



**The Economic Benefits to Freshwater Anglers
Of Achieving the Anadromous Fish Restoration
Program Fish Population Goals for the
Sacramento River System**

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Purpose of the Sacramento River Sport Fishing Valuation Study



- ❖ To assess the current (1999) value of the Sacramento River sport fishery .
- ❖ To estimate the increase in value of the fishery as a result of achieving the AFRP fish population goals.

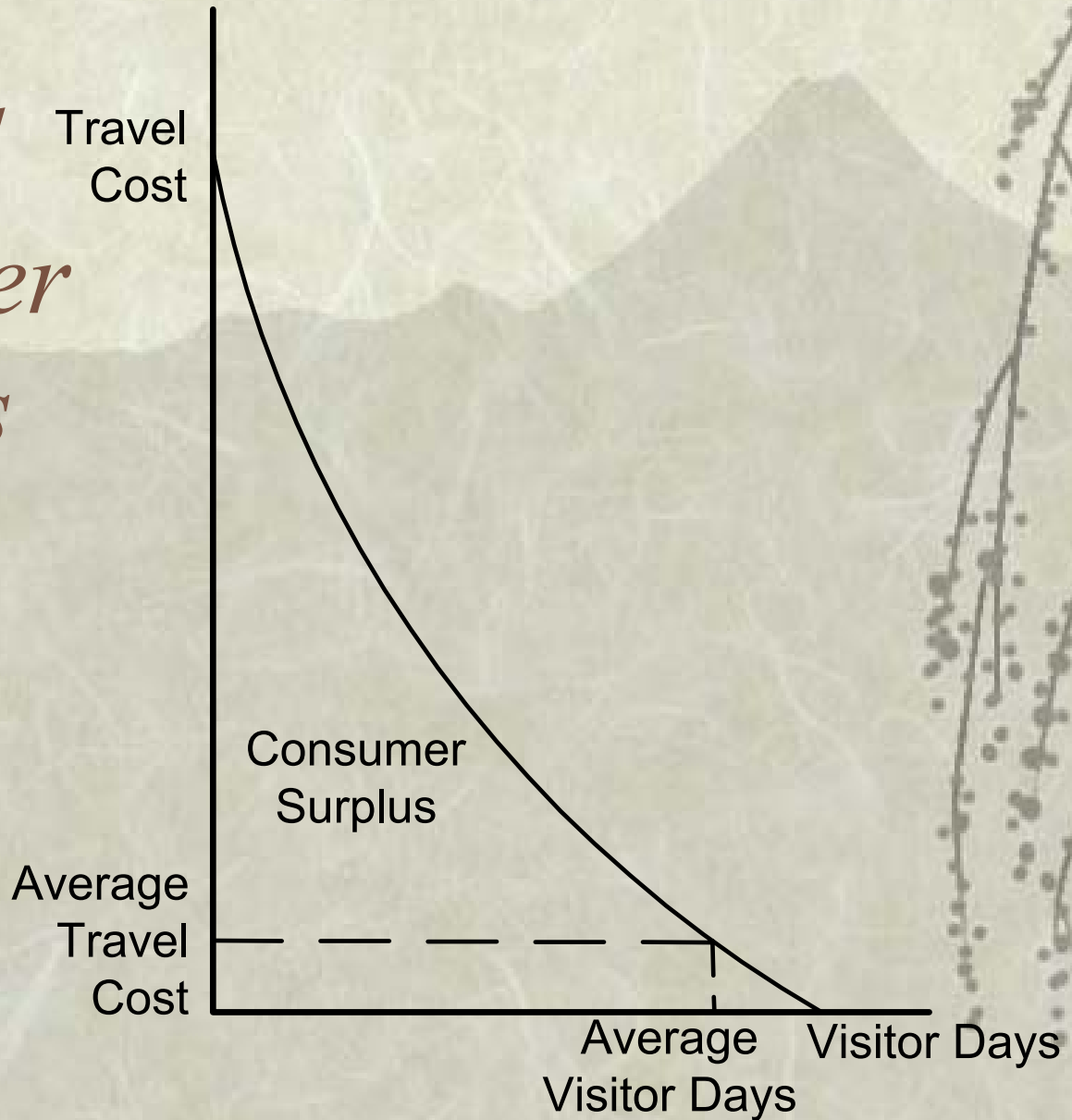
The Anadromous Fish Restoration Program

- ❖ Goal is to at least double natural production of anadromous fish species.
- ❖ Baseline is average production for the 1967-1991 period.
- ❖ Does not affect hatchery production of salmon.
- ❖ Therefore, the AFRP fish population goals for natural production imply an increase in total fish populations.

Methodology

- ❖ Zonal travel cost study.
- ❖ A zonal travel cost study specifies a relationship between the number of annual trips per capita, from a particular origin (county) to a particular destination, as a function of trip cost.
- ❖ The annual value of the fishery is the consumer surplus per visitor day times the total number of visitor days per year.
- ❖ Consumer surplus is the difference between what visitors are willing to pay and what they do pay.

*Graph:
Annual
Consumer
Surplus*



Primary Data Source

- ❖ The data for this study are from the 1999 creel survey done by the California Department of Fish and Game.
- ❖ That survey involved interviewing anglers on the Sacramento, American, Yuba, Mokelumne, and Feather Rivers within the Sacramento River system.
- ❖ Information collected includes the number in the party, species sought, the type and number of fish caught, and the number of hours the party has fished.
- ❖ The regression used 19,427 observations representing 39,063 visitor days.

Model Hypothesis



- ❖ The hypothesis is that anglers choose a fishing destination within the Sacramento River system based on the cost to travel to it and the quality of the fishing site.

The quality of a Fishing Site



- ❖ The weighted catch rate for Salmon and Striped Bass: defined as the number of each species caught per hour of fishing effort times the percentage of angler effort directed towards each species.
- ❖ The presence of other species of interest: specifically rainbow trout and American Shad.

Dependent Variable

- ❖ The dependent variable is the number of annual visitor days by residents of a particular county to a particular fishing destination within the Sacramento River system.
- ❖ The willingness of residents to travel to a fishing site depends on certain characteristics of the residents in addition to the quality of the fishing site.

Resident Characteristics

- ❖ Residents of rural counties are more likely to fish than residents of urban counties (defined as counties with populations of at least 750,000 and where more than 30% live in cities with 100,000 or more residents).
- ❖ Hispanic residents are more likely to fish than the average resident. This relationship is strongest for Hispanic residents of urban counties.

Form of the Regression Equation

The natural log of annual visitor days to a particular fishing site per million of county population is a function of :

1. Travel Cost
2. Weighted Catch Rate
3. Percent of county population that is of Hispanic origin
4. Whether the county is rural or urban
5. Whether American Shad is an important target species
6. Whether rainbow trout is an important target species
7. The product of the urban and Hispanic % variables.

Choice of the Semi-Log Form of the Equation

- ❖ The linear form of the equation yielded a poor fit.
- ❖ The fit for the log-log form was somewhat inferior to the semi-log form.

Coefficients, Means, and T-Values

<i>Coefficient</i>	<i>Value</i>	<i>Means</i>	<i>t-statistics</i>
<i>Intercept</i>	-1.4058	n.a.	-27.8938
<i>Travel Cost</i>	-0.0098	24.2610	-46.3038
<i>Weighted Catch Rate</i>	9.7112	0.0707	38.1433
<i>Hispanic Percent</i>	7.3387	0.1746	26.5420
<i>Rural (=1)</i>	3.1160	0.6463	61.9440
<i>American Shad</i>	0.1520	0.1099	8.1543
<i>Rainbow Trout</i>	0.6399	0.0588	24.0345
<i>Hispanic Percent x Rural</i>	-5.3861	0.1099	-18.8052

Significance of the Included Variables



- ❖ All coefficients have the expected sign.
- ❖ All variables are significant at the 99% confidence interval (t-values greater than 2.6).

Overall Regression Fit

<i>Regression Statistics</i>	
<i>Multiple R</i>	0.8163
<i>R Square</i>	0.6663
<i>Adjusted R Square</i>	0.6662
<i>Standard Error</i>	0.8072
<i>Observations</i>	19427

- ❖ The included independent variables explain 66.6 % of the variation in the dependent variable.

Equation Solutions

Substituting the mean values for all variables other than travel cost yields the following equations:

For Rural Visitors:

$$\text{Ln(Annual Visitor Days/ Million)} = 2.7925 - .0098 * \text{Travel Cost}$$

For Urban Visitors:

$$\text{Ln(Annual Visitor Days/ Million)} = 0.6170 - 0098 * \text{Travel Cost}$$

Estimated Annual Visitor Days

- ❖ Inserting the average travel cost of \$24.26 per visitor day and solving the equations for visits per million yields:
 - Annual urban visitor days per million = 2.02
 - Annual rural visitor days per million = 17.82
 - Weighted average annual visitor days per million = 12.23

Consumer Surplus per Visitor Day

- ❖ For the semi-log form of the equation consumer surplus per visit is equal to the absolute value of the inverse of the travel cost coefficient or \$102.02.
- ❖ Consumer surplus per million residents is the product of the average number of visits per million and consumer surplus per visit and is \$1,248.14.
- ❖ Dividing the total consumer surplus per million by the average visits per million (15.5) yields consumer surplus per visit or \$80.52.

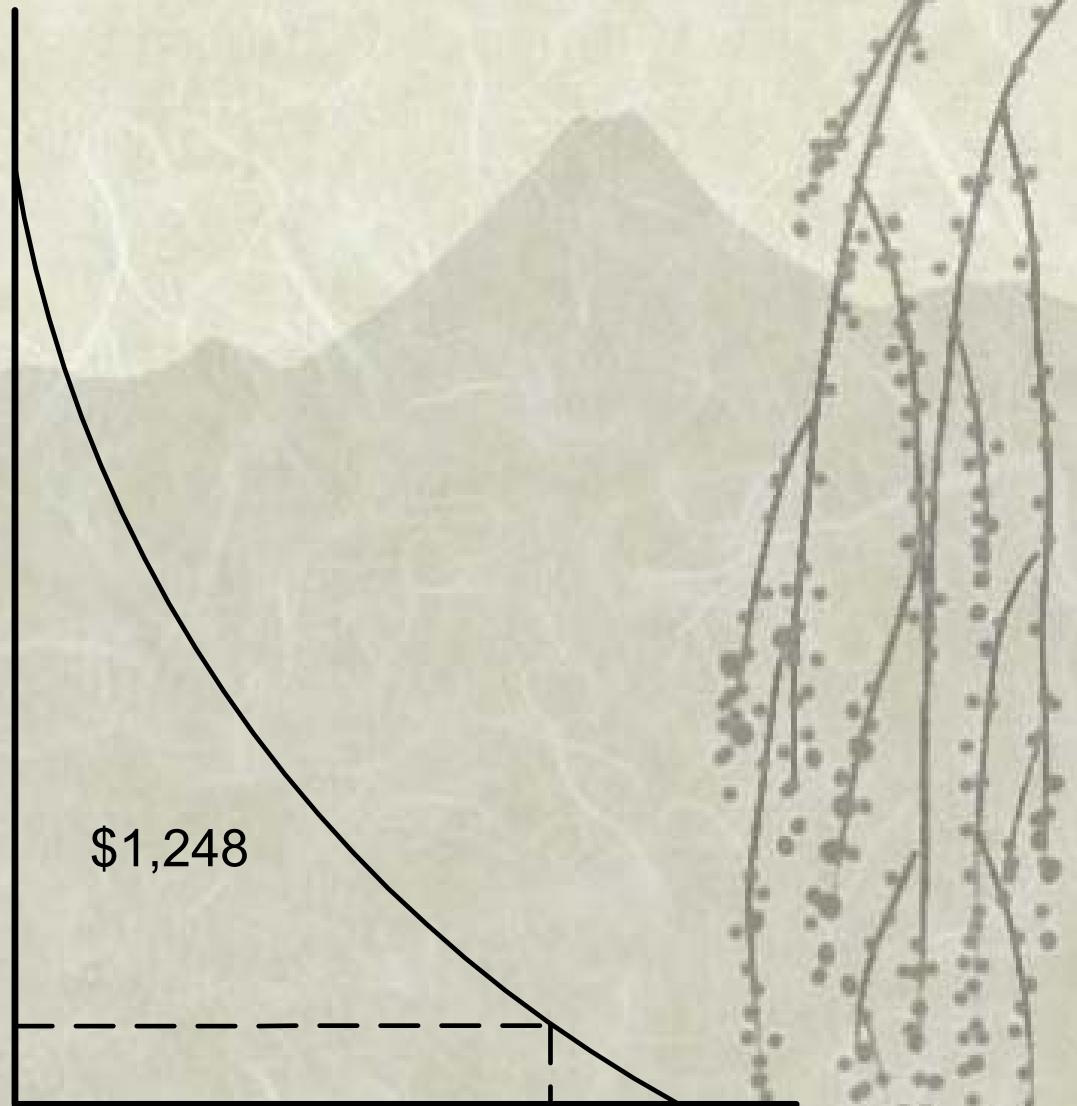
*Graph:
Estimated
Consumer
Surplus*

Travel
Cost

\$24.26

\$1,248

12.23 Visitor Days



The 1999 Value of the Sacramento River System Freshwater Fishery



- ❖ Multiplying the average value per visitor day of \$80.52 times the 469,191 visitor days per year yields an annual value to freshwater anglers using the Sacramento River system of \$37,778,703.

The Value of AFRP Fish Population Increases

- ❖ The percentage increase in fish populations is assumed to be a proxy for the percentage increase in the weighted catch rate.
- ❖ The value of the quality change estimated here is for the results of ongoing AFRP actions measured from the 1999 base year to the year in which the fish population goals are met.
- ❖ Achieving the AFRP goals implies a 53.7% increase in the weighted catch rate (WCR) if hatchery production is held constant at 1999 levels.

Estimated Equations for a 53.7 Percent Increase in the Weighted Catch Rate

The equations used to estimate consumer surplus for a 53.7% increase in the weighted catch rate are:

For Rural Visitors:

$$\text{Ln(Annual Visitor Days /Million)} = 3.1611 - .0098 * \text{Travel Cost}$$

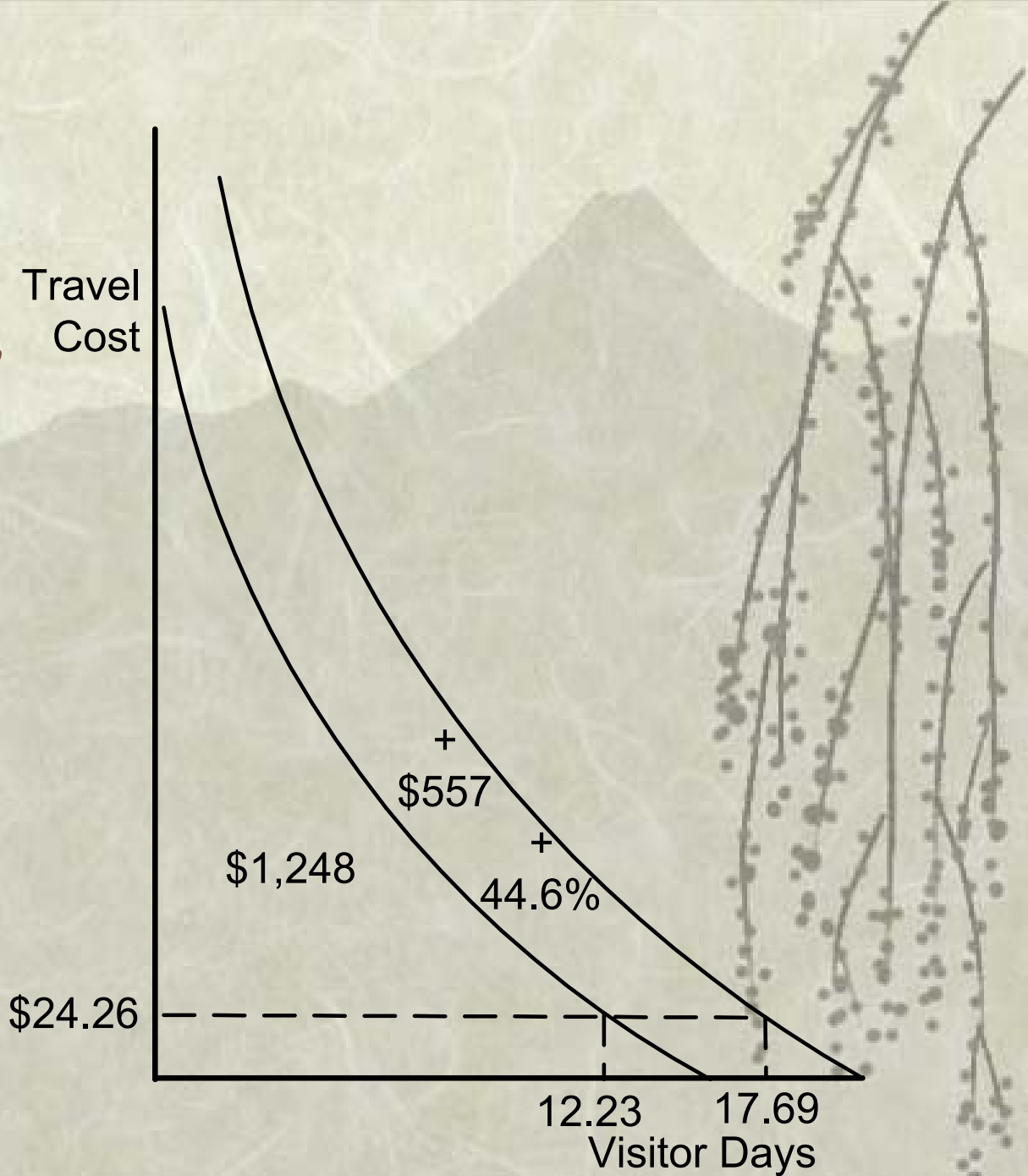
For Urban Visitors:

$$\text{Ln(Annual Visitor Days /Million)} = 0.9857 - 0098 * \text{Travel Cost}$$

*Estimated Annual Visitor Days
following Achievement of the AFRP
Fish Population Goals*

- ❖ Inserting the average travel cost of \$24.26 per visitor day and solving the equations for visits per million yields:
 - Annual urban visitor days per million = 2.93
 - Annual rural visitor days per million = 25.77
 - Weighted average annual visitor days per million = 17.69

*Graph:
Change in
Consumer
Surplus*




The Change in Value for the Sacramento River Freshwater Sport Fishery due to the AFRP Increases in Fish Populations

- ❖ Total consumer surplus increases by \$16,841,218 to \$54,619,921.
- ❖ The percentage increase in the value of the Sacramento River freshwater sport fishery is 44.58%, or 83.07% of the increase in the weighted catch rate.

The Future Value for the Sacramento River Freshwater Sport Fishery due to the AFRP Increases in Fish Populations

Year	Value (1999\$)
2000	\$17,093,836
2005	\$18,414,916
2010	\$19,838,095
2015	\$21,371,262
2020	\$23,022,919
2025	\$24,802,222
2030	\$26,719,037
2035	\$28,783,992
2040	\$31,008,534



Present Value of Benefits of Improvement in the Sacramento River Freshwater Sport Fishery

- ❖ Based on:
 - California's projected annual population growth rate of 1.5%
 - Real discount rate of 3%
- ❖ Present Value (in 1999 dollars) of achieving the AFRP fish population goals is \$507 million over the next 40 years

Other Considerations



- ❖ The actual value of the fishery improvements will be greater than the increased value of the freshwater fishery alone.
- ❖ The value of a larger commercial salmon catch and the enhanced value of the salmon and striped bass ocean sport fishery would be in addition to the value estimated here.