

# Angler Survey of the Lower Mokelumne River, July through December 1999.

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Abstract: An angler survey was performed by boat on the lower Mokelumne River to estimate angling pressure, money spent angling, and in-river harvest of fall-run chinook salmon. During the survey, 1,607 anglers were contacted with 12% fishing specifically for chinook salmon. Harvest estimates indicate that as much as 11% (689) of the 1999 salmon run was caught between the San Joaquin River and Woodbridge Dam. There was also a large striped bass fishery with approximately 44% of contacted anglers fishing for striped bass. Average dollar amount spent was \$35 per angling group with the average salmon angler spending \$14.21 per trip. Total estimated money spent by anglers was \$1,534,859 with \$352,438 spent by salmon anglers.

## INTRODUCTION

Historically, human activities have focused on the extractive value of natural resources and ecological processes without sufficient consideration of the concomitant loss of other social and ecological benefits. The broad goal of ecosystem restoration is to find patterns of human use and interaction with the natural environment that provide greater overall long-term benefits to society as a whole. One aspect of this interaction is sport harvest of chinook salmon, *Oncorhynchus tshawytscha*, in streams of California's Central Valley and Sacramento-San Joaquin Delta.

The Central Valley Project Improvement Act's (CVPIA) Comprehensive Assessment and Monitoring Program (CAMP) estimates natural production of adult chinook salmon in each watershed of the Central Valley by summing in-river escapement estimates, hatchery returns, in-river harvest and ocean harvest estimates (CAMP 1998). In the lower Mokelumne River, a major east-side tributary of the Sacramento-San Joaquin Delta, reports from 1995 through 1999 estimated that approximately 0 to 0.2% of Mokelumne River chinook salmon production was harvested in-river (CAMP 1999). No estimates are made for the Cosumnes River, which joins the Mokelumne on the eastern side of the Sacramento-San Joaquin Delta (Fig. 1).

The purpose of this study is to verify information currently used by the CVPIA CAMP for in-river harvest of adult fall-run chinook salmon in the lower Mokelumne River. The report presents results of an angler survey conducted between Camanche Dam and the San Joaquin River, the length of river presently accessible to adult fall-run chinook salmon. It provides an estimate of in-river and down-river harvest (as defined by CAMP), and fishing pressure for the period 1 July to 31 December 1999. This survey also includes an estimate of money spent by anglers fishing the lower Mokelumne River.

## Study Area

The section of Mokelumne River and Delta between Camanche Dam and the San Joaquin River is approximately 145 km (90 mi) (Fig. 1). Most of the land adjacent to the river

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below Camanche Dam is privately owned. Access for bank angling is achieved from areas around bridges such as Highway 88, and Mackville, Elliott, and Lower Sacramento roads. Public access is also gained at East Bay Municipal Utility District's (EBMUD) Mokelumne River Day-Use Area (MRDUA) and Lake Lodi parks. Bank angling in the North and South forks is accessed by parking on roads atop levees. Boat angling below the Woodbridge Irrigation District Dam (WIDD) is achieved by launching at Wimpy's and New Hope marinas (Thornton Road), and numerous marinas along Brannan Island Road, and several sites along Highway 12 at or downstream of Terminous. Boat angling is conducted from Camanche Dam to WIDD from launches at Lake Lodi and the MRDUA. WIDD effectively blocks striped bass, *Morone saxatilis*, and American shad, *Alosa sapidissima*, access above the dam (Fig. 1). The Mokelumne River from Camanche Dam to Peltier Road is closed to angling annually between 15 October and 31 December.

## METHODS

Roving clerk surveys were performed following the methods described by Hayne (1991), using a 17-ft aluminum jetboat. Surveys were performed on each Saturday and Sunday and one randomly chosen weekday each week from 1 July to 31 December. Survey times were randomly chosen from four preset times (00:00-06:00, 06:00-12:00, 12:00-18:00, 18:00-24:00).

The river was divided into three survey sections based on road boundaries, access points and river mileage (Figure 1):

Section 1: Camanche Dam to WIDD

Section 2: WIDD to New Hope

Section 3: New Hope to the San Joaquin River (Including both Delta forks).

Section 1 was accessed from Lake Lodi, Mokelumne River Beach Resort RV park (at Highway 99), or MRDUA, depending on river flows and daylight. Sections 2 and 3 were accessed from Wimpy's Marina (New Hope Landing).

All anglers encountered were asked a standard set of questions (Fig. 2). Estimates for angler-hours per day, anglers per day, catch per unit effort (CPUE), and total harvest, were calculated as described by Malvestuto (1983):

where:

$$\begin{aligned} \text{Angler-hours / day (x):} \quad a*b &= c \\ c/d &= x \\ a &= \text{time spent sampling} \\ b &= \text{number of anglers encountered} \\ d &= a/\text{number of hours available in a day} \end{aligned}$$

$$\begin{aligned} \text{Anglers / day (y):} \quad x/e &= y \\ x &= \text{angler-hours / day} \\ e &= \text{average duration of fishing trips} \end{aligned}$$

CPUE (z):	f/g	= z ( fish per angler-hour)
	f	= number of fish caught
	g	= total number of angler-hours (from time when fishing began to time when angler was contacted)
Total catch or harvest(t)	z*h	= t
	z	= CPUE
	h	= total estimated angler-hours

All reported *Micropterus* sp. were grouped as black bass. All reported *Lepomis* sp. were grouped as sunfish. All reported *Ictalurus* sp. were grouped as catfish.

During the survey a number of parameters were measured or observed by the clerks, such as water temperature, creel numbers, angler methods, fishing licenses, and how anglers accessed the river (boat, bank fishing, wading). Water temperatures were obtained with a Lowrance X65 Depth Sounder. Creeled fish were measured and lengths recorded when possible. If captured fish were released, the angler was asked to estimate the fish lengths. Angler method and access were determined visually by the clerks or by asking anglers. Display of a fishing license was determined visually by the clerks. Anglers were not asked if they had purchased a license to reduce confrontation, which may have jeopardized data and crew safety. River flow was provided by EBMUD and the United States Geological Survey.

Anglers were asked approximately how much money they spent for that particular fishing excursion. Answers were placed into predetermined categories on the data collection sheet (Fig. 2). Total estimated dollar amount spent was calculated by the number of surveys in each category multiplied by the mean dollar amount in each category. Totals were then divided by the number of surveys performed to provide the average amount spent by each group. The average amount spent by each group surveyed was then multiplied by the total estimated number of groups of anglers.

## RESULTS

Mean daily Mokelumne River flow below Camanche Dam ranged from 885 cfs on 1 July to 325 cfs on 7 September. Flow below WIDD ranged from 644 cfs on 1 July to 97 cfs on 15 September (Fig.3). Mean daily flow on the Cosumnes River at Michigan Bar ranged from 121 cfs on 9 November to 23 cfs on 14 October. Water temperature for the study ranged from 23.0°C in July to 7.8°C in December (Table 1). Monitoring performed by EBMUD at the WIDD fish passage facility indicate that adult fall-run chinook salmon began ascending the ladder in early to mid-August. The number of adult salmon passing WIDD as of 31 December 1999 was 5,305 with an estimated total run of 5,338 by 1 February 2000.

### **Angling pressure**

The number of anglers encountered and the estimated total anglers are presented in Table 2. Estimated angler-hours per month by target species are presented in Table 3. Target fish species by river section and month are presented in Table 4. Catch per unit effort (CPUE) and estimated total harvest for all fish species observed are presented in Tables 5 and 6, respectively. Observations of kept and released fish are presented in Table 7. Methods of angling and success rate of methods are presented in Tables 8 and 9, respectively. The amount spent by groups contacted and estimated dollar amount spent by anglers grouped by target fish species are presented in Table 10. Angler residence as defined by state and county is presented in Table 11. Observations of fishing licenses are provided in Table 12.

## **DISCUSSION**

### **Chinook salmon**

Twelve percent of anglers contacted were fishing for chinook salmon. Angling for chinook salmon was concentrated from approximately 1.5 miles (2.4 km) above the confluence of the Cosumnes River to Beaver Slough on the South fork of the Mokelumne River (Fig. 1). Fishing for salmon started at the end of August and ended in the beginning of November (Tables 3 and 4). Fish were caught between the beginning of September and end of October (Tables 5 and 6). Of the observed salmon caught, 72% (21) were caught in Section 2. The remaining 28% (8) were caught in Section 3 (Table 6). There were no observations of salmon caught in Section 1 although previous surveys suggest a small percent of the run (<1% of total run) is captured in this section (Merz and Mulrooney 1998). Anglers using jigs comprised 67% of the salmon anglers and caught 69% of total salmon. Trollers comprised 32% of anglers targeting salmon and caught the remaining 31% of creel chinook salmon (Tables 8 and 9). Although 2% of salmon anglers were bank fishing in Section 1, all chinook salmon caught were by boat anglers in sections 2 and 3. Of the 29 salmon creel 4 (14%) had a clipped adipose fin, 3 (10%) were smaller than 60 cm (considered "jacks"); 8 (28%) were adult females and 18 (62%) were adult males. At least 2 (7%) creel fish had been snagged by jigging methods.

The estimated number of chinook salmon caught from 1 July through 31 December 1999 is 689. Video and trap counts by EBMUD verified 5,338 adult chinook salmon moved past WIDD by the end of December 1999. The 1999 Cosumnes River fall-run chinook salmon spawner escapement survey (CDFG 2000) used carcass counts to estimate a total run of 136 fish. Based on this ratio of escapement (136: 5,338) it is estimated that 18 fish captured by anglers would have entered the Cosumnes River and 671 would have passed WIDD. The total estimated escapement of fall-run chinook salmon to the Cosumnes/Mokelumne drainage was 6,027. There was no information collected for Dry Creek. The estimated percentage of the run captured is 11% with 572 kept (9%). Merz and Mulrooney (1999b) found similar harvest estimates during a survey in 1998. According to the CAMP Annual Reports (1998) it is estimated that between 0 and 0.2% of total escapement measured at WIDD was caught by anglers between 1995 and 1997 in-river down to the San Joaquin River. The results of this survey suggest that CAMP

may underestimate annual total harvest of fall-run chinook salmon on the lower Mokelumne and Cosumnes rivers.

### **Striped bass**

Striped bass constituted 44% of the target species for the groups surveyed (Table 4). Of all the striped bass caught 449 (78%) were smaller than 457mm (18 inches). This suggests a healthy juvenile striped bass fishery in this section of river.

### **Black bass**

Largemouth bass, *M. salmoides*, comprised 11% of the target species for the groups surveyed (Table 4). All black bass anglers stated they were specifically angling for largemouth. However, several spotted bass, *M. punctulatus*, and at least 2 smallmouth bass, *M. dolomieu*, were observed in creels of anglers who identified the fish as largemouth. Hybridization among these species compounds this misidentification (Pipas and Bulow 1998). Black bass anglers released 91% of the fish caught (Table 9). Many anglers contacted with creeled fish were in tournaments and stated that the fish would be released after weigh in, suggesting the black bass population of the Mokelumne River and associated delta supports mostly a sport fishery. Tournaments were observed on weekends from 18 September 1999 through 16 November 1999 with anglers covering large tracts of the Sacramento- San Joaquin Delta not monitored in this survey.

### **Catfish**

Catfish comprised 25% of the target species of angling groups surveyed (Table 4). Twenty-two percent of catfish anglers were targeting channel catfish, *I. punctatus*, while the rest indicated they were angling for catfish in general. One angler was adamant about catching blue catfish, *I. furcatus*, which is uncommon in the Delta (P. Moyle, personal communication). Similar to the black bass issue, many anglers misidentified channel catfish as white, *I. catus*, or blue catfish, and black bullhead, *I. melas*, and brown bullhead, *I. nebulosus* as channel catfish. Bullhead were the most common catfish creeled, followed by channel catfish. All catfish anglers contacted used bait although one striped bass angler captured a catfish by lure (Table 9). Of all catfish caught 72% were kept. This suggests that this catfish population mostly supports sustenance anglers.

### **Rainbow trout**

Eighty-three percent of rainbow trout creeled were from Section 1 and 17% from Section 2 (Table 6). Of all rainbow trout creeled none were over 18 inches<sup>3</sup>. All creeled fish appeared to be wild and were not adipose fin-clipped. Current regulations prohibit keeping non-clipped fish (CDFG 1999).

### **Other fisheries**

Twenty percent of anglers contacted had no specific target species but were successful in capturing numerous fish of several species. The majority of these anglers were bankfishing with bait. The combination of anglers targeting American shad, bluegill and black crappie constituted less than 3% of all anglers contacted (Table 4). Approximately 40% of non-black bass sunfish creeled were bluegill, *L. macrochirus*, and 60% were

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<sup>3</sup> California Department of Fish and Game size criteria used to separate resident and ocean steelhead

redeer sunfish, *L. microlophus* (Table 6). Anglers commonly misidentified redear sunfish as bluegill.

### **Angler demographics**

Eleven percent of anglers contacted planned to spend the night locally, either by car or boat camping, houseboat rental or paying for lodging. This was also observed for 4% of salmon anglers contacted. The estimated dollar amount spent by total anglers over the 6-month period was \$1,534,235 of which \$352,438 was spent on chinook salmon sport angling (Table 10b).

The average distance anglers traveled to fish the lower Mokelumne River was 45 miles (min: 0; max: 385). Sixty-six percent of anglers contacted were from Sacramento and San Joaquin counties with 34% of anglers traveling from outside the local area (Table 11). This suggests that as much as \$51,000 may be spent by salmon anglers who reside outside of the local economy (Sacramento and San Joaquin counties) with approximately \$522,000 brought into the local economy by all anglers from outside the Sacramento-San Joaquin area over the 6-month period.

### **License observations**

Approximately 50% of anglers contacted did not have a properly displayed license as described in the California Department of Fish and Game angling regulations (CDFG 1999). In fact, several anglers openly stated that they did not have a license (approximately 1%) (Table 12).

### **ACKNOWLEDGMENTS**

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### **LITERATURE CITED**

- California Department of Fish and Game. 2000. 1999 Cosumnes River spawner escapement survey. California Department of Fish and Game, Sacramento, California, USA.
- \_\_\_\_\_. 1999. California Sport Fishing Regulations. California Department of Fish and Game, Sacramento, California.
- Hayne, D. W. 1991. The access point creel survey: procedures and comparison with the roving-clerk creel survey. American Fisheries Society Symposium 12:123-138.

- Malvestuto, S. P. 1983. Sampling the recreational fishery. L. A. Nielsen and D. L. Johnson, editors. Fisheries Techniques. American Fisheries Society, Bethesda, Maryland, USA.
- Merz, J. E. and M. B. Mulrooney. 1999a. Fall 1998 angler survey of the lower Mokelumne River, San Joaquin County, California. East Bay Municipal Utility District, Lodi, California, USA.
- Merz, J. E. and M. B. Mulrooney. 1999b. A preliminary angler survey of the lower Mokelumne River between its confluence with the Cosumnes and San Joaquin Rivers. September 12 – October 22, 1998.
- Pipas, J. C. and F. J. Bulow. 1998. Hybridization between redeye bass and smallmouth bass in Tennessee streams. Transactions of the American Fisheries Society 127:141-146.
- United States Fisheries and Wildlife Service. 1999. Comprehensive Assessment and Monitoring Program (CAMP). Annual Report 1998. U. S. Fish and Wildlife Service, Sacramento, California, USA.
- 
- \_\_\_\_\_. 1998. Comprehensive Assessment and Monitoring Program (CAMP). Annual Report 1995-97. U. S. Fish and Wildlife Service, Sacramento, California, USA.
- 
- \_\_\_\_\_. 1997. Comprehensive Assessment and Monitoring Program (CAMP) Implementation Plan. U. S. Fish and Wildlife Service, Sacramento, California, USA.

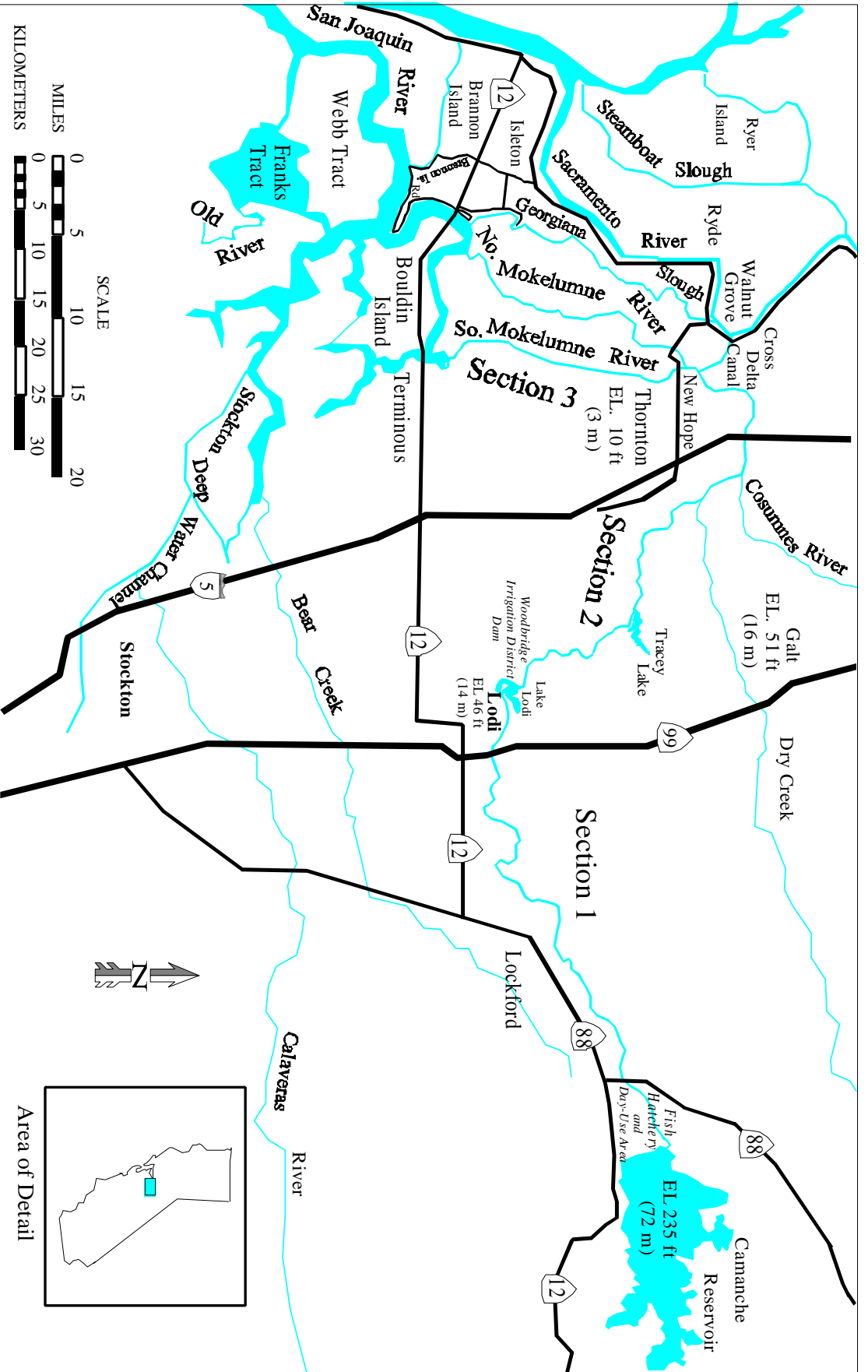


Figure 1. The lower Mokelumne River and associate portions of the Sacramento-San Joaquin Delta, California



Lower Mokelumne River and Delta  
Boat Angler Survey

<sup>1</sup>Date: \_\_\_\_\_ <sup>2</sup>Weather \_\_\_\_\_ <sup>4</sup>Water Temperature \_\_\_\_\_

<sup>3</sup>Survey Area \_\_\_\_\_ <sup>5</sup>Survey Crew: \_\_\_\_\_

<sup>6</sup>Survey Start Time: \_\_\_\_\_ <sup>9</sup>Contact Location Description \_\_\_\_\_

<sup>7</sup>Survey Stop Time: \_\_\_\_\_ \_\_\_\_\_

<sup>8</sup>Total Time: \_\_\_\_\_ Contact GPS Location <sup>10</sup> GPS ID # \_\_\_\_\_

<sup>12</sup> Angler Contact Time: \_\_\_\_\_ <sup>11</sup>N: \_\_\_\_\_

W: \_\_\_\_\_

<sup>13</sup>Disposition: \_\_\_\_\_

Shore:      Automobile                      Walk-in      Boat:      Drifting              Anchored              Other  
  
                    Wading                      Bank fishing                      Trolling              Jigging

<sup>14</sup> No. male adults	<sup>15</sup> No. female adults	<sup>16</sup> No. male children	<sup>17</sup> No. female children
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<sup>18</sup>Where are you from? \_\_\_\_\_ <sup>19</sup>Did you spend the night locally?    Y      N

<sup>20</sup> From this list, please pick the category that most accurately describes your costs for this fishing trip:	A: <\$20	B: \$20 - \$50	C: \$51 - \$100
	D: \$101 - \$200	E: \$201 - \$500	F: >\$500

<sup>21</sup>What time did you start fishing? \_\_\_\_\_ AM PM

<sup>22</sup>What are you fishing for? \_\_\_\_\_ <sup>23</sup>Method:      bait              artificial lure

Creel data

<sup>24</sup> Species	<sup>25</sup> released?	<sup>26</sup> length (mm/in)	<sup>27</sup> ad clip?	<sup>28</sup> other marks/notes
		in mm		
		in mm		
		in mm		
		in mm		
		in mm		
		in mm		

<sup>29</sup>Fishing License information \_\_\_\_\_ <sup>30</sup>Notes: \_\_\_\_\_

Angler 1	yes	no	unobservable	
Angler 2	yes	no	unobservable	
Angler 3	yes	no	unobservable	
Angler 4	yes	no	unobservable	
Angler 5	yes	no	unobservable	

<sup>31</sup>deltssht99.xls <sup>32</sup>pg \_\_\_\_\_ of \_\_\_\_\_

Figure 2. Angler survey data sheet for the lower Mokelumne River survey, 1 July through 31 December 1999.

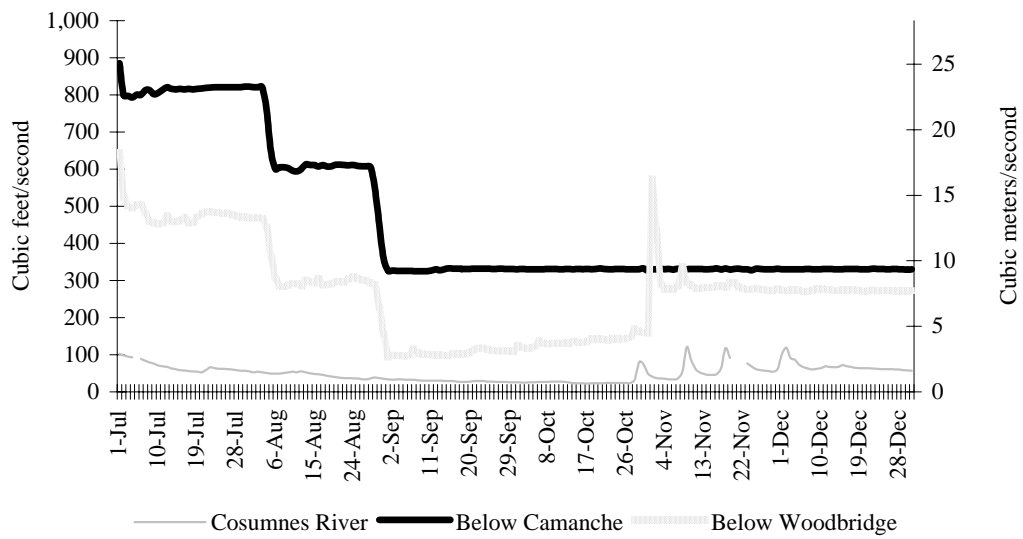


Figure 3. Average daily flows measured at Camanche and Woodbridge dams on the Mokelumne River, and the Cosumnes River at Michigan Bar, California. 1 July through 31 December 1999.

Table 1. Water temperatures (°C) recorded during an angler survey of the lower Mokelumne River, 1 July through 31 December 1999.

Section	Month	Number of samples	Maximum	Minimum	Mean	SD
1	Jul-99	12	22.7	12	16	4.32
	Aug-99	-	-	-	-	- *
	Sep-99	4	15.3	14.2	14.8	0.6
	Oct-99	6	14.4	14	14.3	0.2
	Nov-99	1	-	-	13	-
	Dec-99	1	-	-	12	-
2	Jul-99	18	22.3	15.4	17.3	1.7
	Aug-99	9	20.5	15.5	17.6	1.9
	Sep-99	15	19.5	19.5	20.8	0.5
	Oct-99	67	21.2	14	15.8	1.2
	Nov-99	9	18.5	10.5	12.4	1.4
	Dec-99	8	14	8.1	12	6.2
3	Jul-99	111	23	19	20.4	1.3
	Aug-99	-	-	-	-	-
	Sep-99	54	21.5	20	20.8	0.3
	Oct-99	156	17.3	14.5	15.5	0.8
	Nov-99	156	14.5	9.9	12.2	1.8
	Dec-99	43	9.5	7.8	8	0.3

\* Temperature equipment malfunction

Table 2a. Angling pressure estimates for the Mokelumne River between Camanche Dam and the San Joaquin River, 1 July through 31 December 1999.

Number of anglers encountered		percent	daily mean	daily min	daily max	SD
Adult						
Females	126	8%	1.6	0	19	2.98
Males	1,324	82%	17.2	0	127	14.7
Children (<16 yr)						
Females	16	1%	0.2	0	4	1.17
Males	141	9%	1.8	0	19	2.62
total	1,607		19	0	153	17

Table 2b. Estimated number of angler-hours per day; per month and as a percent total.

Survey area	Month	Estimated anglers		Percent total
		per day	per month	
1	July	92	2,841	3%
	August	58	1,793	2%
	September	114	3,429	4%
	October	68	1,015	1%
	November	-	-	-
	December	-	-	-
2	July	89	2,754	3%
	August	125	3,890	4%
	September	232	6,970	8%
	October	579	17,964	20%
	November	148	4,440	5%
	December	27	836	1%
3	July	213	6,589	7%
	August	103	3,183	4%
	September	169	5,060	6%
	October	439	13,597	15%
	November	401	12,025	13%
	December	112	3,484	4%
Estimated Total		495	89,870	

Table 3. Estimated angler hours per month, per river section for each target species recorded for the period 1 July through 31 December 1999.

Survey area	Month	American shad	Anything	Bluegill	Black crappie	Chinook salmon	Catfish	Largemouth bass	Rainbow trout	Striped Bass	Unknown	Total
1	July	-	813	-	-	-	-	-	1,274	-	110	2,196
	August	-	126	-	-	-	-	-	1,614	-	54	1,793
	September	-	1,506	-	-	821	-	-	1,095	-	-	3,422
	October	-	46	-	-	335	-	-	761	-	-	1,142
2	November	-	-	-	-	-	-	-	-	-	-	0
	December	-	-	-	-	-	-	-	-	-	-	0
	July	83	358	-	-	-	-	-	165	1,983	165	2,754
	August	199	2,085	-	-	154	-	-	-	1,084	309	3,831
3	September	-	879	-	-	2,951	1,381	377	-	691	-	6,278
	October	-	911	-	-	16,218	182	182	-	547	-	18,040
	November	-	-	-	-	669	-	334	-	2,712	-	3,716
	December	-	374	-	-	-	-	-	-	291	-	665
Total	July	-	2,263	251	-	-	943	1,257	-	1,446	189	6,349
	August	-	489	-	-	-	633	317	-	1,209	230	2,879
	September	-	1,737	-	-	58	579	926	-	2,431	-	5,731
	October	-	1,644	-	-	3,288	685	1,507	-	6,439	137	13,701
Total	November	-	842	-	-	-	481	962	-	9,620	120	12,025
	December	-	255	-	102	-	-	-	-	4,798	-	5,155
Total		281	14,327	251	102	24,494	4,885	5,863	4,909	33,251	1,314	89,676

Table 4a. Estimated number of anglers per day; per month and as a percent total.

Survey area	Month	Estimated anglers		Percent total
		per day	per month	
1	July	14	439	3%
	August	14	448	3%
	September	34	1,040	8%
	October	14	449	3%
2	July	25	787	6%
	August	29	891	7%
	September	52	1,622	13%
	October	49	1,519	12%
3	July	18	571	4%
	August	19	576	4%
	September	14	449	3%
	October	16	489	4%
12,855	July	18	571	4%
	August	19	576	4%
	September	14	449	3%
	October	16	489	4%

Table 4b. Target fish species as a percentage of total anglers contacted per survey area per month for the period 1 July through 31 December, 1999.

Survey area	Month	American shad	Anything	Black bass	Bluegill	Black crappie	Chinook salmon	Catfish	Rainbow trout	Striped Bass	Unknown
		July	-	37%	-	-	-	-	-	-	58%
1	August	-	7%	-	-	-	-	-	90%	-	3%
	September	-	44%	-	-	-	24%	-	32%	-	-
	October	-	6%	-	-	-	44%	-	50%	-	-
	November	-	-	-	-	-	-	-	-	-	-
2	July	3%	13%	-	-	-	-	-	6%	72%	6%
	August	6%	54%	-	-	-	4%	-	-	29%	8%
	September	-	14%	6%	-	-	47%	22%	-	11%	-
	October	-	5%	1%	-	-	89%	1%	-	3%	-
3	July	-	60%	-	-	-	18%	-	-	73%	-
	August	-	13%	-	-	-	-	-	-	40%	-
	September	-	54%	-	-	-	4%	-	6%	72%	6%
	October	-	14%	6%	-	-	47%	22%	-	11%	-
12,855	July	-	36%	20%	4%	-	-	-	15%	23%	3%
	August	-	17%	11%	-	-	-	-	22%	42%	8%
	September	-	30%	16%	-	-	1%	10%	-	42%	-
	October	-	12%	11%	-	-	24%	5%	-	47%	1%

Table 5. Estimated average catch per unit effort (CPUE) for each fish species observed during an angler survey of the lower Mokelumne River from Camanche Dam to the San Joaquin River, 1 July through 31 December 1999.

Survey Area	Month	American shad	Black bass	Black crappie	Chinook salmon	Catfish	Rainbow trout	Sacramento pikeminnow	Sacramento sucker	Striped bass	Sunfish
1	July	-	-	-	-	-	0.0091	-	-	-	-
	August	-	-	-	-	-	0.0117	-	-	-	-
	September	-	-	-	-	-	0.0031	-	0.0006	-	-
	October	-	-	-	-	-	0.0090	-	-	-	-
2	November	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-
	July	0.0024	0.0008	-	-	-	0.0024	-	-	0.0187	-
	August	0.0004	0.0012	-	-	-	-	0.0014	-	0.0086	-
3	September	-	0.0027	-	0.0008	0.0004	-	-	-	0.0020	-
	October	-	0.0005	-	0.0032	0.0002	-	-	-	0.0003	-
	November	-	0.0026	-	-	-	-	-	-	0.0085	-
	December	-	0.0048	-	-	-	-	-	-	0.0048	-
3	July	-	0.0199	-	-	-	-	-	-	0.0399	0.0082
	August	-	0.0048	-	-	-	-	0.0014	-	0.0429	0.0026
	September	-	0.0330	-	-	-	-	-	-	0.1174	0.0006
	October	-	0.0127	-	0.0057	0.0080	-	-	-	0.0410	-
3	November	-	0.0065	0.0003	-	0.0019	-	-	-	0.0240	-
	December	-	0.0058	-	-	-	-	-	-	0.0235	-

Table 6. Estimated number of fish captured per survey area per month for the period 1 July through 31 December, 1999.

Survey area	Month	American shad	Bluegill	Black crappie	Chinook salmon	Catfish	Black bass	Sacramento pikeminnow	Rainbow trout	Redear	Striped Bass	Sacramento Sucker
1	July	-	-	-	-	-	-	-	486	-	-	-
	August	-	-	-	0	-	-	-	265	-	-	-
	September	-	-	-	0	-	-	-	593	-	-	-
	October	-	-	-	-	-	-	-	345	-	-	66
2	November	-	-	-	-	-	-	-	-	-	-	-
	December	-	-	-	-	-	-	-	-	-	-	-
	July	102	-	-	-	-	337	-	341	-	294	-
	August	11	-	-	-	66	163	-	-	-	247	-
3	September	1	-	-	127	29	282	-	-	-	828	-
	October	-	-	-	415	14	39	-	-	-	307	-
	November	-	-	-	0	-	382	-	-	-	-	-
	December	-	-	-	-	-	266	-	-	-	76	-
3	July	-	715	0	-	2,975	229	134	-	1,040	1,438	-
	August	-	56	-	-	664	1,128	-	-	98	978	-
	September	-	36	-	0	963	124	-	-	-	1,455	-
	October	-	423	-	147	2,490	158	-	-	-	1,000	-
3	November	-	-	28	-	1,513	200	-	-	-	131	-
	December	-	-	0	-	-	134	-	-	-	298	-
		114	1,230	28	689	8,714	3,442	134	2,030	1,138	7,052	66



Table 7. Total creel or released fish observed during an angler survey on the lower Mokelumne River below Camanche dam to the San Joaquin River, July 1 - December 31, 1999

Species	total caught	released	not released	not released
American shad	4	3	1	25%
Black bass	186	170	16	9%
Black crappie	1	0	1	100%
Catfish	220	62	158	72%
Chinook Salmon	29	5	24	83%
Rainbow Trout	26	20	6	23%
Sacramento pikeminnow	2	2	0	0%
Sacramento sucker	1	1	0	0%
Striped Bass	588	493	95	16%
Sunfish	47	1	46	98%
Other	51	2	50	96%
Total fish	964	586	379	48%

Table 8a. Method of angling as a proportion of anglers contacted on the lower Mokelumne River, 1 July through 31 December 1999.

Section		Bank	Anchored	Drift	Trolling	Wading
1	July	67%		33%		
	August	56%	33%			11%
	September	86%				14%
	October	60%				40%
	November					
	December					
2	July	100%				
	August	64%	32%		4%	
	September	14%	41%		45%	
	October		17%	39%	44%	
	November		100%			
	December				100%	
3	July	77%	14%	2%	6%	
	August	59%	25%		16%	
	September	37%	30%		33%	
	October	23%	16%	27%	34%	
	November	20%	28%		52%	
	December	3%	54%		43%	

Table 8b. Methods used by anglers contacted during an angler survey of the lower Mokelumne River, 1 July through 31 December 1999.

Section	Bait		lure		fly	
	anglers contacted	percent	anglers contacted	percent	anglers contacted	percent
1	81	71%	28	25%	5	4%
2	136	40%	202	60%	0	0%
3	713	61%	447	39%	0	0%

Table 9. Success rate of angling methods as a proportion of fish captured by method and survey area of the lower Mokelumne River, 1 July through 31 December 1999.

Survey Area	Method	American shad n = 4	Black bass n = 186	Black crappie n = 1	Chinook salmon n = 29	Catfish n = 217	Rainbow trout n = 27	Sacramento pikeminnow n = 2	Sacramento sucker n = 1	Striped bass n = 589	Sunfish n = 12
1	Bait Lure	-	-	-	-	74%	4%	-	100%	-	-
	Fly	-	-	-	-	11%	11%	-	-	-	-
2	Bait Lure	100%	16%	-	72%	1%	-	-	-	6%	3%
	Fly	-	-	-	-	-	-	-	-	-	-
3	Bait Lure	-	1%	100%	3%	99%	-	50%	-	79%	-
	Fly	-	83%	-	24%	-	-	50%	-	17%	100%