

**CENTRAL VALLEY SALMON AND STEELHEAD
HARVEST MONITORING PROJECT**

1998 ANGLER SURVEY ^{1/}

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ABSTRACT

The California Department of Fish and Game conducted an angler survey on the Sacramento River and six major tributaries between April and December 1998. The purpose of the survey was to estimate the in-river effort and harvest of nine sport fish species. Thirty eight thousand nine hundred twenty-two anglers were surveyed and they spent an estimated 3,079,837 angler-hours sport fishing. Chinook salmon was the target of most anglers, having expended 1,330,017 angler-hours in pursuit of this species. Striped bass was the second most sought species with 1,141,327 angler-hours expended targeting this species. The most common fish in angler's creel was chinook salmon. Anglers harvested an estimated 84,181 chinook salmon. Striped bass and catfish were also abundant in anglers' creel. Anglers harvested an estimated 83,503 striped bass and 66,372 catfish.

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INTRODUCTION

Native anadromous fish stocks in many Central Valley rivers and streams have declined to such a critical level that many stocks are currently listed or are candidates for listing under the Endangered Species Act. In an effort to restore the abundance of natural stocks, the Central Valley Project Improvement Act (CVPIA) was enacted in October, 1992. This Act calls for the development of restoration actions that ensure long-term sustainable populations of native anadromous fish stocks. To evaluate the effectiveness of these restoration actions the Comprehensive Assessment and Monitoring Program (CAMP) was developed under Section 3406(b)(16) of the Act.

To assist in the CAMP monitoring program, the California Department of Fish and Game (CDFG) developed the Central Valley Salmon and Steelhead Harvest Monitoring Project. The CDFG has used angler surveys in past efforts to monitor the harvest of anadromous fish within Central Valley rivers and streams. Unfortunately, no comprehensive or long-term (more than 5 years) surveys have been made on a consistent basis. This project is designed as long-term monitoring program to determine annual estimates of total in-river harvest of sport fish from the Sacramento River and major tributaries. The data will also complement and enhance other ongoing CDFG harvest monitoring programs such as Department's adult striped bass, adult sturgeon and ocean salmon harvest.

STUDY AREA

The study area consists of 554 miles of the Sacramento River and major tributaries which were divided into 18 sampling sections. The rivers comprising the study area are: Sacramento River from Carquinez Bridge upstream to the Anderson-Cottonwood Irrigation District (ACID) Dam in Redding (eight sections); Feather River from its confluence with the Sacramento River at Verona upstream to the Oroville Project Fish Barrier Dam in Oroville (three sections); Yuba River from the confluence with the Feather River near Marysville to one mile upstream of the Hwy. 20 bridge crossing (two sections); American River from its confluence with the Sacramento River at Discovery Park upstream to Nimbus Dam (three sections); San Joaquin River from its confluence with the Sacramento River upstream to Mossdale Crossing near Tracy (one section); South Fork Mokelumne River from its confluence with the San Joaquin River upstream to Interstate 5 Bridge crossing including the North Fork Mokelumne River (two sections); Stanislaus River from McHenry Avenue bridge near Meyers upstream to Goodwin Dam (one section) (Figure 1).

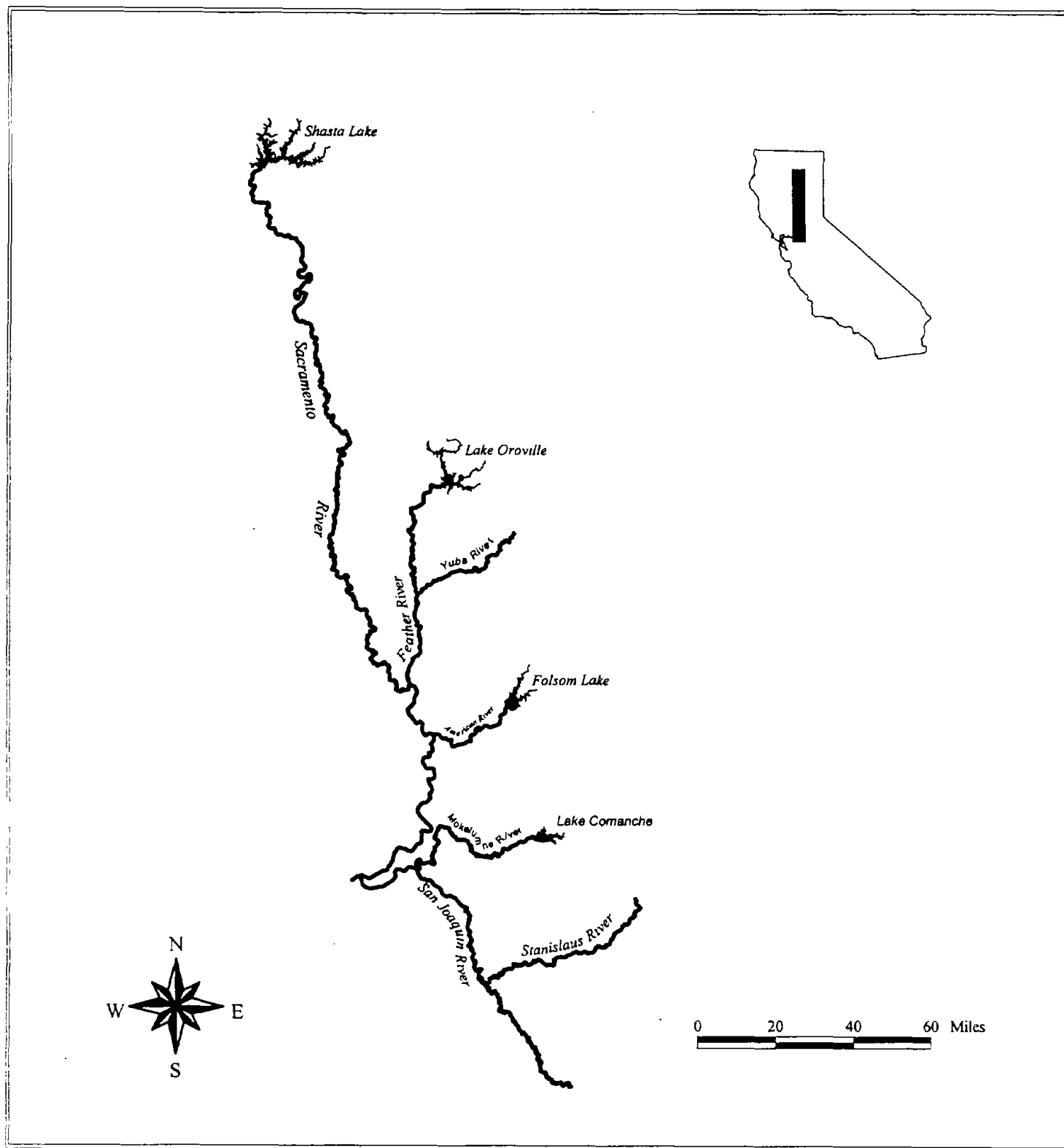


Figure 1. Angler Survey Rivers

PROCEDURES

Statistical Design

A stratified random sample design, based on the design used by the Sacramento River System Sport Fish Inventory (Wixom, 1995) was used to estimate the in-river harvest during the daytime sport fishery. While a night fishery exists in the Central Valley rivers, no effort was made by this survey to evaluate the harvest by night time sport anglers.

A total of eighteen sections was sampled. Sixteen sample sections ranged in length from 4 to 58 river miles. Two sample sections, which represented unique fisheries, were approximately one river mile in length. Sampling schedules and data summaries were compiled on a monthly basis. Months were arbitrarily chosen as sample periods.

All sample sections were surveyed eight randomly selected times each month - four weekdays and four weekend days. Weekdays and weekend days were placed in separate strata because more angling effort is commonly associated with weekend days.

All sample sections were surveyed by kayaks or power boats with the exception of the Stanislaus River. Kayaks were used in shallow upstream reaches while power boats were used in rivers where tides, wind, and waves demanded the use of more seaworthy boats. The Stanislaus River was sampled by visiting designated access points between McHenry Avenue bridge and Goodwin Dam. If vehicle(s) are present at an access point, then the creel clerk tries to locate the angler(s) by hiking along the stream bank until found. Sampling below McHenry Avenue bridge is not feasible because of the limited public access and difficulty in locating anglers.

For each section surveyed, a random start time and launch location was chosen. Start times were classified as either early or late. An early start time was scheduled to begin ½ hour after sunrise, while a late start time would vary depending on length of section and time of year. Typically, a late start time was scheduled so that the survey would end at or near sunset. Launch locations would either be at the upstream or downstream end of the sections to be surveyed. In those sections where kayaks were used, the launch location was always at the upstream end of the section.

All data collected were linked by river mile. Actual river miles were used for the Sacramento River sections. Each tributary was given a unique number series to identify it from other rivers in the database. The number series assigned to each tributary were as follows: Feather River, 400 series; American River, 500 series; Yuba River, 600 series; San Joaquin River, 700 series; South Fork Mokelumne River, 800 series; North Fork Mokelumne River, 900 series; Stanislaus River, 1000 series. River mile designations were marked in ascending order from downstream to upstream.

Data Collection

Three field data sets were required to calculate use and catch: hourly counts, angler counts, and angler interviews. Hourly counts determined the portion of the whole represented by the sample day angler count. For this survey, hourly counts collected by Wixom (1995) were used. Where hourly count data was unavailable, data sets were developed by using the hourly counts of representative rivers.

On each sampling day, the procedure was to make a high speed pass to the end of the section. This first pass was called the angler count. Data collected during the angler count included: time of observation, location by river mile, number of boats, number of boat anglers, and the number of shore anglers. At the end of the angler count, a second pass was made traveling back through the section to conduct angler interviews. Prior to beginning the interviews, the survey crew determined the feasibility of interviewing all anglers counted during the angler count. If it was determined that this was not feasible, then they randomly chose a N^{th} angler to be interviewed. Once a N^{th} angler interval was chosen, that interval was maintained through the entire section for that survey date. Data collected during each interview included: location by river mile, fishing method, number of hours fished, number of anglers in group, target species, zip code, whether the trip was completed, and the number of fish kept and released by species.

Nine sport fish species found in the Central Valley rivers were considered 'Target Species'. Those species were: chinook salmon, steelhead, rainbow trout, striped bass, sturgeon (all species), American shad, catfish (all species), sunfish (all species), and black bass (all species) (Table 1). If anglers did not indicate they were fishing for one of the target species, the code 'ANY' was used.

The number of fish kept and released was recorded separately for each of the nine target species. All other fish species caught were recorded separately by species in a column labeled "Other" (Table 2).

A length measurement was used to differentiate between steelhead and rainbow trout. All rainbow trout 18" or greater were considered to be steelhead. Rainbow trout less than 18" were recorded as rainbow trout (McEwan, 1998)¹.

Additional data were collected from five of the nine target species when kept by anglers. The five species were: chinook salmon, steelhead, rainbow trout, striped bass and sturgeon. Each fish was measured to the nearest .5 centimeter fork length and inspected for any marks or tags. A total length measurement was taken on sturgeon. All chinook salmon and steelhead caught were inspected for the presence of an adipose fin. A salmon or steelhead missing an adipose fin indicated the fish was of hatchery origin and likely contained a coded-wire tag (CWT) in its head. The head was removed from adipose fin clipped fish and sent to the CDFG Ocean Salmon Project laboratory in Healdsburg for later analysis.

¹D. McEwan, 1998, Senior Biologist, California Department of Fish and Game.

Table 1. Species symbols, common and scientific names of target species observed in the 1998 Angler Survey, April 1 through December 31, 1998.

Family	Target Species	Species Symbol	Common Name	Scientific Name
Salmonidae:	Chinook Salmon	KS	King Salmon	<i>Oncorhynchus tshawytscha</i>
	Steelhead	SH	Steelhead Trout	<i>Oncorhynchus mykiss</i>
	Rainbow Trout	RT	Rainbow Trout	<i>Oncorhynchus mykiss</i>
Perichthyidae:	Striped Bass	SB	Striped Bass	<i>Morone saxatilis</i>
Acipenseridae:	Sturgeon	ST	White Sturgeon	<i>Acipenser transmontanus</i>
			Green Sturgeon	<i>Acipenser medirostris</i>
Clupeidae:	American Shad	AS	American Shad	<i>Alosa sapidissima</i>
Ictaluridae:	Catfish	CF	Channel Catfish	<i>Ictalurus punctatus</i>
			White Catfish	<i>Ameiurus catus</i>
			Brown Bullhead	<i>Ameiurus nebulosus</i>
			Black Bullhead	<i>Ameiurus melas</i>
Centrarchidae:	Sunfish	SF	Bluegill	<i>Lepomis macrochirus</i>
			Redear Sunfish	<i>Lepomis microlophus</i>
			Black Crappie	<i>Pomoxis nigromaculatus</i>
Other:	Black Bass	BB	Largemouth	<i>Micropterus salmoides</i>
			Smallmouth	<i>Micropterus dolomieu</i>
			Spotted Bass	<i>Micropterus punctulatus</i>
Other:	Any Species	ANY	The "ANY" designation was used for anglers who indicated they were not fishing for a specific species.	

Table 2. Non-target species symbols, common and scientific names of species observed in the 1998 Angler Survey, April 1 through December 31, 1998.

Family	Common Name	Species Symbol	Scientific Name
Cyprinidae:	Common Carp	CP	<i>Cyprinus carpio</i>
	Hardhead	HH	<i>Mylopharodon conocephalus</i>
	Splittail	SPT	<i>Pogonichthys macrolepidotus</i>
	Squawfish	SQ	<i>Ptychocheilus grandis</i>
Catostomidae:	Sacramento Sucker	SKR	<i>Catostomus occidentalis</i>
Pleuronectidae:	Starry Flounder	STR	<i>Platichthys stellatus</i>
Sciaenidae:	White Croaker (Kingfish)	KF	<i>Genyonemus lineatus</i>

Estimate Calculations

Sample day estimates for angler-hours were created by dividing the observed angler count by the average hourly count within the respective hour interval. The mean of the sample days within a stratum was expanded by the number of days available in the month to obtain the total for the stratum. For each month and section, weekend and weekday strata were combined for total estimated angler-hours as follows:

$$\text{TOTALAH}_i = ((\text{ALLWD}_i * \text{WDAVG}_i) + (\text{ALLWE}_i * \text{WEAVG}_i))$$

TOTALAH_i = total angler-hours (the subscript i denotes the stratum containing a particular combination of section and month).

ALLWD_i and ALLWE_i = number of weekdays and weekend days, respectively available in the month.

WDAVG_i and WEAVG_i = mean of expanded sample-day angler-hours for weekdays and weekend days, respectively.

Hourly count data was not available for all rivers surveyed. For example, Feather River hourly counts were used with Yuba River angler count data; Sacramento River counts were used with San Joaquin River and Mokelumne River angler count data; and American River hourly counts were used with Stanislaus River angler count data.

Angler hour estimates were scaled down to each species by multiplying the total angler-hours by the observed percent distribution of effort for each target species:

$$\text{TOTALAHSP}_{ij} = \text{TOTALAH}_i * \text{FISHHRS}_{ij}$$

TOTALAHSP_{ij} = estimated angler-hours (subscript i denotes the stratum containing a particular combination of section and month, j denotes target species)

TOTALAH_i = total angler-hours (the subscript i denotes the stratum containing a particular combination of section and month).

FISHHRS_{ij} = the ratio of the sample total angler-hours for species "j" divided by the sample total angler-hours for all species in section and month "i".

CPUE was calculated from the sample total number of fish caught divided by the sample total hours fished for each target species within the selected month and section "i". It was assumed that the catch rate was the same for all days of the week. Separate values were calculated for harvested and released fish. Therefore:

$$CPUE_{ij} = \text{SUMFISH}_{ij} / \text{SUMHRS}_{ij}$$

$CPUE_{ij}$ = catch-per-unit-effort for harvested or released target species.

SUMFISH_{ij} = total observed number of fish harvested or released.

SUMHRS_{ij} = total observed angler-hours expended to catch and release a target species.

Catch is the product of the estimated angler-hours and CPUE for target species, section, and month selected, where:

$$\text{CATCH}_{ij} = \text{TOTALAHSP}_{ij} * CPUE_{ij}$$

CATCH_{ij} = Estimated catch for a harvested or released target species.

TOTALAHSP_{ij} = estimated angler-hours (subscript i denotes the stratum containing a particular combination of section and month, j denotes target species)

$CPUE_{ij}$ = catch-per-unit-effort for harvested or released target species.

FINDINGS

Angler surveys began on the Sacramento, Feather, Yuba and American rivers in April, 1998. Surveys began on the San Joaquin and Mokelumne rivers in July and the Stanislaus River in August, 1998.

A total of 38,922 anglers was interviewed, and these data form the basis for the angling effort and harvest estimates.

A total of 3,079,837 angler-hours was spent sport fishing in the Central Valley rivers surveyed. Chinook salmon was the species targeted most. Anglers spent 1,330,017 angler-hours fishing for chinook salmon. Striped bass was the second most targeted species with anglers expending 1,141,327 angler-hours fishing (Table 3).

The most common fish in the creel was chinook salmon followed by striped bass. This survey estimated that anglers harvested 84,181 salmon and 83,503 striped bass. Catfish were also commonly found in anglers' creels with an estimated 66,372 harvested in 1998 (Table 3).

Table 3. Summary of angler effort and catch for selected species on the Sacramento, Feather, American, Yuba, San Joaquin, Mokelumne and Stanislaus rivers for the period April 1 through December 31, 1998.

River Reach Section #	Carquinez Br. to Sacramento (1,2)	Sacramento to Colusa (3,4)	Colusa to Red Bluff (5,6)	Red Bluff to Redding (7,8)	American River (9-10,1)	Feather River (11-12,1)	Yuba River (13,14)	San Joaquin River (15)	Mokelumne River (16,17)	Stanislaus River (18)	TOTALS
Total Estimated Angler Hours	926,392	406,734	351,472	238,511	316,212	530,070	37,508	210,853	58,699	3,386	3,079,837
Number Days Sampled	110	115	131	129	120	186	131	36	76	16	1,050
Chinook Salmon											
Angler-Hours	206,658	170,492	178,505	149,561	264,541	356,025	3,663	131	441	0	1,330,017
Estimated Kept	8,653	6,920	12,291	17,690	19,756	18,163	694	0	14	0	84,181
Estimated Released	100	93	479	818	18,505	13,800	118	0	0	0	33,913
Steelhead											
Angler-Hours	417	0	284	56	9,535	21,704	6,698	0	0	0	38,694
Estimated Kept	0	0	0	0	116	94	0	0	0	0	210
Estimated Released	0	0	32	16	883	960	760	0	0	0	2,651
Rainbow Trout											
Angler-Hours	0	0	1,807	81,941	1,639	3,119	14,298	0	0	1,037	101,841
Estimated Kept	0	0	277	1,280	189	350	392	0	0	28	2,516
Estimated Released	0	0	222	51,448	733	1,764	8,964	0	0	85	63,216
Striped Bass											
Angler-Hours	525,342	203,394	150,174	25	15,986	107,725	957	105,700	30,801	1,223	1,141,327
Estimated Kept	32,615	13,828	18,611	0	1,074	9,227	29	6,218	1,901	0	83,503
Estimated Released	110,880	41,653	42,411	30	2,598	18,034	153	34,032	7,464	114	257,369
Sturgeon (all species)											
Angler-Hours	94,582	9,476	4,644	0	0	2,860	0	5,614	12	0	117,188
Estimated Kept	2,346	172	18	0	0	0	0	102	0	0	2,638
Estimated Released	6,177	77	54	0	0	0	0	248	0	0	6,556
American Shad											
Angler-Hours	7,291	10	7,927	25	12,916	9,370	9,451	0	0	0	46,990
Estimated Kept	5,426	0	1,521	0	2,892	1,252	55	0	0	0	11,146
Estimated Released	0	0	4,551	0	206	7,249	10,882	0	0	0	22,888
Catfish (all species)											
Angler-Hours	9,299	11,602	1,572	0	806	1,934	116	51,340	8,503	213	85,385
Estimated Kept	8,510	6,190	328	0	0	660	0	46,419	4,208	57	66,372
Estimated Released	4,153	4,226	59	0	59	657	0	25,740	1,058	0	35,952
Sunfish (all species)											
Angler-Hours	0	0	0	6	0	113	0	342	307	0	768
Estimated Kept	0	0	0	0	0	0	0	3,309	944	0	4,253
Estimated Released	0	0	0	0	0	0	0	990	62	0	1,052
Black Bass (all species)											
Angler-Hours	3,364	27	186	30	210	1,137	0	18,652	11,983	419	36,008
Estimated Kept	730	0	86	44	0	5	0	2,058	995	0	3,918
Estimated Released	1,503	0	28	0	0	168	0	14,515	11,405	57	27,676
Anything											
Angler-Hours	79,444	11,724	6,371	2,668	10,459	12,796	2,326	31,075	6,652	494	164,009
Estimated Kept	4,354	709	197	81	234	134	49	12,637	2,180	0	20,575
Estimated Released	9,952	2,842	159	0	766	1,565	29	12,804	2,470	0	30,587

REFERENCES

American Fisheries Society. 1991. Common and scientific names of fishes from United States and Canada. Fifth Edition. Special Publication 20, 183 pp.

AQUAMAPS. 1988. Complete Atlas & Anglers Guide to the Sacramento River, Shasta Dam to San Pablo Bay. First Edition. Edited and Published by Northern California Angler Publications, Inc., Elk Grove, CA, 128 pp.

Wixom, Lynn H., Pisciotto, J. and Lake, C. 1995. Final Performance Report - Sacramento River System Sport Fish Catch Inventory. California Department of Fish and Game, Inland Fisheries Division, 76 p.

APPENDIX A

Description of the River Sections Surveyed

Description of river sections surveyed

River Miles	Section Number	Description	Distance (Miles)
Sacramento River/Delta			
-22 to 12	1.0	Carquinez Bridge to Rio Vista Bridge	35
13 to 59	2.0	Rio Vista Bridge to mouth of American River	48
60 to 89	3.0	American River to Knights Landing (Hwy. 113 Bridge)	29
90 to 143	4.0	Knights Landing to Colusa (River Rd. Bridge)	54
144 to 199	5.0	Colusa to Hamilton City (Hwy. 32 Bridge)	56
200 to 242	6.0	Hamilton City to Red Bluff Diversion Dam	43
243 to 280	7.0	Red Bluff Diversion Dam to Deschutes Road Bridge	38
281 to 298	8.0	Deschutes Road Bridge to ACID Dam at Redding	18
American River			
500 to 504	9.0	Discovery Park to Interstate 80 Bridge	4
505 to 522	10.0	Interstate 80 Bridge to Hazel Avenue Bridge	18
523	10.1	Hazel Avenue Bridge to Nimbus Dam	1
Feather River			
400 to 438	11.0	Verona to Sunset Pumps	39
439 to 458 460 to 467	12.0	Sunset Pumps to Feather River Fish Hatchery (excluding Thermalito River outlet)	28
459	12.1	Thermalito River Outlet (only)	1
Yuba River			
600 to 612	13.0	Marysville to Daguerre Point Dam	13
613 to 622	14.0	Daguerre Point to 1 mile upstream Hwy. 20 Bridge	8
San Joaquin River/Delta			
700 to 757	15.0	Mossdale Crossing to the confluence with the Sacramento River	58
Mokelumne River			
800 to 822	16.0	South Fork - from mouth to Interstate 5 Bridge Crossing	23
900 to 910	17.0	North Fork - from mouth to confluence with South Fork at New Hope Landing	11
Stanislaus River			
1029 to 1058	18.0	Stanislaus River from McHenry Avenue to Goodwin Dam	29

APPENDIX B

Estimated Angler-Hours and Number of Days Sampled

CENTRAL VALLEY HARVEST MONITORING PROJECT

1998 Angler Survey Estimate Summary

TOTAL NUMBER OF ANGLER-HOURS

River Section No	Sacramento				American 9-10 1	Feather 11-12 1	Yuba 13,14	San Joaquin 15	Mokelumne 16,17	Stanislaus 18	TOTAL
	1,2	3,4	5,6	7,8							
January											0
February											0
March											0
April	151,001	71,280	37,313	7,945	—	76,987	1,426				345,952
May	159,033	74,110	55,289	6,857	—	38,914	3,633				337,838
June	48,549	32,344	59,569	5,128	24,103	28,992	8,182				204,867
July	49,482	56,088	33,263	18,812	—	57,168	7,242	39,497	10,089		271,641
August	64,419	54,062	24,997	13,001	29,362	55,383	1,831	35,025	13,995		292,055
September	127,396	83,940	81,602	82,302	76,014	108,003	3,333	24,997	8,652	3,085	579,324
October	191,704	44,820	46,704	63,350	124,414	153,450	7,610	42,868	—	301	675,221
November	98,742	5,508	8,534	25,231	48,508	7,759	2,379	42,285	12,230	—	249,176
December	38,066	4,582	4,201	15,865	15,811	3,434	1,872	28,181	13,733	—	123,765
TOTAL	926,392	406,734	351,472	238,511	316,212	530,070	37,508	210,853	58,699	3,386	3,079,837

TOTAL NUMBER OF SAMPLE-DAYS

River Section No	Sacramento				American 9-10 1	Feather 11-12 1	Yuba 13,14	San Joaquin 15	Mokelumne 16,17	Stanislaus 18	TOTAL
	1,2	3,4	5,6	7,8							
January											0
February											0
March											0
April	8	8	15	12	—	21	16				80
May	15	15	16	15	—	24	14				99
June	16	16	18	15	22	19	12				116
July	13	14	13	16	—	18	15	7	16		110
August	12	15	15	16	24	24	16	8	18		146
September	13	13	15	15	24	22	16	7	16	8	149
October	12	11	15	15	16	21	15	4	—	8	117
November	8	11	13	12	16	20	14	4	12	—	110
December	13	12	13	13	18	19	13	8	16	—	123
TOTAL	110	115	131	129	120	186	131	36	78	16	1050

- Notes
- Apr - No surveys of Sec. 9, 10, 10 1
 - May - No surveys of Sec. 9, 10, 10.1
 - Jun - No surveys of Sec. 11
 - Jul - No surveys of Sec. 9, 10, 10.1, 11
 - Oct - No surveys of Sec. 16,17 (angling regulation error)
 - Nov - No surveys of Sec. 18 (closed to angling Oct. 15 - Dec. 31)
 - Dec - No surveys of Sec. 18 (closed to angling Oct. 15 - Dec. 31)

APPENDIX C

Estimated Harvest, Released and Angler-Hours by Target Species

1998 Angler Survey Estimate Summary

CHINOOK SALMON

TOTAL ESTIMATED HARVEST

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	111	0				111
June	0	0	0	0	120	144	0				264
July	50	620	500	0	---	1,497	525	0	0		3,192
August	575	1,672	1,584	212	557	3,109	150	0	0		7,859
September	2,698	2,863	6,648	7,065	3,645	4,905	19	0	0	0	27,843
October	4,829	1,735	2,859	7,207	10,303	8,248	0	0	---	0	35,181
November	501	30	319	1,073	4,684	149	0	0	14	---	6,770
December	0	0	381	2,133	447	0	0	0	0	---	2,961
TOTAL	8,653	6,920	12,291	17,690	19,756	18,163	694	0	14	0	84,181

TOTAL ESTIMATED RELEASED

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	28	0				28
June	0	0	0	0	0	105	0				105
July	0	0	0	0	---	322	40	0	0		362
August	0	17	0	12	376	279	15	0	0		699
September	0	61	300	265	1,099	1,029	38	0	0	0	2,792
October	100	0	164	334	6,521	11,875	25	0	---	0	19,019
November	0	15	0	105	10,013	162	0	0	0	---	10,295
December	0	0	15	102	496	0	0	0	0	---	613
TOTAL	100	93	479	818	18,505	13,800	118	0	0	0	33,913

ESTIMATED ANGLER-HOURS

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	784	0				784
May	0	0	0	0	---	1,579	30				1,609
June	0	0	0	0	89	7,994	0				8,083
July	2,934	16,695	16,795	3,274	---	54,023	2,603	0	0		96,324
August	14,761	48,100	23,331	4,655	22,447	53,717	678	0	0		167,689
September	64,677	61,349	81,067	69,609	71,371	105,429	200	131	312	0	454,145
October	116,566	41,695	45,516	47,362	122,009	129,911	152	0	---	0	503,211
November	7,535	2,653	7,690	11,306	42,460	2,415	0	0	129	---	74,188
December	185	0	4,106	13,355	6,165	173	0	0	0	---	23,984
TOTAL:	206,658	170,492	178,505	149,561	264,541	356,025	3,663	131	441	0	1,330,017

1998 Angler Survey Estimate Summary

STEELHEAD TROUT

TOTAL ESTIMATED HARVEST

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	0	0				0
June	0	0	0	0	0	17	0				17
July	0	0	0	0	---	0	0	0	0		0
August	0	0	0	0	0	0	0	0	0		0
September	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	77	0	0	---	0	77
November	0	0	0	0	0	0	0	0	0	---	0
December	0	0	0	0	116	0	0	0	0	---	116
TOTAL:	0	0	0	0	116	94	0	0	0	0	210

TOTAL ESTIMATED RELEASED

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	0	0				0
June	0	0	0	0	0	0	0				0
July	0	0	0	0	---	0	50	0	0		50
August	0	0	0	0	0	12	0	0	0		12
September	0	0	0	0	0	27	57	0	0	0	84
October	0	0	22	16	0	849	279	0	---	0	1,166
November	0	0	10	0	364	72	121	0	0	---	567
December	0	0	0	0	519	0	253	0	0	---	772
TOTAL:	0	0	32	16	883	960	760	0	0	0	2,651

ESTIMATED ANGLER-HOURS

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	154				154
May	0	0	0	0	---	0	309				309
June	0	0	0	0	0	17	0				17
July	0	0	0	0	---	0	218	0	0		218
August	0	0	0	0	0	140	0	0	0		140
September	0	0	33	0	0	60	549	0	0	0	642
October	0	0	108	56	0	17,412	2,907	0	---	0	20,483
November	417	0	143	0	2,405	4,075	1,503	0	0	---	8,543
December	0	0	0	0	7,130	0	1,058	0	0	---	8,188
TOTAL:	417	0	284	56	9,535	21,704	6,698	0	0	0	38,694

1998 Angler Survey Estimate Summary

RAINBOW TROUT

TOTAL ESTIMATED HARVEST

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	27	232	—	265	61				585
May	0	0	22	94	—	43	30				189
June	0	0	74	174	66	0	30				344
July	0	0	28	402	—	0	129	0	0		559
August	0	0	29	109	58	20	9	0	0		225
September	0	0	0	53	65	0	75	0	0	28	221
October	0	0	67	175	0	0	25	0	—	0	267
November	0	0	0	21	0	0	33	0	0	—	54
December	0	0	30	20	0	22	0	0	0	—	72
TOTAL	0	0	277	1,280	189	350	392	0	0	28	2,516

TOTAL ESTIMATED RELEASED

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	27	2,829	—	1,411	0				4,267
May	0	0	22	3,246	—	64	121				3,453
June	0	0	0	2,218	0	135	273				2,826
July	0	0	0	6,072	—	0	1,950	0	0		8,022
August	0	0	94	5,231	0	0	507	0	0		5,832
September	0	0	0	8,778	291	0	2,807	0	0	85	11,761
October	0	0	0	10,393	0	154	2,818	0	—	0	13,365
November	0	0	64	11,895	73	0	382	0	0	—	12,414
December	0	0	15	788	369	0	306	0	0	—	1,476
TOTAL	0	0	222	51,448	733	1,764	8,964	0	0	85	63,216

ESTIMATED ANGLER-HOURS

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	663	6,661	—	926	583				8,833
May	0	0	154	6,645	—	533	664				7,996
June	0	0	147	4,548	44	409	1,249				6,397
July	0	0	198	15,517	—	383	2,813	0	0		18,911
August	0	0	97	2,134	612	46	826	0	0		3,715
September	0	0	0	12,585	259	0	2,205	0	0	910	15,959
October	0	0	311	17,575	0	521	4,500	0	—	127	23,034
November	0	0	192	13,757	355	190	848	0	0	—	15,340
December	0	0	45	2,519	369	111	612	0	0	—	3,656
TOTAL	0	0	1,807	81,941	1,639	3,119	14,298	0	0	1,037	103,841

1998 Angler Survey Estimate Summary

STRIPED BASS

TOTAL ESTIMATED HARVEST

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No:	1,2	3,4	5,6	7,8	9-10 1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	9,589	4,922	4,010	0	—	7,173	29				25,733
May	10,398	5,378	6,839	0	—	1,719	0				24,130
June	1,232	1,590	7,174	0	624	17	0				10,637
July	860	1,597	659	0	—	162	0	705	113		4,098
August	672	169	72	0	148	33	0	282	390		1,764
September	1,455	91	0	0	202	38	0	452	86	0	2,324
October	1,580	62	57	0	78	64	0	218	—	0	2,059
November	4,960	15	0	0	0	21	0	2,848	678	—	8,622
December	1,861	8	0	0	24	0	0	1,813	634	—	4,138
TOTAL:	32,815	13,828	18,811	0	1,074	9,227	29	6,218	1,901	0	83,503

TOTAL ESTIMATED RELEASED

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No:	1,2	3,4	5,6	7,8	9-10 1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	18,843	5,095	3,472	0	—	5,181	29				30,600
May	35,252	12,014	14,238	0	—	12,037	0				73,541
June	6,099	7,385	21,377	0	1,694	70	14				36,639
July	9,031	13,869	3,015	0	—	23	49	7,306	1,777		35,070
August	13,078	1,724	173	0	341	456	61	7,405	2,855		26,093
September	8,329	502	78	30	485	188	0	4,357	481	114	14,562
October	7,367	958	60	0	78	32	0	3,586	—	0	12,081
November	12,623	106	0	0	0	0	0	7,571	1,085	—	21,385
December	2,258	0	0	0	0	67	0	3,807	1,266	—	7,398
TOTAL	110,880	41,653	42,411	30	2,598	18,034	153	34,032	7,484	114	257,369

ESTIMATED ANGLER-HOURS

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	124,700	66,231	30,578	0	—	71,198	587				293,294
May	117,564	70,254	52,224	0	—	32,573	145				272,760
June	26,714	31,075	52,273	0	8,978	562	69				119,671
July	21,236	29,518	12,986	0	—	694	49	8,076	2,533		75,092
August	23,674	2,070	1,032	0	2,299	452	92	8,983	4,788		43,390
September	41,874	837	63	15	2,738	603	15	7,338	2,333	1,223	57,039
October	64,215	1,434	707	0	762	282	0	27,582	—	0	94,982
November	79,963	1,413	311	0	0	393	0	31,890	10,113	—	124,083
December	25,402	562	0	10	1,209	968	0	21,831	11,034	—	61,016
TOTAL	525,342	203,394	150,174	25	15,986	107,725	857	105,700	30,801	1,223	1,141,327

1998 Angler Survey Estimate Summary

STURGEON (all species)

TOTAL ESTIMATED HARVEST

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	
Section No.	1,2	3,4	5,6	7,8	9-10 1	11-12.1	13,14	15	16,17	18	TOTAL
January											
February											
March											
April	599	77	18	0	—	0	0				694
May	1,116	95	0	0	—	0	0				1,211
June	186	0	0	0	0	0	0				186
July	20	0	0	0	—	0	0	37	0		57
August	93	0	0	0	0	0	0	0	0		93
September	27	0	0	0	0	0	0	0	0	0	27
October	65	0	0	0	0	0	0	0	—	0	65
November	126	0	0	0	0	0	0	0	0	—	126
December	114	0	0	0	0	0	0	65	0	—	179
TOTAL:	2,346	172	18	0	0	0	0	102	0	0	2,638

TOTAL ESTIMATED RELEASED

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	
Section No.	1,2	3,4	5,6	7,8	9-10 1	11-12.1	13,14	15	16,17	18	TOTAL
January											
February											
March											
April	1,410	58	54	0	—	0	0				1,522
May	726	19	0	0	—	0	0				745
June	576	0	0	0	0	0	0				576
July	1,000	0	0	0	—	0	0	74	0		1,074
August	421	0	0	0	0	0	0	0	0		421
September	985	0	0	0	0	0	0	24	0	0	1,009
October	297	0	0	0	0	0	0	54	—	0	351
November	545	0	0	0	0	0	0	31	0	—	576
December	217	0	0	0	0	0	0	65	0	—	282
TOTAL:	6,177	77	54	0	0	0	0	248	0	0	6,556

ESTIMATED ANGLER-HOURS

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	
Section No.:	1,2	3,4	5,6	7,8	9-10 1	11-12.1	13,14	15	16,17	18	TOTAL
January											
February											
March											
April	15,619	4,184	4,570	0	—	1,644	0				26,017
May	24,769	2,149	0	0	—	1,100	0				28,018
June	8,136	14	74	0	0	0	0				8,224
July	5,061	0	0	0	—	0	0	2,578	0		7,639
August	7,112	0	0	0	0	0	0	0	0		7,112
September	9,847	0	0	0	0	0	0	643	0	0	10,490
October	4,973	0	0	0	0	0	0	652	—	0	5,625
November	8,875	0	0	0	0	116	0	977	0	—	9,768
December	10,390	3,129	0	0	0	0	0	764	12	—	14,295
TOTAL	94,582	9,476	4,644	0	0	2,860	0	5,814	12	0	117,188

1988 Angler Survey Estimate Summary

AMERICAN SHAD

TOTAL ESTIMATED HARVEST

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10 1	11-12 1	13,14	15	16,17	18	
January											
February											
March											
April	1,050	0	0	0	--	0	0				1,050
May	4,173	0	25	0	--	71	0				4,269
June	203	0	988	0	2,892	906	55				5,044
July	0	0	508	0	--	275	0	0	0		783
August	0	0	0	0	0	0	0	0	0		0
September	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	--	0	0
November	0	0	0	0	0	0	0	0	0	--	0
December	0	0	0	0	0	0	0	0	0	--	0
TOTAL	5,426	0	1,521	0	2,892	1,252	55	0	0	0	11,146

TOTAL ESTIMATED RELEASED

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10 1	11-12 1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	--	19	0				19
May	0	0	124	0	--	207	271				602
June	0	0	3,671	0	206	6,624	10,018				20,519
July	0	0	756	0	--	399	593	0	0		1,748
August	0	0	0	0	0	0	0	0	0		0
September	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	--	0	0
November	0	0	0	0	0	0	0	0	0	--	0
December	0	0	0	0	0	0	0	0	0	--	0
TOTAL	0	0	4,551	0	206	7,249	10,882	0	0	0	22,888

ESTIMATED ANGLER-HOURS

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10 1	11-12 1	13,14	15	16,17	18	
January											
February											
March											
April	914	0	0	0	--	85	0				999
May	5,912	10	597	25	--	808	2,224				9,576
June	465	0	5,133	0	12,796	7,349	6,832				32,575
July	0	0	2,190	0	--	837	395	0	0		3,422
August	0	0	7	0	120	291	0	0	0		418
September	0	0	0	0	0	0	0	0	0	0	0
October	0	0	0	0	0	0	0	0	--	0	0
November	0	0	0	0	0	0	0	0	0	--	0
December	0	0	0	0	0	0	0	0	0	--	0
TOTAL	7,291	10	7,927	25	12,916	9,370	9,451	0	0	0	46,990

1998 Angler Survey Estimate Summary

SUNFISH (all species)

TOTAL ESTIMATED HARVEST

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	0	0				0
June	0	0	0	0	0	0	0				0
July	0	0	0	0	---	0	0	0	0		0
August	0	0	0	0	0	0	0	2,929	782		3,711
September	0	0	0	0	0	0	0	380	162	0	542
October	0	0	0	0	0	0	0	0	---	0	0
November	0	0	0	0	0	0	0	0	0	---	0
December	0	0	0	0	0	0	0	0	0	---	0
TOTAL	0	0	0	0	0	0	0	3,309	944	0	4,253

TOTAL ESTIMATED RELEASED

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	0	0				0
June	0	0	0	0	0	0	0				0
July	0	0	0	0	---	0	0	0	0		0
August	0	0	0	0	0	0	0	847	62		909
September	0	0	0	0	0	0	0	143	0	0	143
October	0	0	0	0	0	0	0	0	---	0	0
November	0	0	0	0	0	0	0	0	0	---	0
December	0	0	0	0	0	0	0	0	0	---	0
TOTAL	0	0	0	0	0	0	0	990	62	0	1,052

ESTIMATED ANGLER-HOURS

River:	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No.:	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	0	0	0	0	---	0	0				0
May	0	0	0	0	---	0	0				0
June	0	0	0	8	0	0	0				6
July	0	0	0	0	---	0	0	0	0		0
August	0	0	0	0	0	0	0	247	194		441
September	0	0	0	0	0	113	0	95	113	0	321
October	0	0	0	0	0	0	0	0	---	0	0
November	0	0	0	0	0	0	0	0	0	---	0
December	0	0	0	0	0	0	0	0	0	---	0
TOTAL	0	0	0	6	0	113	0	342	307	0	768

1998 Angler Survey Estimate Summary

BLACK BASS (all species)

TOTAL ESTIMATED HARVEST

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	81	0	0	0	—	0	0				81
May	0	0	0	0	—	0	0				0
June	0	0	0	0	0	0	0				0
July	0	0	57	44	—	0	0	742	393		1,236
August	513	0	0	0	0	5	0	584	399		1,481
September	136	0	0	0	0	0	0	187	140	0	443
October	0	0	0	0	0	0	0	489	—	0	489
November	0	0	29	0	0	0	0	31	27	—	87
December	0	0	0	0	0	0	0	65	36	—	101
TOTAL	730	0	86	44	0	5	0	2,058	995	0	3,918

TOTAL ESTIMATED RELEASED

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	162	0	0	0	—	0	0				162
May	0	0	0	0	—	0	0				0
June	0	0	0	0	0	0	0				0
July	99	0	28	0	—	0	0	4,933	4,542		9,602
August	1,108	0	0	0	0	19	0	3,491	5,193		9,809
September	136	0	0	0	0	0	0	1,288	1,658	57	3,137
October	0	0	0	0	0	128	0	1,885	—	0	1,813
November	0	0	0	0	0	21	0	2,948	0	—	2,969
December	0	0	0	0	0	0	0	172	12	—	184
TOTAL	1,503	0	28	0	0	168	0	14,515	11,405	57	27,676

ESTIMATED ANGLER-HOURS

River	Sacramento				American	Feather	Yuba	San Joaquin	Mokelumne	Stanislaus	TOTAL
Section No	1,2	3,4	5,6	7,8	9-10.1	11-12.1	13,14	15	16,17	18	
January											
February											
March											
April	487	0	0	0	—	68	0				555
May	0	0	0	0	—	224	0				224
June	101	0	0	8	132	17	0				258
July	62	0	71	22	—	0	0	5,619	3,925		9,899
August	2,409	0	0	0	0	14	0	3,200	3,860		9,483
September	305	27	0	0	0	231	0	1,857	2,792	419	5,631
October	0	0	0	0	78	519	0	2,622	—	0	3,219
November	0	0	115	0	0	64	0	4,709	251	—	5,139
December	0	0	0	0	0	0	0	645	1,155	—	1,800
TOTAL	3,364	27	188	30	210	1,137	0	18,652	11,983	419	38,008

1998 Angler Survey Estimate Summary

ANYTHING (anglers fishing for any species)

TOTAL ESTIMATED HARVEST

River Section No.:	Sacramento				American 9-10.1	Feather 11-12.1	Yuba 13,14	San Joaquin 15	Mokelumne 16,17	Stanislaus 18	TOTAL
	1,2	3,4	5,6	7,8							
January											
February											
March											
April	149	77	0	41	—	19	0				286
May	390	86	49	0	—	79	0				604
June	118	73	18	24	59	17	0				307
July	474	241	108	0	—	0	49	4,340	1,070		6,282
August	2,248	116	22	0	58	0	0	4,866	233		7,541
September	665	61	0	0	0	19	0	2,095	849	0	3,690
October	313	40	0	18	117	0	0	543	—	0	1,029
November	0	15	0	0	0	0	0	341	28	—	384
December	0	0	0	0	0	0	0	452	0	—	452
TOTAL	4,354	709	197	81	234	134	49	12,837	2,180	0	20,575

TOTAL ESTIMATED RELEASED

River Section No.:	Sacramento				American 9-10.1	Feather 11-12.1	Yuba 13,14	San Joaquin 15	Mokelumne 16,17	Stanislaus 18	TOTAL
	1,2	3,4	5,6	7,8							
January											
February											
March											
April	580	0	0	0	—	19	0				599
May	1,045	229	25	0	—	202	0				1,501
June	1,052	88	18	0	119	23	0				1,278
July	1,507	1,151	58	0	—	0	0	4,376	755		7,845
August	4,434	1,189	50	0	421	8	0	4,725	1,522		12,329
September	934	46	0	0	65	113	0	2,118	193	0	3,469
October	382	120	0	0	78	1,157	0	489	—	0	2,226
November	0	61	10	0	0	21	14	838	0	—	944
December	18	0	0	0	83	22	15	258	0	—	396
TOTAL	9,952	2,842	158	0	766	1,565	29	12,804	2,470	0	30,587

ESTIMATED ANGLER-HOURS

River Section No.:	Sacramento				American 9-10.1	Feather 11-12.1	Yuba 13,14	San Joaquin 15	Mokelumne 16,17	Stanislaus 18	TOTAL
	1,2	3,4	5,6	7,8							
January											
February											
March											
April	9,281	784	1,378	1,284	—	2,092	103				14,920
May	10,866	1,440	1,543	187	—	1,924	241				16,001
June	10,982	794	1,783	566	1,434	909	32				16,500
July	19,006	2,903	810	0	—	1,203	1,185	10,106	2,048		37,241
August	12,955	2,823	523	212	3,709	641	234	9,089	1,861		32,047
September	8,747	1,104	181	93	1,846	986	364	5,374	1,543	320	20,318
October	5,252	657	61	158	1,546	4,212	51	2,255	—	174	14,366
November	1,108	526	84	168	1,188	314	31	1,917	489	—	5,803
December	1,447	693	30	0	938	535	105	2,334	731	—	6,813
TOTAL	79,444	11,724	6,371	2,668	10,459	12,796	2,326	31,075	6,652	494	164,009