Economic Value of the Sacramento River to Freshwater Anglers: A Zonal Travel Cost Approach

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Chapter 1

1. Introduction

The Sacramento River is the largest river entirely within California. It supplies approximately 35% of the state's total water supply. Historically, the Sacramento River was bordered by up to 500,000 acres of riparian forest, but today only around 25,000 acres of riparian habitat and valley oak woodland remain within the Sacramento River corridor from Shasta Dam to its confluence with the Feather River. Since the late 1980s, several thousand acres along the river have been taken out of agricultural use and restored to improve riparian habitat along the Sacramento River. The main approach followed by state and non-state agencies was to permanently convert flood-prone agricultural lands bordering the river from agricultural production to habitat by revegetating with native trees, shrubs etc. (Golet et al., 2003). Riparian habitat along the Sacramento River is critically important for various threatened species, fisheries, migratory birds, plants, and the natural system of the river itself. The restoration so far has been a modest effort to undo the anthropogenic change that occurred in the valley since the Gold Rush that had resulted in the loss of 95 percent of natural wetlands (Kelley, 1989).

Despite an extensive economic literature on environmental valuation and benefit-cost analysis, there is a dearth of literature for valuation of ecosystem services for the Sacramento River. The Millennium Ecosystem Assessment (2005) distinguished between supportive services (those that lead to the maintenance of the conditions for life, such as nutrient cycling), provisioning services (those that provide direct inputs to human economy, such as food and water), regulating services (such as flood and disease control), and cultural services (such as provision of opportunities for recreation and spiritual or historical purposes). To avoid the problems associated with too broad and economically imprecise definitions of ecosystem services, Brown et al. (2007) argue that ecosystem services should be defined as "flows from an ecosystem that are of relatively immediate benefit to humans and occur naturally" (Brown et al., 2007:334). Boyd and Banzhaf (2007:619) suggest narrowing this definition even further to include only end-products: components of nature, directly enjoyed, consumed, or used to yield human well-being."

Following this approach, we focus on direct use benefits of the Sacramento River in northern California to recreational anglers. The most appropriate and least controversial approach for estimating the value of recreational use is the travel cost model, which is based on the idea that the cost of getting to a recreational site is a measure of the value individuals place on its use. The only other study Gallo (2002) is based on data for a single year, 1999. Our analysis builds upon the Gallo (2002) study in that we examine multiple years of data across multiple sections of the Sacramento River. River conditions, fish habitat and recreational opportunities vary widely over the 377 miles of the Sacramento River. Multiple years of data allows for the possibility of performing separate regressions, and estimating willingness to pay coefficients for each of the six river sections instead of aggregating over the whole river.

2. Background/Primer of Zonal Travel Cost Method

In conventional economics it is generally accepted that measures of economic value should be based on the preferences of individuals. More specifically, the economic value of a resource is measured by the maximum willingness to pay to obtain a good or service. Dollars are a universally accepted measure of economic value because the amount that people are willing to pay for something reflects how much of all other for-sale goods and services they are willing to give up to get it. Under most circumstances individuals must pay an actual price or incur expenses to obtain the good. So, to determine the value that visitors place on the Sacramento River resource, economists estimate consumer surplus or net willingness to pay, which is defined as the difference between the maximum an individual is willing to pay to fish at the Sacramento River versus the expenditures paid to fish the Sacramento River. For example, if a visitor is willing to pay up to $90 to fish at the Sacramento River and incurred $50 in expenses while traveling to and fishing the Sacramento River, then the net economic value that the visitor places on the Sacramento River is $40. By taking the summation of the consumer surplus or net willingness to pay by all visitors to the Sacramento River, we can estimate the value that visitors place on the Sacramento River resource.

Estimation of the value of the Sacramento River is accomplished using a travel cost model. Harold Hotelling first suggested the use of travel costs, to estimate the demand for recreational sites, in the late 1940’s. The model was further developed by Knetsch and Clawson in the 1950’s and 1960’s and has since gained broad acceptance among resource economists (ecosystemvaluation.org). The literature in resource and environmental economics contains numerous studies using variations on the travel cost model.

This family of approaches to valuing a resource is based on the idea that the cost of getting to a recreational site is a measure of the value individuals place on its use. A demand curve is generated from the various travel costs and the associated number of trips. It is fundamental to economic theory that the higher the price of a good or service the smaller the quantity demanded. In the vernacular of the travel cost model this means that as travel cost increases, as it does with distance from the site, the smaller the number of trips made annually. The total value of the resource is estimated as the area under the generated demand curve.

When analyzing the creel data provided by the CDFW the zonal travel cost method was chosen. The zonal travel cost method is the original and simplest approach. The biggest advantage of the approach is that requires mostly secondary data, with some simple data collected from visitors, which is what the creel survey is limited to.

3. Study Area and Data Description

3.1. Study Area

The geographic scope of this study is the 377 miles of Sacramento River between Keswick and Verona. See Figure 1. This length of the river is composed of 6 river sections.

3.2. Data Sources

The California Department of Fish and Wildlife (CDFW) Angler Survey is conducted on 377 miles of the Sacramento, American, and Feather rivers. That survey involves interviewing anglers on the Sacramento, American, Yuba, Mokelumne, and Feather Rivers within the Sacramento River system and for rivers south of the Sacramento-San Joaquin Delta. CDFW divides the survey into thirteen sections ranging from 1 to 56 miles. However only three regions are in the Sacramento River Conservation Area, and thus data from only six of the thirteen survey areas (sections 3-8) will be utilized in the analysis. The description of each section utilized in the study is provided in Figure 1.

Interviews were conducted on four weekdays and four weekends each month (in most cases). Information recorded includes the date, the number in the fishing party, the hours the group had fished, the river mile at which the interview occurred, fish species sought, number and species of fish caught, and the zip code of the anglers. Unfortunately, no other demographic information is collected from each angler.

In order to analyze the effect of angler characteristics on visitation, the zip code of the anglers is matched with the zip code level demographic information provided by the US Census / American Community Survey Data. Zip code level data is only published as five year averages and thus limits the study to the 2007-2011 period. For each angler home zip code demographic variables including median income, education attainment, race, age, urban/rural designation was collected. The implicit assumption in matching the creel survey data with zip code level demographics is that the individual angler surveyed in the creel data is identical to the median individual within the home zip code

The 2007-2011 editions of AAA’s Your Driving Costs provide travel cost per mile data. The AAA average cost per mile attempts to account for the full cost of driving by considering fuel, maintenance, depreciation, registration and insurance costs. Of course these costs vary by both driving distance and type of vehicle. Results of our recreation survey indicate that the overwhelming majority of anglers drive either four-wheel drive pickups or sport utility vehicles. Therefore, we use the AAA average cost per mile estimates for trucks and sport utility vehicles and also assume that the typical angler drives 15,000 total miles per year. Median income by zip code is provided by the US Census / American Community Survey Data. Assuming that the average angler works 40 hours per week, 50 weeks per year, conversion from median income to hourly wage rates is accomplished by dividing median income by 2000, the average annual hours worked per year. Driving distance and time is calculated from the origin ZIP codes to the destination ZIP codes by the Geographical Information Center CSU-Chico, using ESRI

ARCMap 10's Network Analyst Extension, with data from Open Street Map and the US Census Bureau.

Certain adjustments were made to the data in order to limit the travel cost analysis to day trips. Inconsistencies arise when single-day and multi-day trips are mixed since the latter involve additional expenditures such as lodging. Also multi-day trips are less likely to be for purposes of fishing only and it is difficult to assign a particular share of travel costs to that activity. For that reason day trips are defined as those trips where the round trip travel time is less 600 miles.

3.3. Summary Statistics and Trends in Creel Data

Summary statistics indicate 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. Species targeted by section in 2013 is summarized in Figure 2.

As the Sacramento River transitions from a cold to warm water fishery when moving south along the river, so do the species targeted. Fisherman surveyed in Section 8 near Redding, targeted Rainbow trout almost exclusively. Chinook Salmon was the most targeted species in Section 5, 6 and 7, however there also differences across these three sections. Cold-water species, Rainbow Trout and Steelhead, are also heavily targeted in Section 7 and to a lesser extent in Section 6, while in Section 5 Striped Bass and other warm-water species become the most targeted species after Chinook Salmon. In Section 3 and 4, Chinook Salmon remain prominent but are overtaken by Striped Bass as the most highly targeted species.

Seasonality and method of fishing, summarized in Figure 3, also vary across sections due to differences in fishing seasons and migration across the various target species. In Section 8, rainbow trout is the main target and can be fished year around. We see a relatively uniform distribution of fishing effort, with March – May and Sept - Nov as the peak periods. Fishing guides are more heavily utilized in Section 8 than any other section in the study, which is not surprising given Section 8's reputation as a blue ribbon trout fishery.

The Chinook Salmon season, the most targeted species in the Section 6 and 7, is open from Mid-July to Mid-December. The peak of the fishing season begins with the opening of the Chinook Salmon but tends to taper off by November along with the main run of the Chinook Salmon. Steelheads, feeding on salmon eggs, also arrive in Section 7 during the Sept – November period, which also contributes to the peak fishing season. Most of the fishing in these two sections is by boat and the use of guides is very prominent during the Chinook Salmon season. Participation decreases substantially during the non-peak months.

Similar to Section 6 and 7, fishing in section 5 peaks during the July-September period. This is not surprising given that Chinook Salmon is the most targeted species in Section 5, as well as Section 6 and 7. However, there are differences between section 5, and Section 6 and 7. There are far fewer guided trips in section 5 than in section 6 and 7 during the peak salmon months while fishing participation is higher in section 5 than 6 and 7 during the off peak salmon months. The higher participation during the March – June months corresponds to the entry of Striped Bass the second most sought after species in Section 5, into the Sacramento River. Stripers that winter in the ocean start moving upstream to fresh water for spawning. During the spring, the bulk of the legal population is spread throughout the Delta and as far north as Colusa and Princeton on the Sacramento River. Good fishing can be expected throughout the spawning area at this time. By mid-June, most legal-sized bass have left fresh water and returned to the ocean.

Fishing effort is fairly uniform across the season in Section 3 and 4. Fishing effort increases in February with the opening of the of the Sturgeon season, remains strong with the arrival of Striped Bass into the Sacramento River and tails off after October as the Chinook Salmon run tails off. Boat fishing is very popular in Section 3 and 4, but what separates Section 3 and 4 in terms of participation from the other sections is the number of shore fisherman and guided trips. Section 3 and 4 have the largest number of shore fisherman and least amount of guided trips relative to Sections 5-8.

The differences in average miles per trip across sections, summarized in Figure 4, may be the most pertinent disparity in regards to resource valuation. The average miles per trip summarized in Figure 4 indicate that Section 3-4 is fish mostly by locals. The average distance traveled per trip, one-way, is 25-30 miles. The average miles traveled per trip increases to roughly 50 miles in sections 5 and 6 and 115 miles in section 7. This indicates that the composition of fisherman changes as you move further north along the Sacramento River with destination fisherman replacing local fisherman. This point is driven home further in Figure 5, which indicates angler origins and destinations. Perhaps most striking is the number of fisherman that travel from the San Francisco Bay area to section 7 and 8, rather than sections 3-6 which are much closer. The basic premise of the travel cost method is that the time and travel cost expenses that people incur to visit a site represent the “price” of access to the site. Thus, peoples’ willingness to pay to visit the site can be estimated based on the number of trips that they make at different travel costs. This is analogous to estimating peoples’ willingness to pay for a marketed good based on the quantity demanded at different prices.

4. Empirical Specification

The travel cost model specifies a relationship between the number of annual visitor days per travel party from a particular origin to a particular destination and the travel cost. There are also five demographic variables included in the regression analysis: median income, average age, percentage white, and percentage of college education attainment of the zip code or origin. One dummy variable is also included, specifying whether the county of origin is urban or rural. Finally, a time trend variable is included in the regression analysis.

Travel cost, in real terms, includes two elements. It is defined as the sum of the direct cost of the trip, and the opportunity cost in terms of lost wages for the duration of the trip. Each of these elements of travel cost is estimated in the conventional manner. Direct travel cost is equal to the cost per mile times the number of miles required to make the round trip to the site. Opportunity cost is calculated as one-third of the average hourly wage rate for the county of origin times the number of hours of travel time. In order to make the travel cost comparable across time the sum of direct costs and the opportunity cost of time is then divided by the consumer price index to convert nominal costs to real terms.

Median income of a zip code, which serves as a proxy for income of a visitor from a zip code is also accounted for in the analysis. Consumer income is a key determinant of consumer demand or in this case visitation. The relationship between income and demand can be both direct and inverse. To account for the possibility that at certain levels of income the relationship between income and visitation may be negatively related but at other levels of income the relationship between income and visitation is positive, we include an income squared term to the regression to test for a quadratic relationship between income and visitation.

Next we consider how demographic considerations including age, education attainment and ethnicity affect visitation. The ethnic composition of the zip code of origin is likely to be an important determinant of participation in recreational fishing. In particular, the larger the share of the population that is of white origin and the smaller the share that is of other ethnic backgrounds, the more likely that residents of that zip code will fish. According to a 2014 study commissioned by the Recreational Boating & Fishing Foundation and the Outdoor Industry Foundation (2014), 75.3% of freshwater anglers were Caucasian while African Americans, Asian and Hispanic together represented only 20%. The same study also suggests that age and education attainment and visitation are likely to be positively related. 13-17 year olds only make up 8.3% of the total number of freshwater participants while 37% are 45 years of age or older. It also the case that the majority, of freshwater participants have attended college, graduated college or earned a post-graduate degree. Therefore, we expect the zip codes with a higher percentage of college graduates or higher average age should also have higher visitation rates to the Sacramento River.

Whether an area is urban or rural is an important determinant of resident participation in fishing activity. Compared to residents of rural areas, there is a lower probability of an urban resident being a frequent angler (USFWS 2011). The difficulty is in distinguishing rural from urban areas. The definition adopted here is that a county with a population over 750,000 and where 30% or more of the county population lives in a city of more than 100,000 residents is urban. If the ZIP code reported on the survey entry is in an urban county the observation is assigned a one, while if it is in a rural county a value of zero is assigned.

4.1. Estimated Equation

The first specification considered was a multisite cross-section travel cost model. Interactive variables and t-tests confirmed what was suggested by the summary statistics. The willingness to pay is indeed significantly different from site to site and thus single-site pooled time-series, cross-section analysis is more appropriate. Following Loomis and Cooper (1990), both multiple year cross-section, and panel models including fixed and random effects specifications were considered to detect trends in visitation. The fixed effects panel specification performed poorly. Simple t-tests confirmed that every coefficient in the model was insignificant while the F-test indicated that the model as whole had no predictive capability. Hellerstein (1993) highlights the drawback of in applying fixed effects to travel cost models. When most of the variability in a travel cost data set exists within cross-sections rather than intertemporally, the fixed effects specification reduces the power of estimators. On the other hand, the random effects panel model yielded results consistent with the pooled time series specification. However, the fact that the sample captures visitors from each zip code on average only 2.6 out of the possible 5 years casts doubts that panel data techniques are truly appropriate for this study. For brevity and clarity, only the pooled OLS results will be presented. Results for the panel fixed and random effects specification are available upon request.

For each of the m sites, the following time series equation was estimated in log-linear form using ordinary least squares.

$$Ln(Vis_{it}/Pop_{it}) = \alpha + \beta_1 TC_{it} + \beta_2\, Income_{it} + \beta_3\, (Income_{it})^2 + \beta_4\, Urban_{it} + \beta_5\, \%White_{it} + \beta_6 \%College_{it} + \beta_7\, Age_{it} + \beta_8 Time_{it} + \varepsilon_{it}$$

Where, i = 1, . . ., n is the number of visitor zip code origins; t = 1, . . ., T years;

Vis_{it} is the number of visitor days per million from the zip code of origin, i, in year, t;

Pop_{it} is the population (in millions) of the zip code of origin, i, in year, t;

TC_{ij} = is the cost of traveling origin i to the specified site in year t = (AAA cost per mile*round trip distance in miles + 0.33(hourly wage rate*round trip travel time);

$Income_{it}$ = Median income of the zip code of origin, i, in year, t;

$(Income_{it})^2$ = Median income squared of the zip code of origin, i, in year, t;

$Urban_{it}$ = 0 or 1 and is a dummy variable defining the zip code of origin, i as urban (1) or rural (0), in year t;

$\%White_{it}$ = Percentage of the population that are White of the zip code of origin, i, in year, t;

%College$_{it}$ = Percentage of the population that have a college degree for a traveling party from county of the zip code of origin, *i*, in year, *t*;

Age$_{it}$ = Average age of the population of the zip code of origin, *i*, in year, *t*;

Time$_{it}$ = A variable included to capture a constant trend and is equal to Year – 2007, thus 2008 observations have Time = 1, 2009 observations have Time = 2 and so on.

5. Results

5.1. Estimation of Willingness-to-Pay

Table 1 shows that there is a negative and significant relationship, at the 1% significance level, between the visitation rate and travel cost, in all sections. This means that increase in travel cost by $1 increases in travel cost reduces the visitation rate by as little as .003 percent in section 7 and as much as .0125 percent in section 3, which indicates that anglers that fish in section 3 are more sensitive and responsive to a change in travel cost than section 7 anglers. For the most part, anglers respond less to changes in travel cost the further you move north along the Sacramento River. The travel cost coefficient is also utilized to estimate the willingness to pay per visitor day, which will be discussed further in section 6.1.

The quadratic relationship between income and visitation holds true across all sections at the 1% significance level meaning that for low level of income, income and visitation are negatively related but at higher level of income, income and visitation are positively related. For low levels of income, the objective of anglers is more likely to be to catch fish for a food source. As income increases, the same anglers can now afford other sources of protein and may substitute away from fishing to other food options. At higher levels of income anglers are likely to fish primarily for recreation and have the option to utilize more expensive fishing methods. They are more likely to fish from a boat than from the shore, switch to more expensive methods of angling such as fly-fishing, and utilize fishing guides. For these anglers, visits to the Sacramento River are likely to be a luxury good, which means an increase in income causes a bigger percentage increase in demand for fishing trips to the Sacramento River.

As stated earlier in the paper, the study period was over the 2007-2011 period, which captures both the collapse of the Chinook population in 2007 and the early stages of the recovery in the later years. As Chinook populations increased over the study period, we would expect visitation to increase as well, particularly in regions in which Chinook Salmon was the primary species targeted. In the three sections in which Chinook Salmon was the primary species targeted, a positive trend in visitation was detected in sections 5. However, visitation declined over time in section 7, and no trend in visitation was detected in section 6 at significant levels. In the three sections in which species other than Chinook Salmon were the primary target, a positive trend in visitation was detected in section 8, while no trend in visitation is detected in sections 3, and 4, at significant levels. Overall, the results of the time trend variable are mixed at best. We did not observe the positive time trend that was expected during the recovery. Perhaps the early stages of the recovery were not strong enough to significantly increase visitation. If we were able to include later years, 2012-2014, when Chinook Salmon population were more fully recovered, we may have observed the positive time trend that was expected.

The Urban coefficient is uniformly negative and significant while the %White coefficient is always positive and significant indicating that most anglers on the Sacramento River were from rural zip codes and had higher Caucasian populations. With the exception of section 5 the Age coefficient is always positive but only significant at standard levels in sections 7 and 8. This result provides somewhat weak evidence that zip codes with an older population tend to have higher visitation rates. The %College variable is less well behaved. In sections 6, 7 and 8 it is positive as predicted but in sections 3, 4, 5 there is a negative relationship. The coefficients are only significant in sections 3, 4, 7, and 8.

5.2. The Value of the Sacramento River to Freshwater Anglers

Using the statistical results from the model and the visitor day use from the California Department of Fish and Wildlife, allows for the estimation of the current value of the fresh water fishing recreation opportunities at the Sacramento River. To calculate willingness to pay per visitor day (WTP) for the log-linear functional form, we utilize the approximation developed by Graham-Tomasi, Adamowics and Fletcher (1990), if $\beta_1 > -1$:

$$WTP = 1/-\beta_1.$$

Figure 6 summarizes the average WTP per visit for each section during the 2007-2011 period. The lowest WTP is $80 per trip in section 3 while the highest WTP per trip is $290 for section 7. WTP per trip generally increases as you move further north along the Sacramento River as the composition of fisherman changes from local fisherman to destination fisherman. The WTP estimates for section 3, 4, and 5 are consistent with the average WTP of $100.25 per trip estimated by Gallo (2002) for the entire Sacramento River system.[1] However the WTP estimates for sections 5-7 are considerably higher than the Gallo estimate, ranging from $228-$290.

Estimating the annual visitor days for each section is accomplished by expanding the daily count in the creel sample, using the same formula that the DFG uses to estimate total fishing hours (this model uses fishing days, not hours). The weekend sample count is multiplied by the ratio of weekend days in a month divided by the days sampled. The same is done for the weekday count (CDFW 2002).

The average total annual value to anglers for each section of the Sacramento River for the 2007-2011 period is the product of the average annual visitation for section *i*, and the WTP per visit for section *i*. Estimated annual visitation by section by year, WTP by section, total annual value to anglers by section are all reported in Figure 6. The average total annual value to anglers for sections 3-8 of the Sacramento River for 2007-2011 is the summation of the total value to anglers across all sections, illustrated in Figure 6 as $10,089,664.

It should be noted that this estimate is the value anglers place on fishing on the Sacramento River. It does not include the impact of spending by those visitors in local economies. The impact of spending by recreationist to the local economy will be considered in a separate study.

WTP and user days used to estimate the total annual value to anglers are likely to be conservative estimates and do not capture the total recreational value of the Sacramento river to all recreationists for a many reasons. First, we restricted the sample to single destination trips

[1] The Gallo study concluded that the WTP per day was $80.52 per fishing day in 1999. The estimate of $80.52 in nominal terms was converted to real terms (2007 $'s) to make WTP figures across studies comparable.

(trips less than 600 miles). Longer trips are likely to be multiple destination trips and are less likely to be for purposes of fishing only. It is difficult to assign a particular share of travel costs to that activity. However, some of the longer trips may very well be single destination trips. By dropping longer trips from the sample, we may be omitting individuals that place the highest WTP for fishing the Sacramento River. Next, preliminary summary statistics from the recreational survey indicate that the incomes of visitors are higher than the average median income of their zip codes, which was used as a proxy for individual income in the zonal travel cost model. Holding all other factors constant, higher incomes imply a higher WTP. Finally, we only considered the value to anglers that fish the Sacramento River. Fishing is only one type of recreation on the river. Total visitation across all visitors is much higher than estimated in this study. For example, Hinton (1980) estimates 2 million recreation visitor days for the Sacramento River.

6. Discussion and Conclusion

The purpose of this study was to estimate economic value of recreational fishing in the main stem of the Sacramento River. In doing that we have made several methodological improvements relative to Gallo (2002). Our analysis showed that it is more appropriate to treat each section surveyed as a unique site rather than pooling all sections, WTP per varies considerably across sections, and WTP estimates for some sections are significantly larger than the estimates derived in the Gallo study. Given the nature of the CDFW creel survey data we were limited to the zonal travel cost approach. However, there are well known shortcomings with the zonal travel cost approach.

The zonal travel cost approach relies on average demographic variables from a zone (zip code in our case), which may not be an accurate description of visitors to a site. The use of zip code level aggregate data instead of individual specific data will result in aggregation bias and yield parameter estimates that do not necessary reflect individual behavior (Moeltner, 2003). However, the alternative is to drop demographic variables that may determine whether an angler chooses to fish at a site, resulting in omitted variable bias, which we considered to be the more significant problem. Both aggregation bias and omitted variable bias will be avoided in a second study in which only primary individual level information has been collected and is being analyzed, and recreational activities associated with the Sacramento River beyond fishing will be considered.

Another shortcoming of the travel cost approach is that it is restricted to estimating the value of recreational services of a site as a whole. It cannot easily value change in quality of recreation site, or consider factors that may be important determinants of value including the addition of new recreation sites or closures of existing sites. When the objective is to value changes in site characteristics at one or more sites, value access to more than one site simultaneously, or value a change in the number of sites, a multiple site travel cost model such as the random utility model is preferred**.** The random utility model was considered for this study but was cost prohibitive.

Finally, it is only possible to estimate direct use values with the entire family of travel cost models. Travel cost models are based on observed behavior, trips to the recreation site. The implicit assumption is that if an individual does not take a trip or use the resource then the individual does not value the resource. The travel cost methods do not allow for the possibility that an individual can place a nonuse value, such as bequest, option, or existence values on the resource. The only method that estimates nonuse values is the controversial contingent valuation method, which was also cost prohibitive.

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Table 1: Results of the Travel Cost Model

VARIABLES	Section 3 Ln(vis/pop)	Section 4 Ln(vis/pop)	Section 5 Ln(vis/pop)	Section 6 Ln(vis/pop)	Section 7 Ln(vis/pop)	Section 8 Ln(vis/pop)
TC	-0.0125***	-0.00995***	-0.00926***	-0.00449***	-0.00345***	-0.00361***
	(0.000990)	(0.000623)	(0.000772)	(0.000637)	(0.000569)	(0.000380)
Income	-4.25e-05***	-4.09e-05***	-6.10e-05***	-6.79e-05***	-4.62e-05***	-3.15e-05***
	(8.14e-06)	(6.78e-06)	(7.69e-06)	(8.71e-06)	(7.28e-06)	(5.13e-06)
Income^2	2.22e-10***	2.19e-10***	3.01e-10***	3.57e-10***	1.98e-10***	1.71e-10***
	(5.26e-11)	(0)	(0)	(5.03e-11)	(0)	(0)
Urban	-1.651***	-1.930***	-1.955***	-1.791***	-1.775***	-1.631***
	(0.122)	(0.0960)	(0.131)	(0.144)	(0.152)	(0.116)
%White	1.064***	1.569***	2.078***	2.298***	2.326***	1.906***
	(0.352)	(0.267)	(0.346)	(0.385)	(0.380)	(0.247)
%College	-0.708*	-1.112***	-0.254	0.161	0.932**	0.638**
	(0.371)	(0.339)	(0.431)	(0.519)	(0.435)	(0.281)
Age	0.00261	0.00324	-0.00114	0.00646	0.0243**	0.0302***
	(0.00920)	(0.00641)	(0.00872)	(0.00990)	(0.00957)	(0.00671)
Time	-0.0385	0.0151	0.0860**	-0.00746	-0.0755**	0.0756**
	(0.0315)	(0.0267)	(0.0352)	(0.0352)	(0.0347)	(0.0295)
Constant	-4.524***	-4.840***	-4.817***	-5.436***	-6.816***	-7.948***
	(0.420)	(0.349)	(0.450)	(0.527)	(0.510)	(0.364)
Observations	809	1,241	825	631	627	1,195
R-squared	0.409	0.510	0.555	0.526	0.545	0.455

*** indicates significance at

Figure 1: Sacramento River Creel Survey Section in Study Area

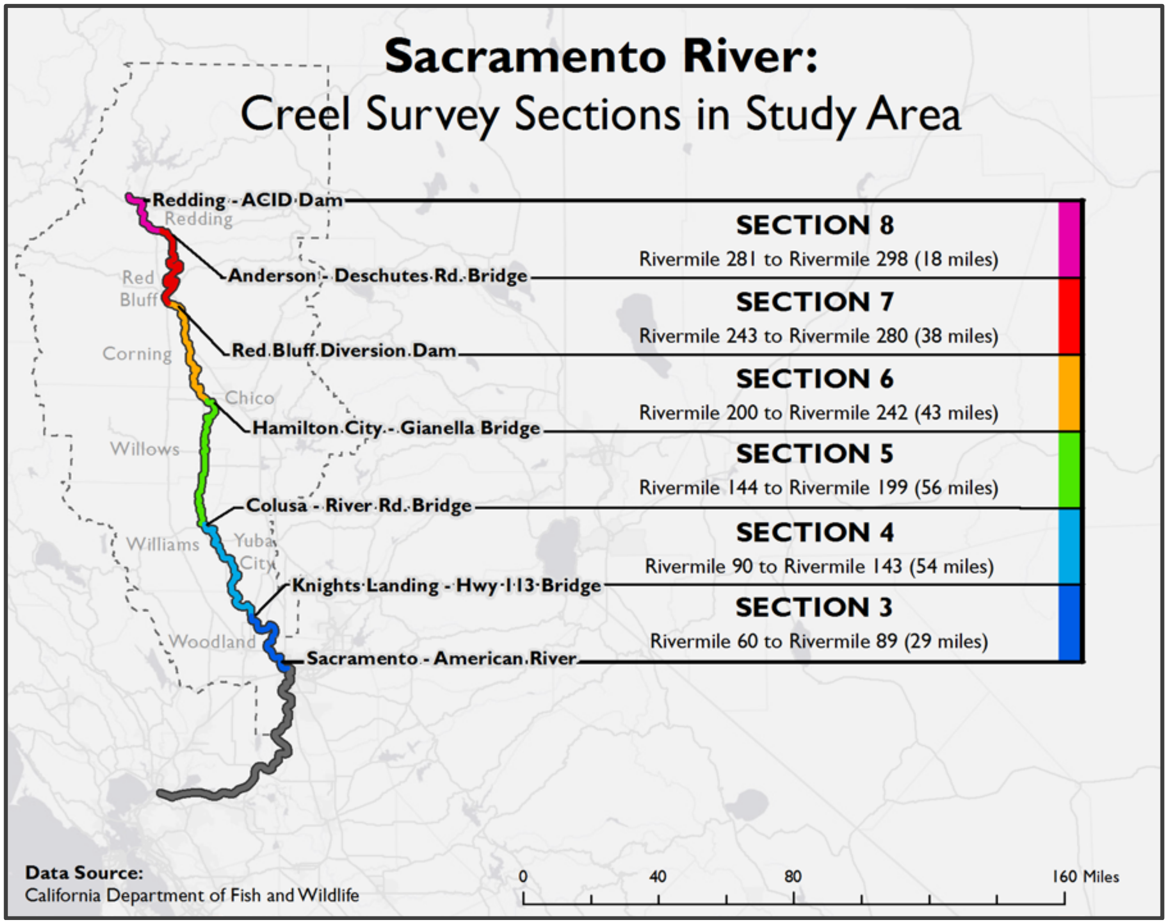


Figure 2: Species Targeted by Section

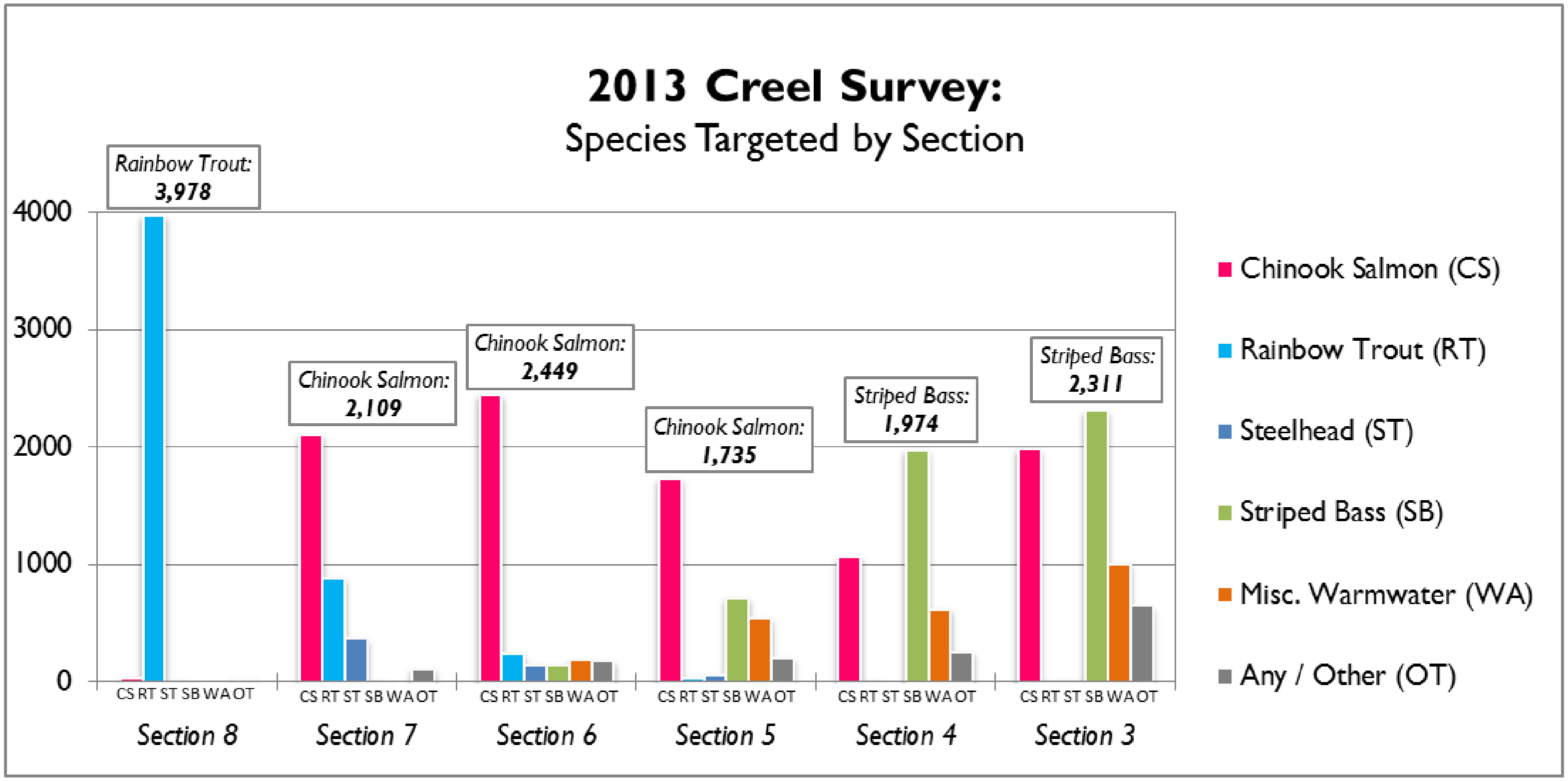
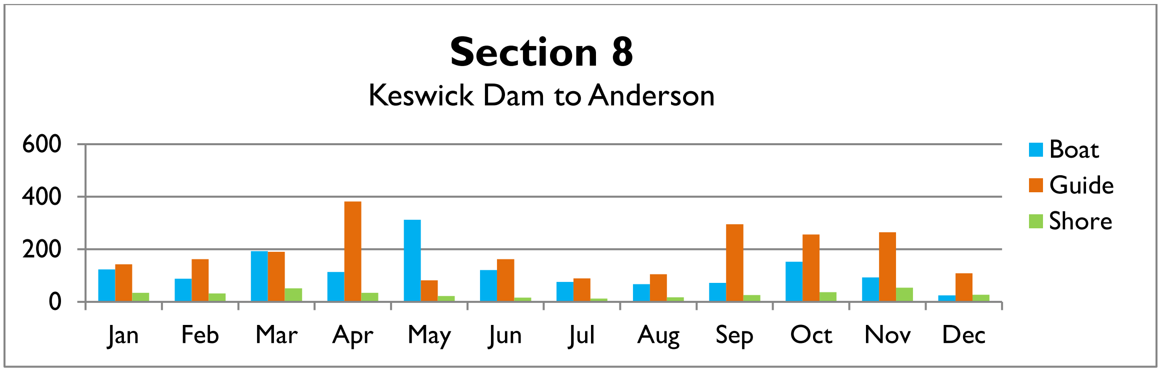
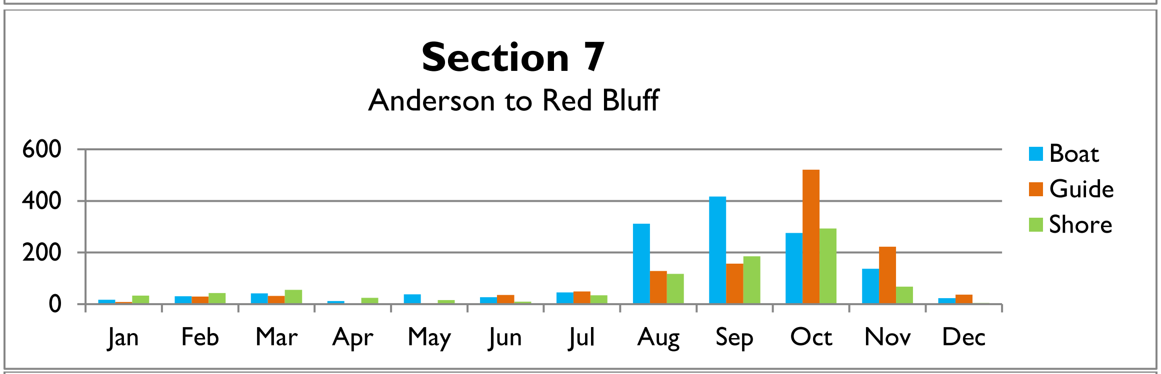
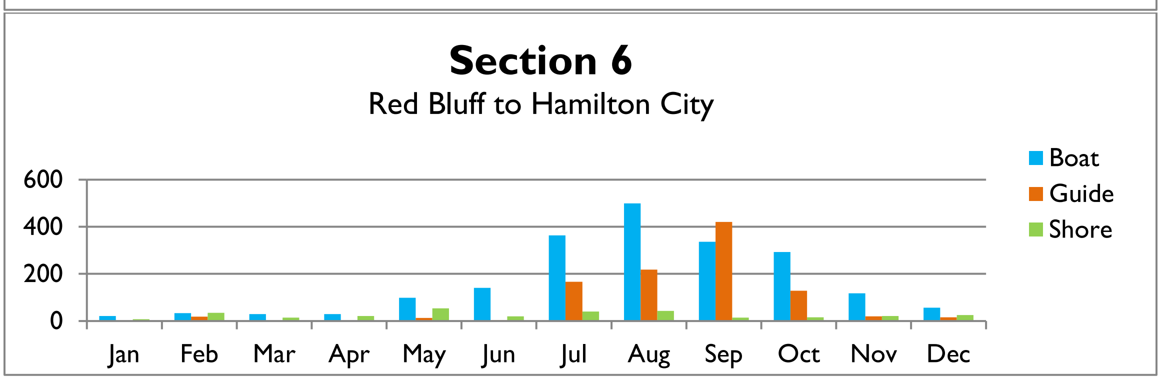
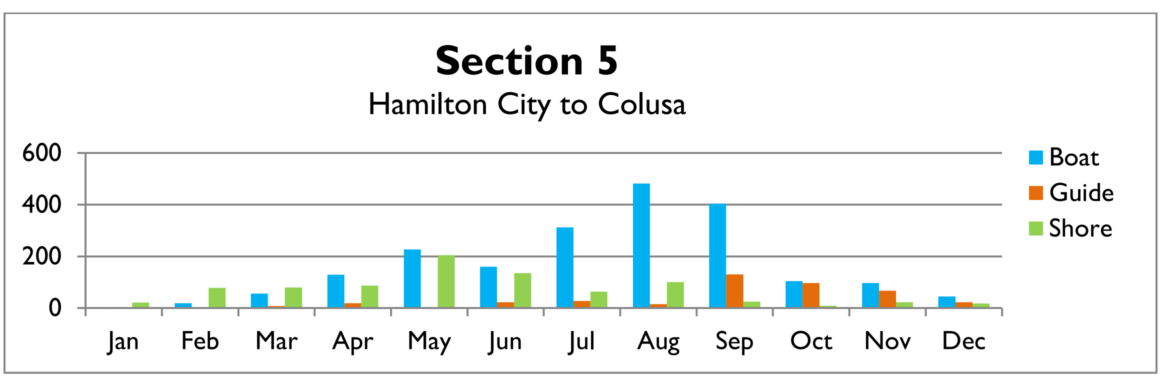


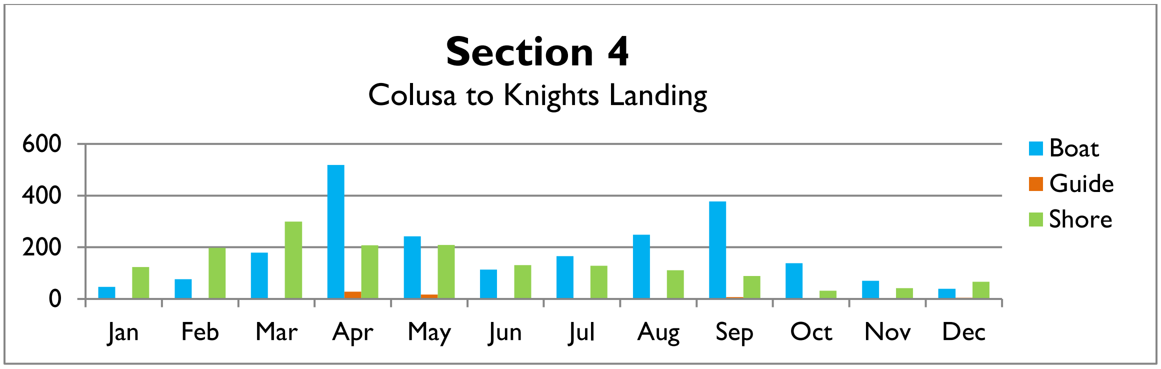
Figure 3: Seasonality by Section










Section 4
Colusa to Knights Landing
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Boat
Guide
Shore

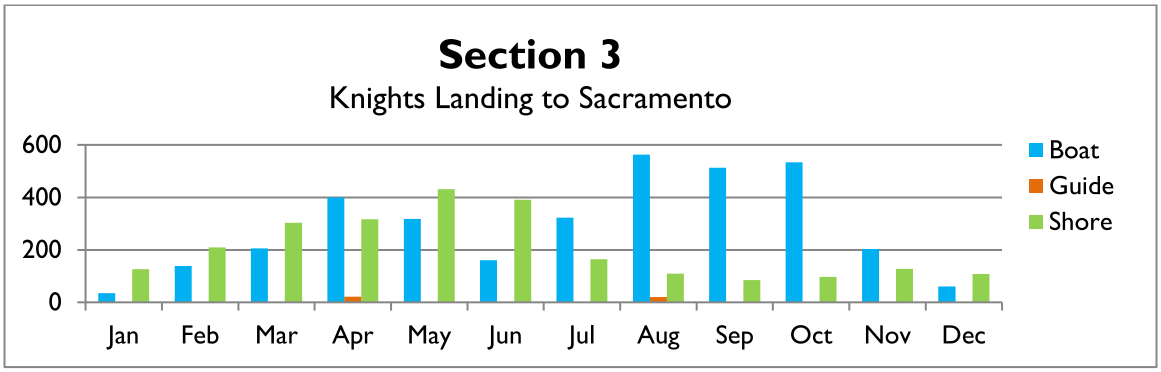

Section 3
Knights Landing to Sacramento
600
400
200
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Boat
Guide
Shore

Figure 4: Average Distance Travelled Per Trip – 2013.

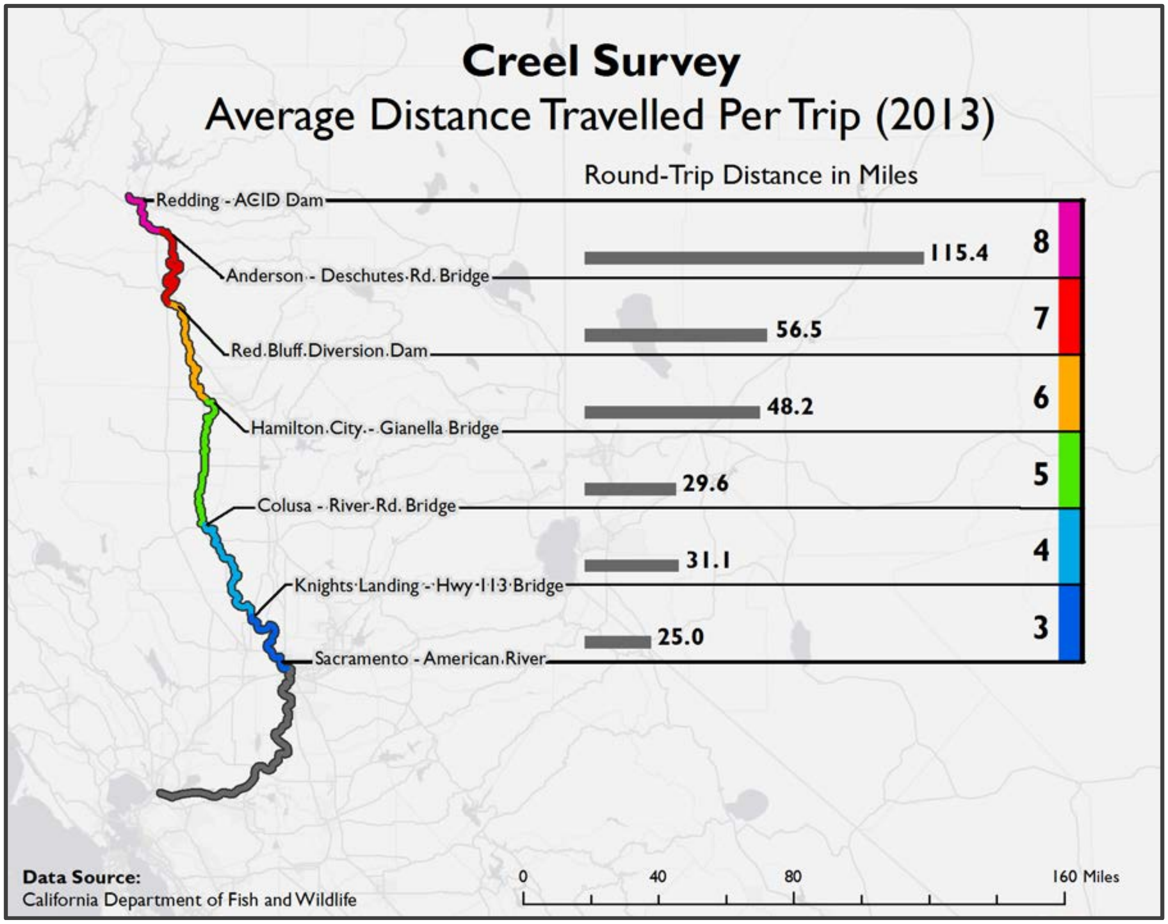


Figure 5: Angler Origins and Destinations

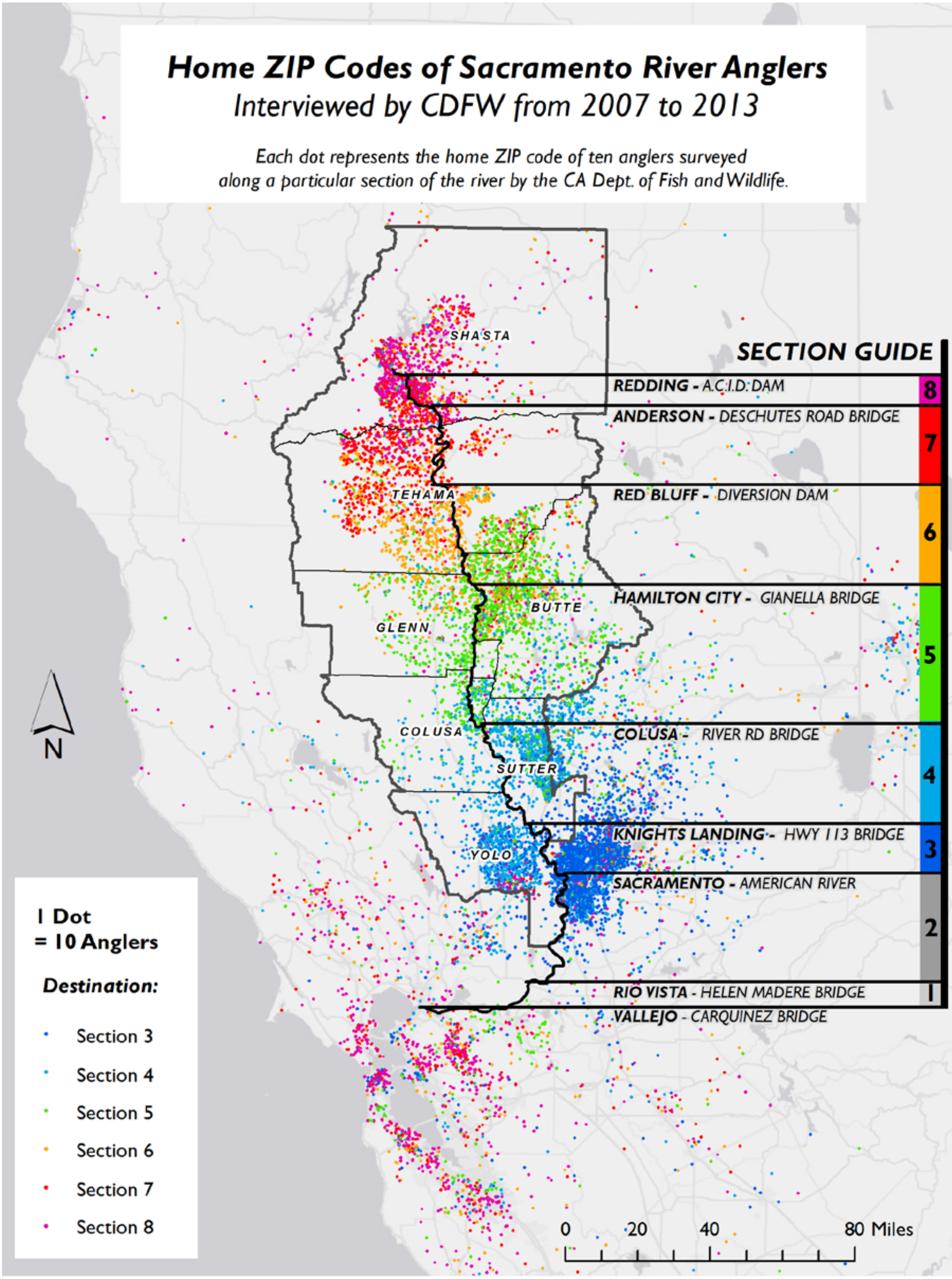


Figure 6: Willingness to Pay, User Days and Total Annual Value to Angelers