0.0151)	(0.0215)	(0.0216)
Male	-0.142***	-0.171***	-0.201***
	(0.0161)	(0.0287)	(0.0201)
Age	0.00649***	0.00221***	0.00875***
	(0.000470)	(0.000677)	(0.000660)
Consumptive	-0.241***		
	(0.0145)		
Constant	3.684***	3.856***	3.562***
	(0.0252)	(0.0399)	(0.0327)
Observations	615	372	243

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 7: Results of the Poisson Model, by River Section

	Dependent variable: total annual number of trips			
Explanatory variables	Section 4 Visits	Section 5 Visits	Section 6 Visits	Section 7 Visits
Travel Cost	-0.000527**	-0.00295***	-0.00348***	-0.00175***
	(0.000242)	(0.000206)	(0.000154)	(0.000208)
Income	4.06e-06***	5.37e-07*	2.52e-06***	1.79e-06***
	(4.71e-07)	(2.95e-07)	(2.72e-07)	(5.76e-07)
Degree	-1.187***	-0.342***	-0.325***	0.425***
	(0.0676)	(0.0236)	(0.0254)	(0.0516)
Male	-1.136***	-0.0344	-0.203***	-0.188***
	(0.0591)	(0.0265)	(0.0267)	(0.0483)
Age	0.0265***	-0.00635***	0.0153***	0.0159***
	(0.00209)	(0.000721)	(0.000755)	(0.00182)
Consumptive Use	-0.837***	-0.419***	0.129***	-0.287***
	(0.0749)	(0.0239)	(0.0220)	(0.0507)
Constant	3.641***	4.337***	3.279***	2.567***
	(0.166)	(0.0392)	(0.0374)	(0.103)
Observations	69	261	217	68

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 8: Results of the Poisson Model, by River Section (Anglers Only)

Dependent variable: total annual number of trips				
	Section 4	Section 5	Section 6	Section 7
Explanatory variables				
Travel Cost	0.00133***	-0.00194***	-0.000272***	-0.000995***
	(0.000216)	(0.000202)	(4.75e-05)	(0.000257)
Income	-2.45e-06***	8.23e-07**	-7.06e-06***	-1.64e-06*
	(6.22e-07)	(3.86e-07)	(4.65e-07)	(8.92e-07)
Degree	-0.656***	-0.314***	-0.399***	0.539***
	(0.0661)	(0.0341)	(0.0386)	(0.0839)
Male	-1.148***	-0.0423	0.518***	-0.862***
	(0.0616)	(0.0515)	(0.0567)	(0.0878)
Age	0.0278***	-0.0135***	0.00685***	0.0143***
	(0.00215)	(0.00105)	(0.00111)	(0.00312)
Constant	2.996***	4.200***	3.606***	3.019***
	(0.129)	(0.0674)	(0.0666)	(0.139)
Observations	64	153	96	33

Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

Table 9: Total Annual Willingness to Pay (WTP) per Trip for Sacramento River Visitors

	Creel Survey Results	Forum Survey Results			
	WTP by Section (All Activities)	WTP by Section (All Activities)	WTP by Section (Anglers Only)	WTP by Activity (All Sections)	WTP Pooled
Sacramento River Section					
Section 3	$ 80 ρ				
Section 4	$ 100	$ 1896	$750		
Section 5	$ 108	$ 339	$515		
Section 6	$ 228	$ 287	$3,675		
Section 7	$ 290	$ 572	$ 1006		
Section 8	$ 277 ρ				
Activity					
Consumptive				$ 1944	
Non-Consumptive				$ 87	
Pooled					
All Activities and Sections					$ 350

ρ Forum Survey did not include Sections 3 and 8.

Figure 1. Survey Sites

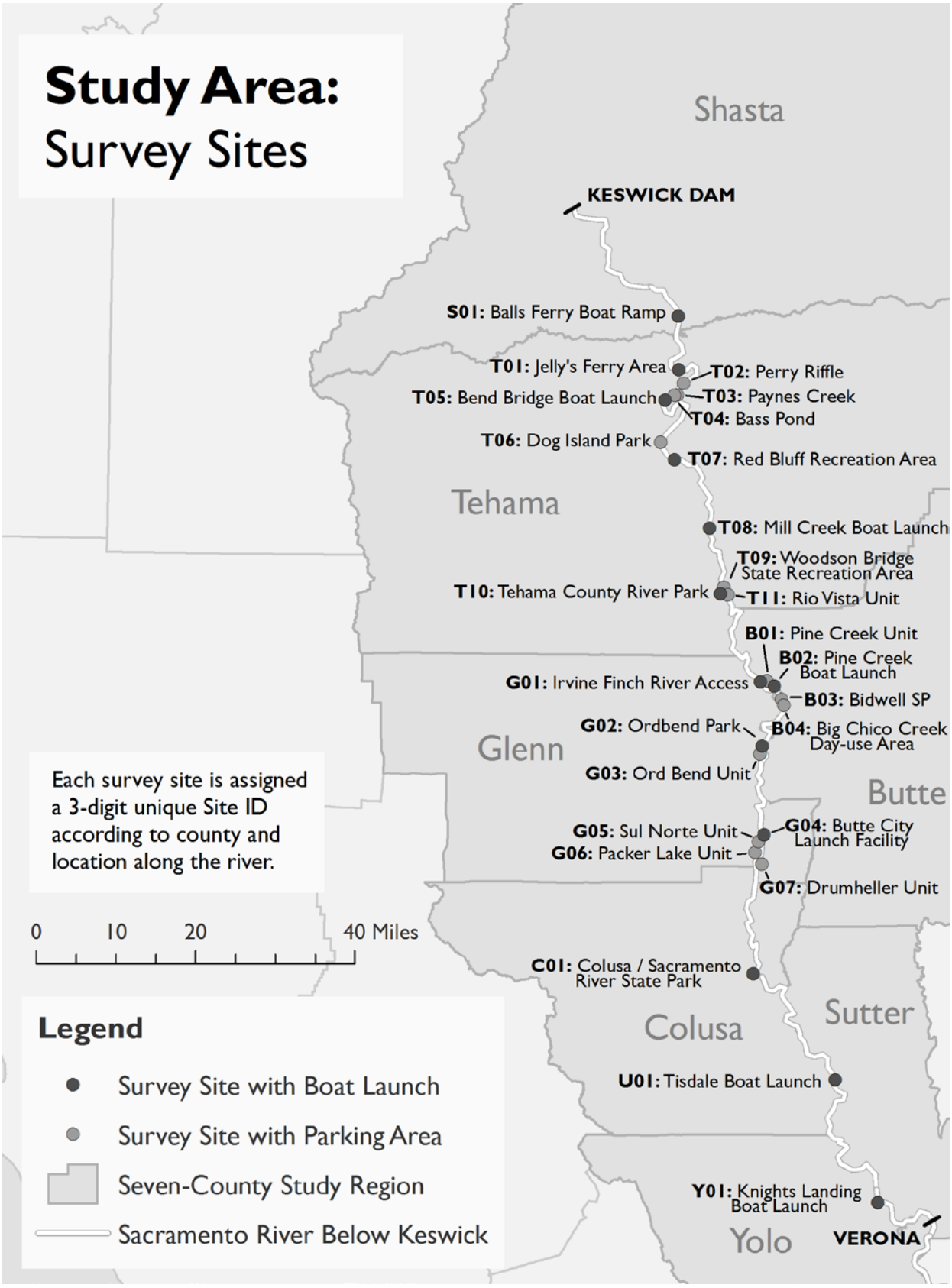


Figure 2. Consumptive vs non-Consumptive Activities

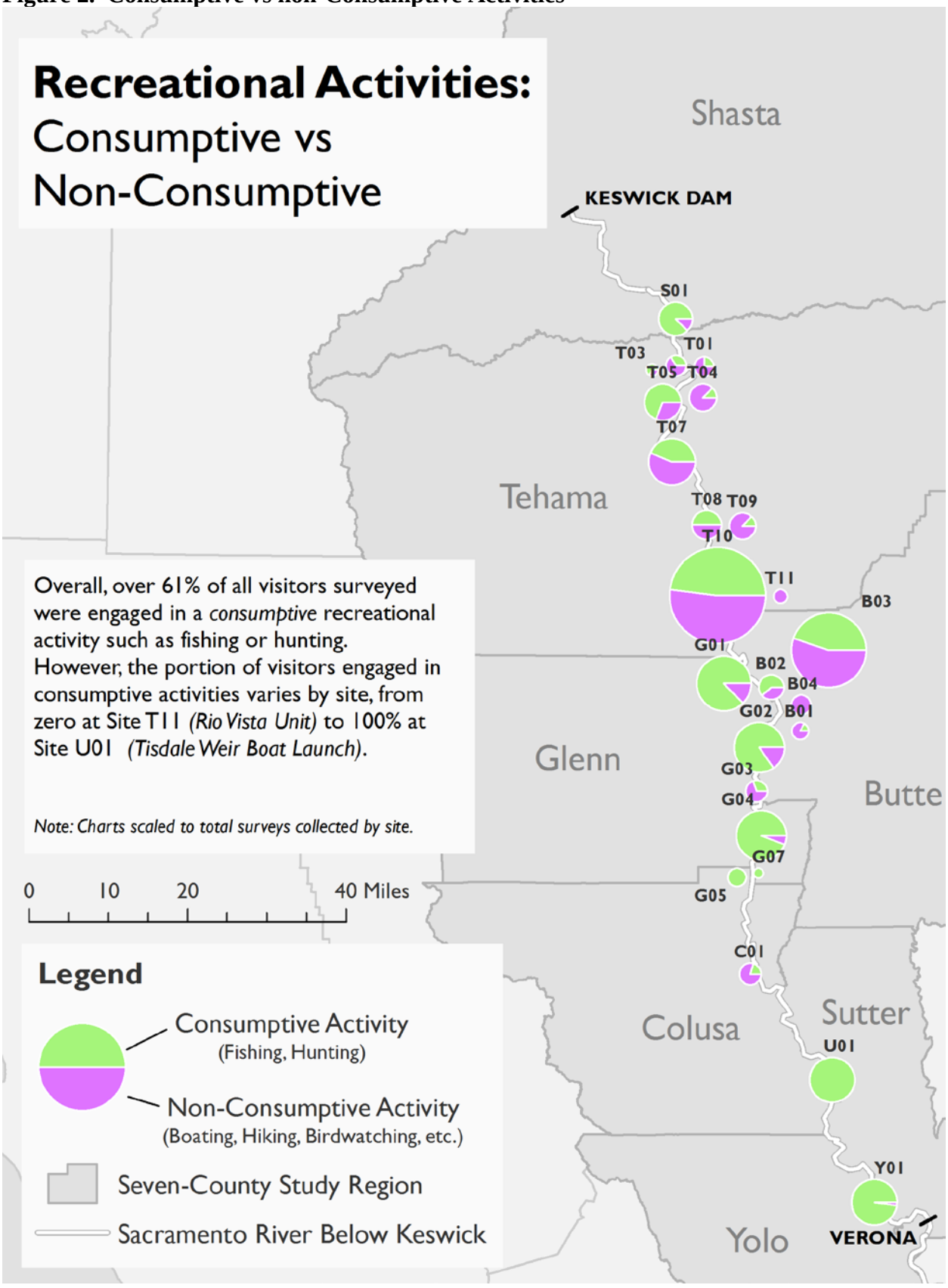


Figure 3: Visitor Satisfaction

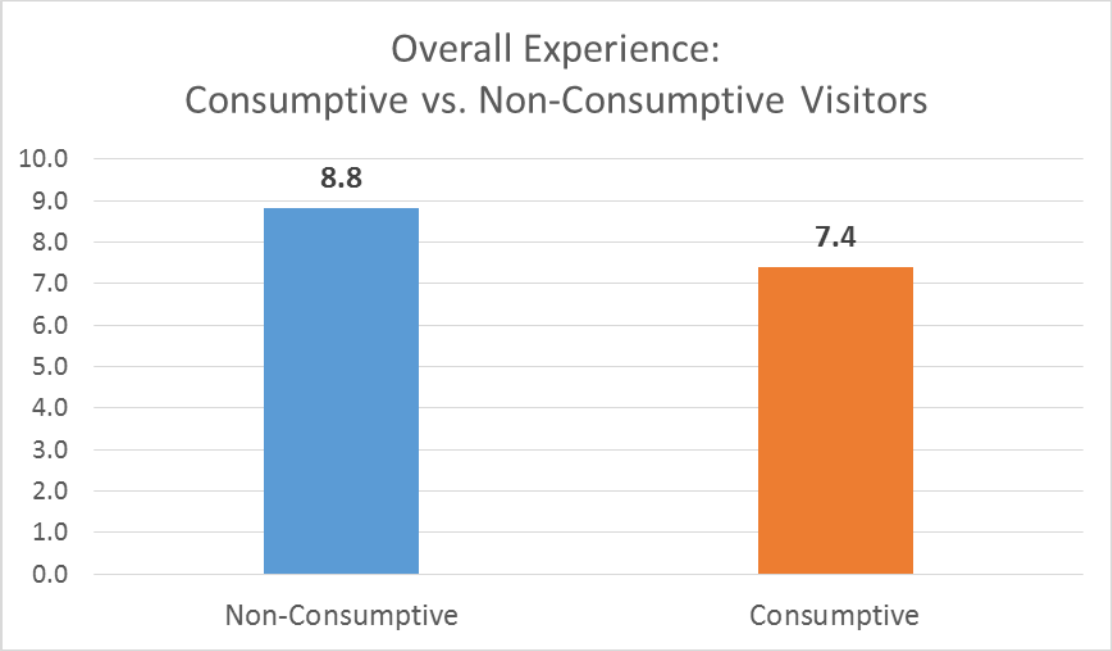


Figure 4: Travel Mode

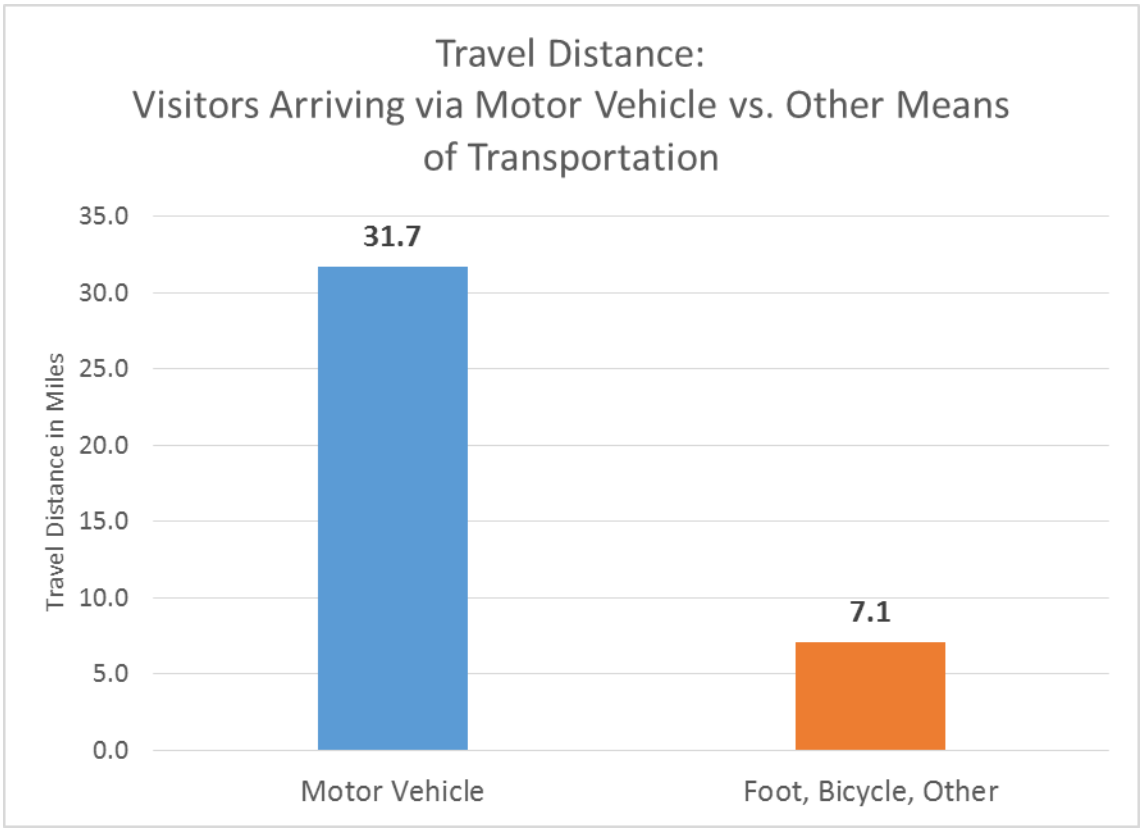


Figure 5: Gender

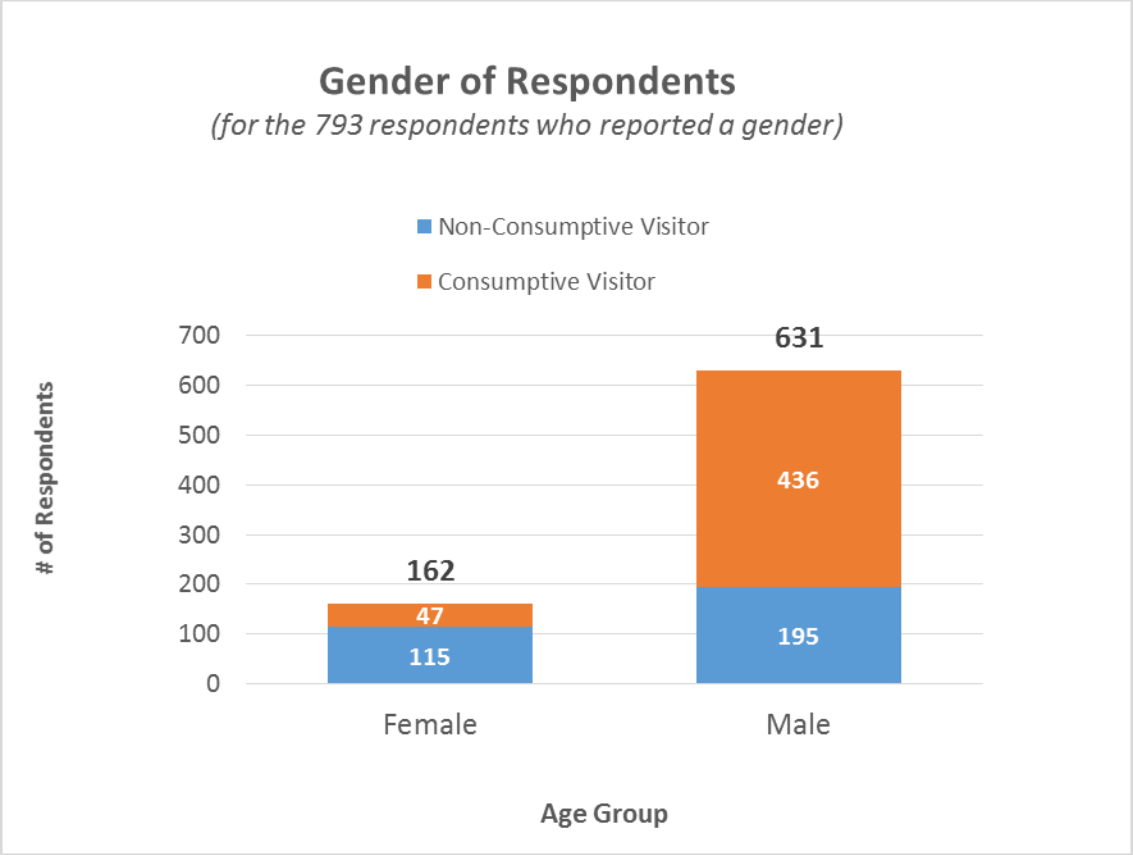


Figure 6: Age

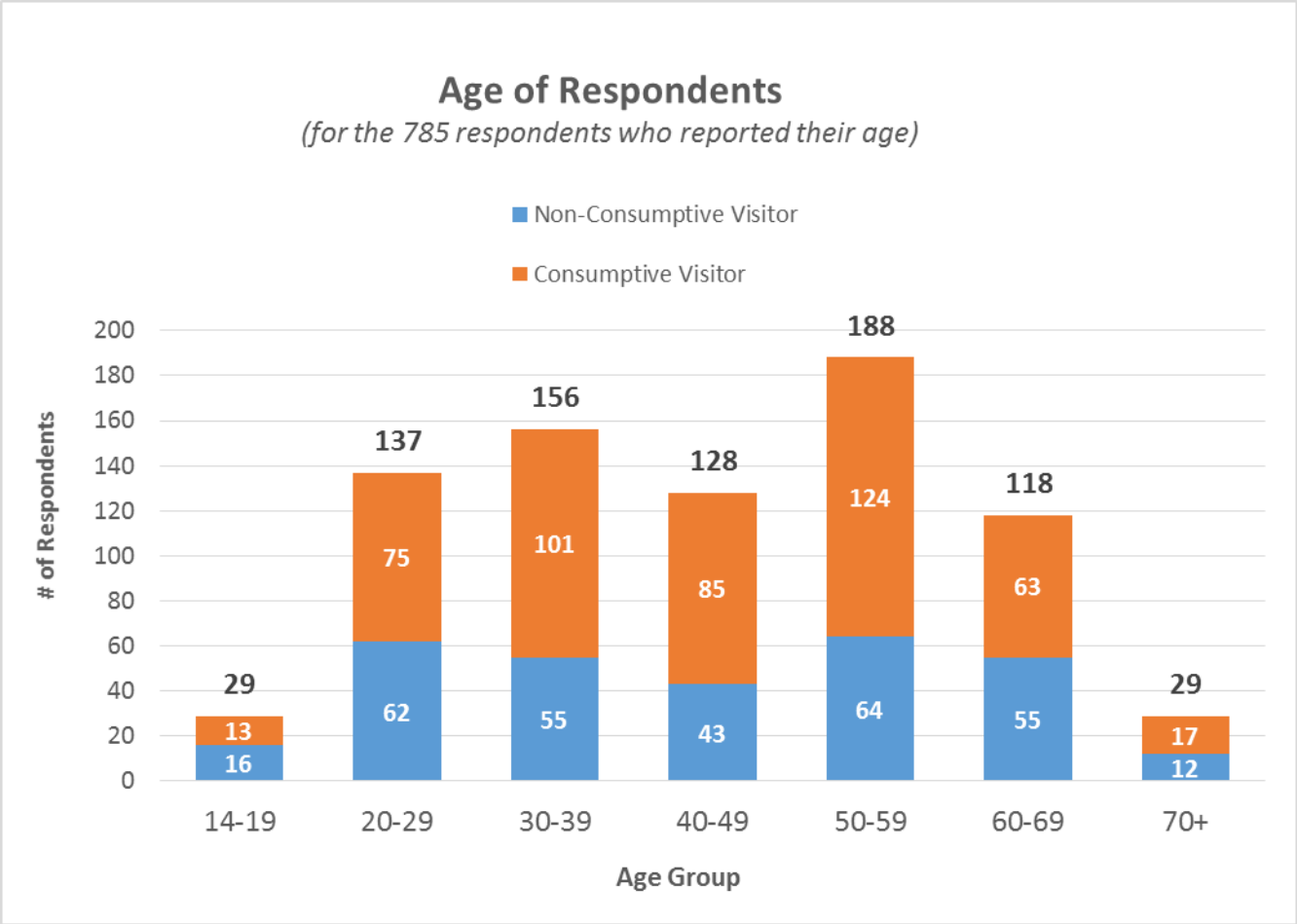

Age of Respondents
(for the 785 respondents who reported their age)
Non-Consumptive Visitor
Consumptive Visitor
# of Respondents
200
180
160
140
120
100
80
60
40
20
0
29
13
16
137
75
62
156
101
55
128
85
43
188
124
64
118
63
55
29
17
12
14-19
20-29
30-39
40-49
50-59
60-69
70+
Age Group

Figure 7: Formal Education

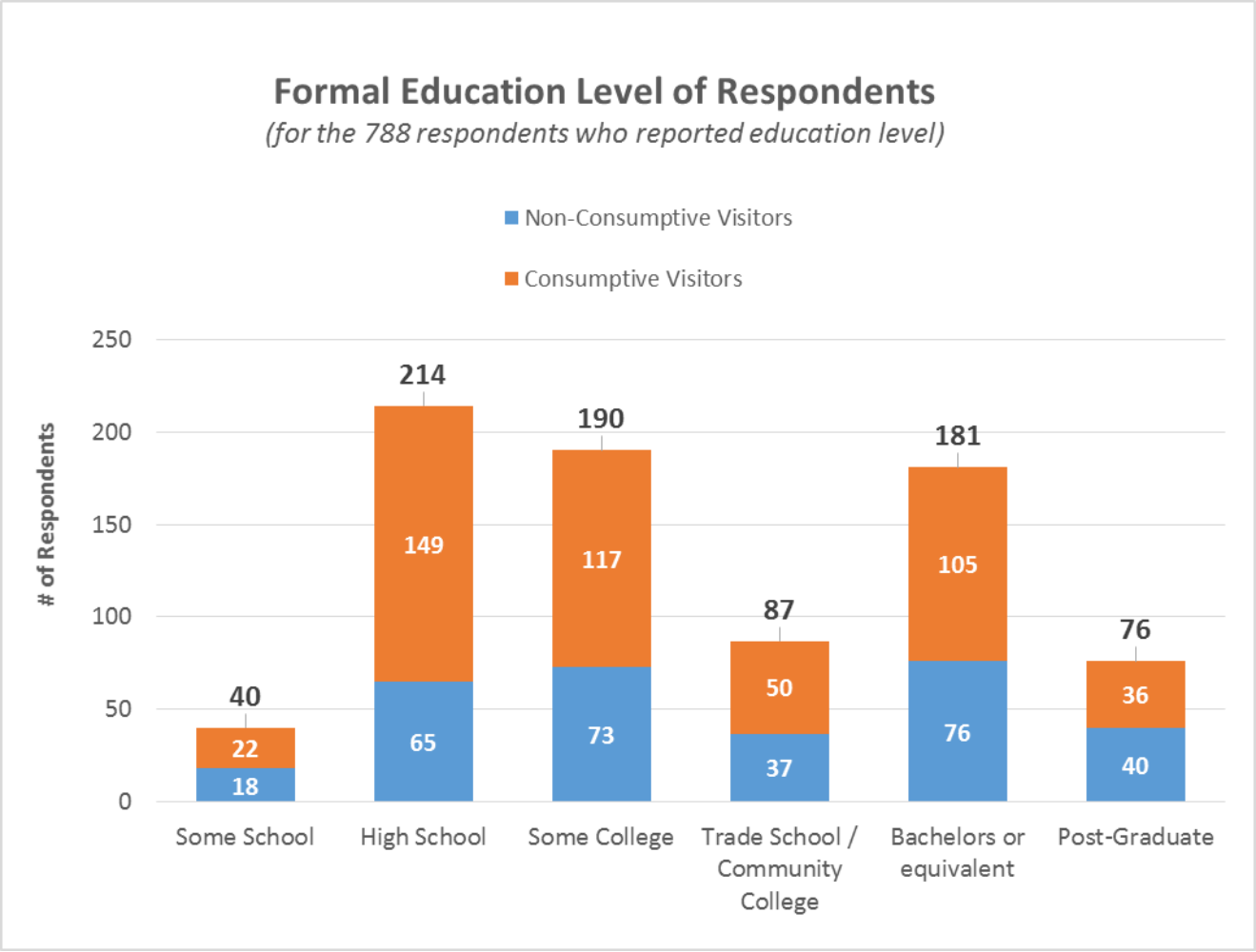


Figure 8: Income

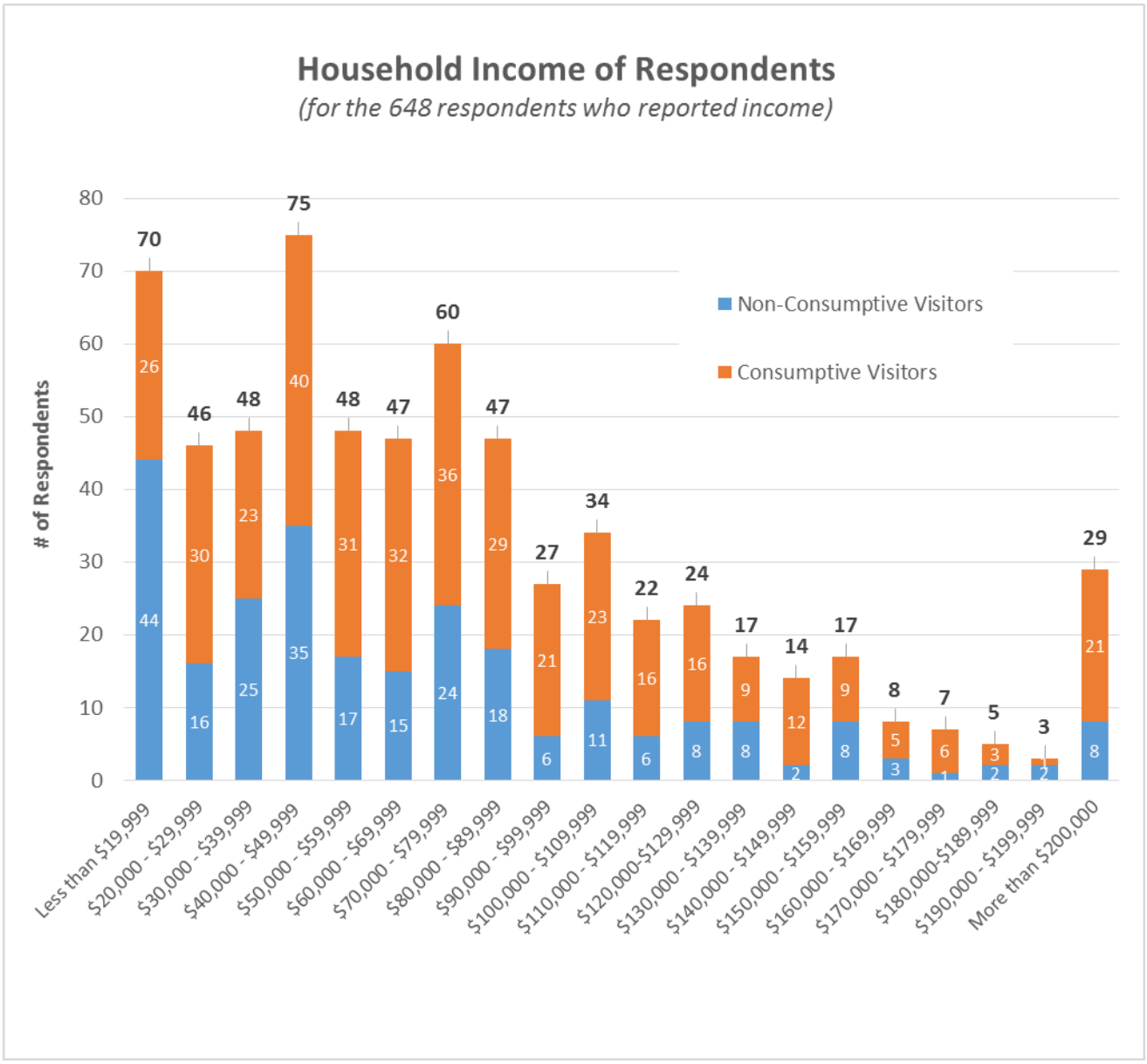
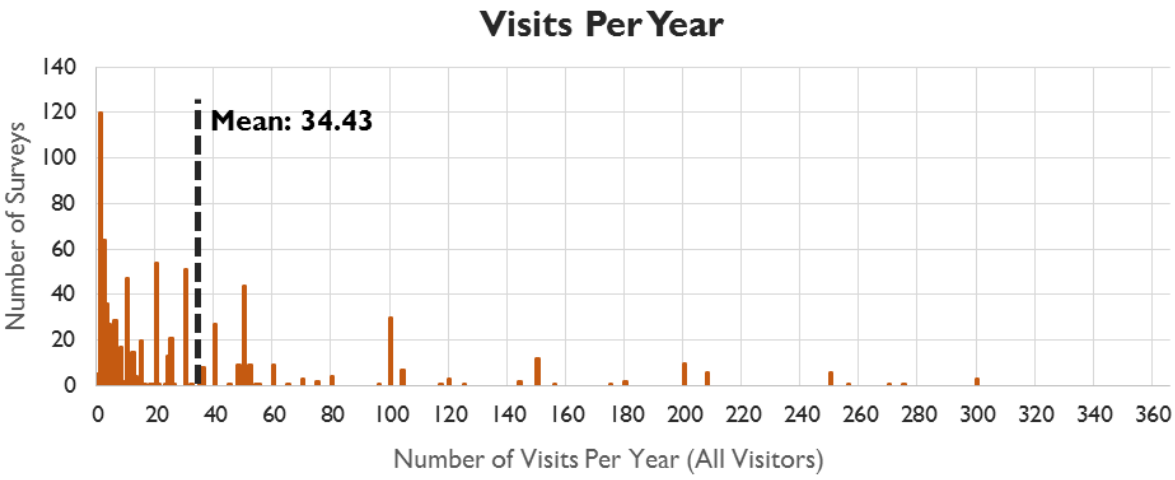


Figure 9: Annual Visitation



APPENDIX A: STUDENT INTERNS

The Forum Recreational Visitor Survey would not have been possible without the thousands of hours contributed by student interns. Each intern was required to spend an average of nine hours per week working on this project – inclusive of survey training sessions, travel to and from sites, time spent at the site, data entry, and participation in semi-weekly team meetings. Projected over sixteen weeks, this is equal to 130 hours of work per student per 3 units of internship credit.

We would like to acknowledge the hard work and dedication of the following individuals from the Department of Economics and other departments on campus.

Paid Student Interns:
Eric Stark (Fall 2014), Connor Franklin (Spring 2015), Joshua Patten (Spring 2015), Aleks Tica (Summer 2015)

Fall 2014 Student Interns:
Connor Franklin (ECON), Joshua Patten (ECON), Ian Villa-Moreno (ECON), Tiffany Lightle (ECON), Michael Allen (ECON), Katie Pitcher (ECON), Johnny Rodriguez (ECON)

Spring 2015 Student Interns:
Aleksandar Tica (ECON), Ashkaan Daneshi (ECON), Cody King (ECON), Ivan Escobedo (ECON), Kevin Fox (ECON), Donte Wallace (ABUS), Nathan Thompson (ECON), Russell Moeai (ECON), Taylor Thomas (ECON)

Summer 2015 Student Interns:
Ashkaan Daneshi (ECON), Christian Garcia (GEOS), David Thibeault (ECON), Hector Inocencio (GEOS), Ivan Escobedo (ECON), Kaden Duggar (ECON), Michael Schrieber (ECON), Sheryl Hott (GEOG)

APPENDIX B: SURVEY

Location and Date of Survey:_____

Name of the student conducting the survey:_____

Part 1: About your current trip to this site

1. What is your zip code? _____

2. Are you visiting this site for recreation (e.g. fishing, hunting, hiking etc.)?

☐ Yes ☐ No

If No, please stop here and return the survey. If Yes, please continue.

3. What is your primary recreational activity on this trip at this site?

☐ Fishing from shore
☐ Hunting: _____ (specify kind)
☐ Bird Watching
☐ Picnicking
☐ Boating/kayaking/canoeing
☐ Dog Walking
☐ Fishing from boat
☐ Wildlife Viewing
☐ Photography
☐ Camping
☐ Hiking or Walking
☐ Other _____ (specify)

4. Choose only one of the following:
☐ I have just arrived and am filling this survey at the beginning of my trip
☐ I have finished my trip and filling this survey at the end of my trip
☐ Neither of the above. I am in the middle of my trip at this site

5. On a scale of 1-10, how satisfied are you with your overall experience on this trip? 1 being "very unsatisfied" and 10 being "very satisfied"

_____

6. If using a boat, how far did you travel from the boat ramp? List upstream and downstream miles separately.

_____ miles upstream

_____ miles downstream

7. How many times do you typically visit this site in a year?

_____ times

8. On this visit, how long have you stayed or intend to stay at this site on this trip?

_____ Hours **or** _____Days _____ Nights

9. How would a 20% higher water level affect your decision to visit this site?

☐ _____(more trips per year)
☐ _____(less trips per year)
☐ No change in visits

10. Do you intend to, or have you visited any other sites for outdoor recreation on this trip from home?

☐ Yes ☐ No

10a. If Yes, what other sites do you intend to visit on this trip:

_____ _____

10b. How long have you stayed, or intend to stay at these other recreational sites on this trip? Please add total time at all other sites, but excluding time spent at this site.

_____Hours **or** _____Days _____Nights

11. About how many outdoor recreational trips do you typically take to other Sacramento River Sites (excluding this site)?

_____ trips

11a. Which other Sacramento River Sites are you most likely to visit?

_____ _____

_____ _____

Part 2: Your trip expenditures

12. What were your primary methods of travel (check all that apply):

☐ Car ☐Truck /SUV ☐ RV ☐ Motorcycle
☐ Airplane ☐ Walking ☐ Other_____

13. Approximately, how long did it take you to get to this site?

_____minutes or _____hours or _____ days

14. Approximately, what is the **one-way** travel distance from your home to this recreation site?

_____ Number of one-way miles

15. Including yourself, how many people are in your group that traveled on this trip with you?

_____ Number of adults

_____ Number of children (younger than 18 years)

16. What are (or will be) your total local expenditures **on this trip** to the area?

Category	Expense ($)
Restaurant Meals	
Lodging	
Transportation (gasoline)	
Groceries	
Other Local Retail	

If you were fishing on this trip, please continue to the next page.

If you were not fishing, skip to Page 5.

Part 3: Your fishing experience

(If you were not fishing, skip to Page 5)

17. Which species are you targeting on this trip?

☐ Chinook Salmon ☐ Steelhead ☐ Rainbow Trout
☐ American Shad ☐ Striped Bass ☐ Sturgeon
☐ Any ☐ Other Species: Name_____

18. **On this visit**, how long have you fished or intend to fish at this site?

____Hours per day

19. What was the total number caught (harvested or released) at this site on this trip:

Chinook Salmon _____ Caught Rainbow Trout _____ Caught
Steelhead _____ Caught American Shad _____ Caught
Striped Bass _____ Caught Sturgeon _____Caught
Other Species _____ Caught

20. Did you hire a guide?

☐ Yes ☐ No

Part 4: About you

These last few questions will help us in evaluating how well our sample represents visitors to the area. **Your answers will be kept strictly confidential and will only be used for the analysis of this study. It will not be given to anyone or used for any other purpose. You will not be identified in any way.**

21. Are you?

☐ Male ☐ Female

22. What was your age at your most recent birthday?

_____ Years

23. Which of the following options best describe your job status?

☐ Employed Full Time
☐ Employed Part Time
☐ Unemployed
☐ Retired
☐ Work at Home (e.g. Raise children
☐ Student Full Time
☐ Volunteer

24. What is your level of education?

☐ Some school
☐ High School
☐ Some College
☐ Trade School/ Community College
☐ Bachelors or equivalent
☐ Post Graduate

25. How many members are in your household?

_____ persons

26. How many household members contribute to paying the household expenses? _____ persons

27. Including these people, what was your approximate household income from all sources (before taxes) last year?

☐ less than $19,999	☐ $20,000 - $29,999	☐ $30,000 - $39,999
☐ $40,000 - $49,999	☐ $50,000 - $59,999	☐ $60,000 - $69,999
☐ $70,000 - $79,999	☐ $80,000 - $89,999	☐ $90,000 - $99,999
☐ $100,000 - $109,999	☐ $110,000 - $119,999	☐ $120,000-$129,999
☐ $130,000 - $139,999	☐ $140,000 - $149,999	☐ $150,000-$159,999
☐ $160,000 - $169,999	☐ $170,000 - $179,999	☐ $180,000-$189,999
☐ $190,000 - $199,999	☐ more than $200,000	

Thank you for completing the survey!