1999 Fall-Run Chinook Salmon Spawning Escapement in the Yuba River

Prepared for:

Yuba County Water Agency
1402 D Street
Marysville, CA 95901
Contact: Donn Wilson
530/741-6278

Prepared by:

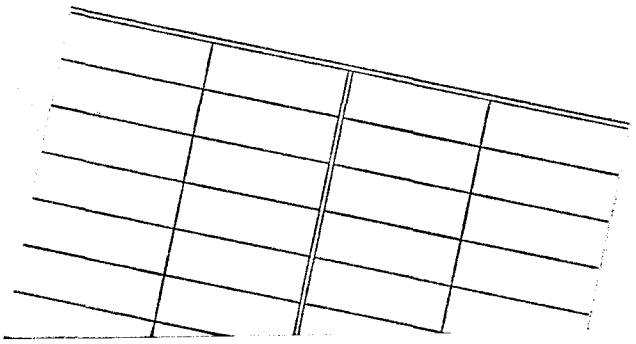
Jones & Stokes
2600 V Street
Sacramento, CA 95818-1914
Contact: William T. Mitchell
916/737-3000

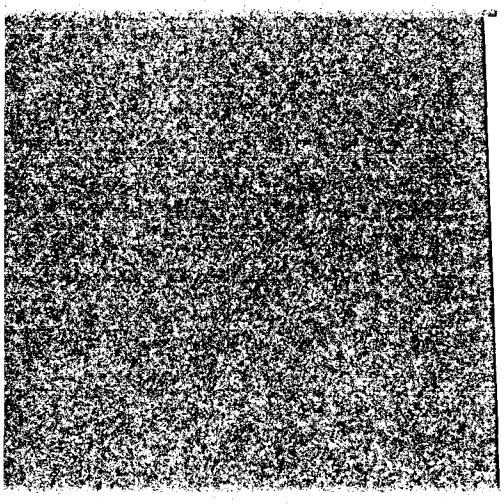
Jones & Stokes

August 2000

3598
1999 Fall-Run Chinook Salmon Spawning Escapement in the Yuba River

97-238





This document should be cited as:

Jones & Stokes. 2000. 1999 fall-run chinook salmon spawning escapement in the Yuba River. August. (J&S 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

Table of Contents

Page

INTRODUCTION 1

METHODS 1

RESULTS 2
- River Conditions 2
- Spawning Escapement, Timing, and Distribution 3
- Run Composition 4
- Hatchery Fish 4
- Recovery Rates 4

RECENT TRENDS IN ABUNDANCE 4

CITATIONS 6
- Printed References 6
- Personal Communications 7

APPENDIX A. Spawning Escapement Estimate Tables A-1

List of Tables and Figures

Table **Page**

1 1999 Yuba River Chinook Salmon Spawning Escapement Estimates by Reach and Age Class 3

2 Annual Fall-Run Chinook Salmon Spawning Escapement in the Yuba River during Pre- (1953-1971) and Post- (1972-Present) New Bullards Bar Reservoir Periods . . . . . follows page 4

Figure **Follows Page**

1 Lower Yuba River Chinook Salmon Spawning Escapement Survey Reaches 1

2 Length Frequencies of Fish Collected in the First Three Weeks of Surveys 2

3 Daily Yuba River Flows Measured at the Smartville and Marysville Gages, October 1 - December 25, 1999 2

4 Mean Daily Yuba River Water Temperatures Measured at Parks Bar, Smartville and the Marysville Gage, September 1 - December 1, 1999 2

5 Weekly Counts of Fresh Salmon Carcasses by Survey Reach, 1999 4

6 Annual Fall-Run Chinook Salmon Spawning Escapement in the Lower Yuba River during Pre- (1953-1971) and Post- (1972-1999) New Bullards Bar (NBB) Reservoir Periods 4

7 Annual Hatchery and Natural Spawning Escapement of Sacramento River Chinook Salmon 5

INTRODUCTION

From 1953 to 1989, the California Department of Fish and Game (DFG) conducted annual surveys of chinook salmon carcasses on the lower Yuba River to estimate fall-run chinook salmon *(Oncorhynchus tshawytscha)* spawning escapement (i.e., the number of salmon that are not caught and return to spawn each year). DFG suspended its surveys of Yuba River salmon carcasses in 1990 because of budget cuts. In response, the Yuba County Water Agency retained Jones & Stokes in 1991 to conduct the escapement surveys. Jones & Stokes continued these surveys through 1999. DFG participated from 1992 through 1994, but was unable to participate in subsequent years.

This report presents the results of the 1999 spawning escapement surveys. The results of the 1991–1998 surveys were reported in previous documents (Jones & Stokes Associates 1992, 1994, 1995, 1996, 1997, 1998, 1999).

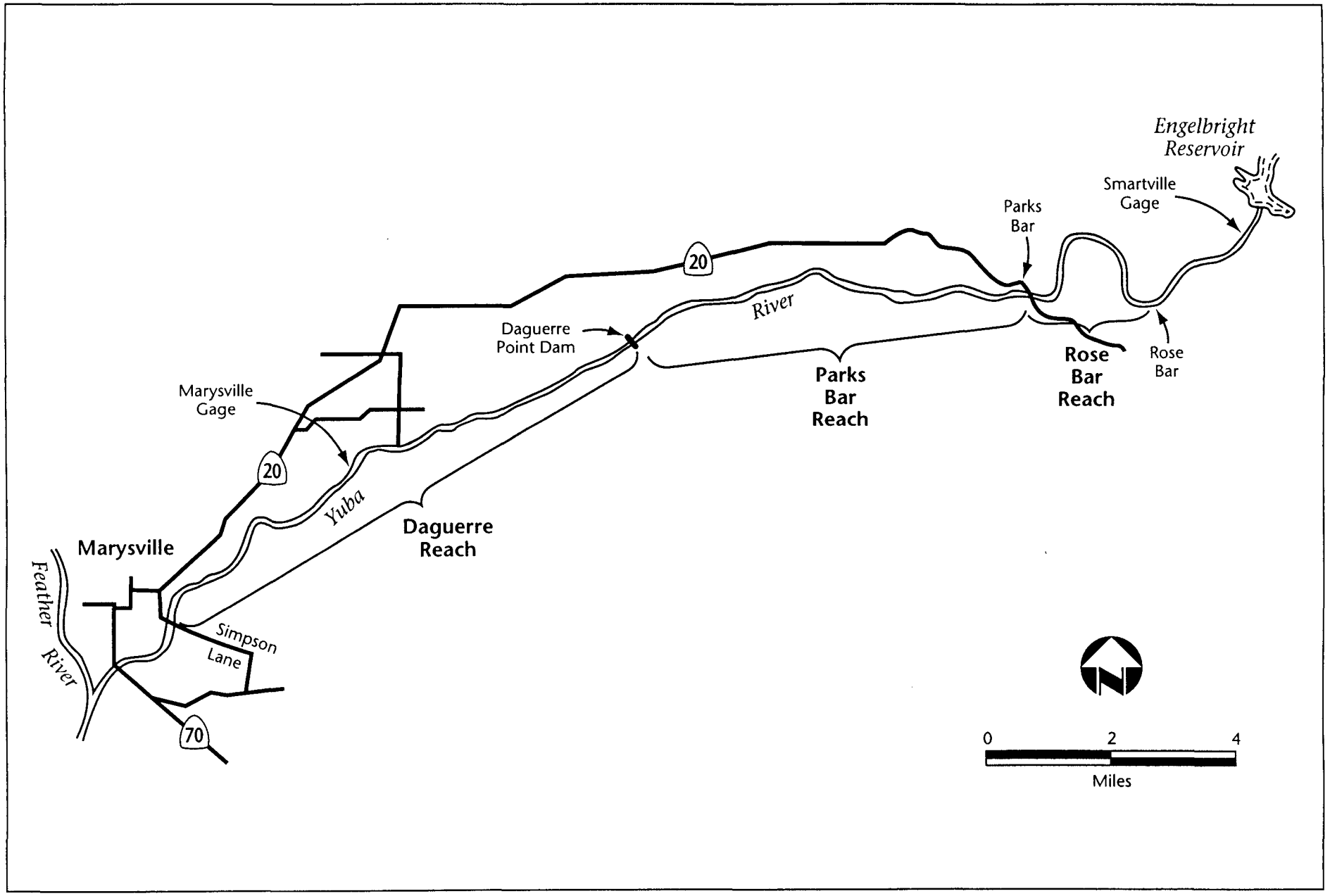
METHODS

Since the 1970s, DFG has used a modified form of the Schaefer mark-recovery method (Schaefer 1951) to estimate the number of chinook salmon that spawn each year in the Yuba River. Weekly carcass surveys were conducted each year during the principal spawning season for fall-run chinook salmon (October through mid-December). Fresh and decomposed carcasses were counted, fresh salmon carcasses were tagged and returned to the river, and carcasses tagged on previous survey dates were recovered and counted. Weekly estimates were computed based on the proportion of tagged carcasses recovered and the total number of tagged and untagged carcasses observed. Weekly estimates were added together to obtain the total spawning escapement estimate. Previous reports describe the sampling methods in more detail (Jones & Stokes Associates 1992, 1994).

Weekly carcass surveys were conducted from October 5, 1999, to December 17, 1999, in the following reaches (Figure 1):

- Rose Bar (Rose Bar at the downstream end of the narrows to Parks Bar at the Highway 20 bridge),
- Parks Bar (Highway 20 Bridge to Daguerre Point Dam), and
- Daguerre (Daguerre Point Dam to the Simpson Lane bridge in Marysville).

These reaches include nearly all of the spawning areas used by chinook salmon in the Yuba River. Spawning may occur in the narrows between Rose Bar and Englebright Dam, but spawning gravels are scarce in this reach. For many years, DFG did not survey the reach above Parks Bar. Instead, DFG assumed that 15.5% of the run spawned above Parks Bar. This figure was based on the average percentage of the total spawning escapement estimated for this reach during the period of 1966–1971



Jones & Stokes

Figure 1
Lower Yuba River Chinook Salmon Spawning Escapement Survey Reaches

(Konnoff pers. comm.). However, recent surveys (1994, 1996-1998) revealed that 25–37% of the run spawns in the Rose Bar Reach.

The sampling methods used during the 1999 spawning escapement surveys on the Yuba River were generally consistent with those used by DFG during past surveys with a few modifications. DFG's practice has been to tag only adult fish carcasses (age 3 and older) and estimate the number of grilse (age 2) by multiplying the adult estimate by the ratio of fresh grilse carcasses to fresh adult carcasses. This assumes that grilse carcasses are recovered at a rate similar to that of adult carcasses. However, by separating the counts between adults and grilse in recent years, Jones & Stokes found that grilse are often recovered at significantly lower rates than adults. Boydstun (1994) also made this observation and suggested that grilse may be more easily overlooked and disappear faster from the stream because of their smaller size. To avoid this potential bias, both adults and grilse were differentiated and tagged in 1999. Because recovery rates may differ between reaches, independent estimates of both adults and grilse were made for each reach. Distinctly colored tags were used to identify carcasses from each reach.

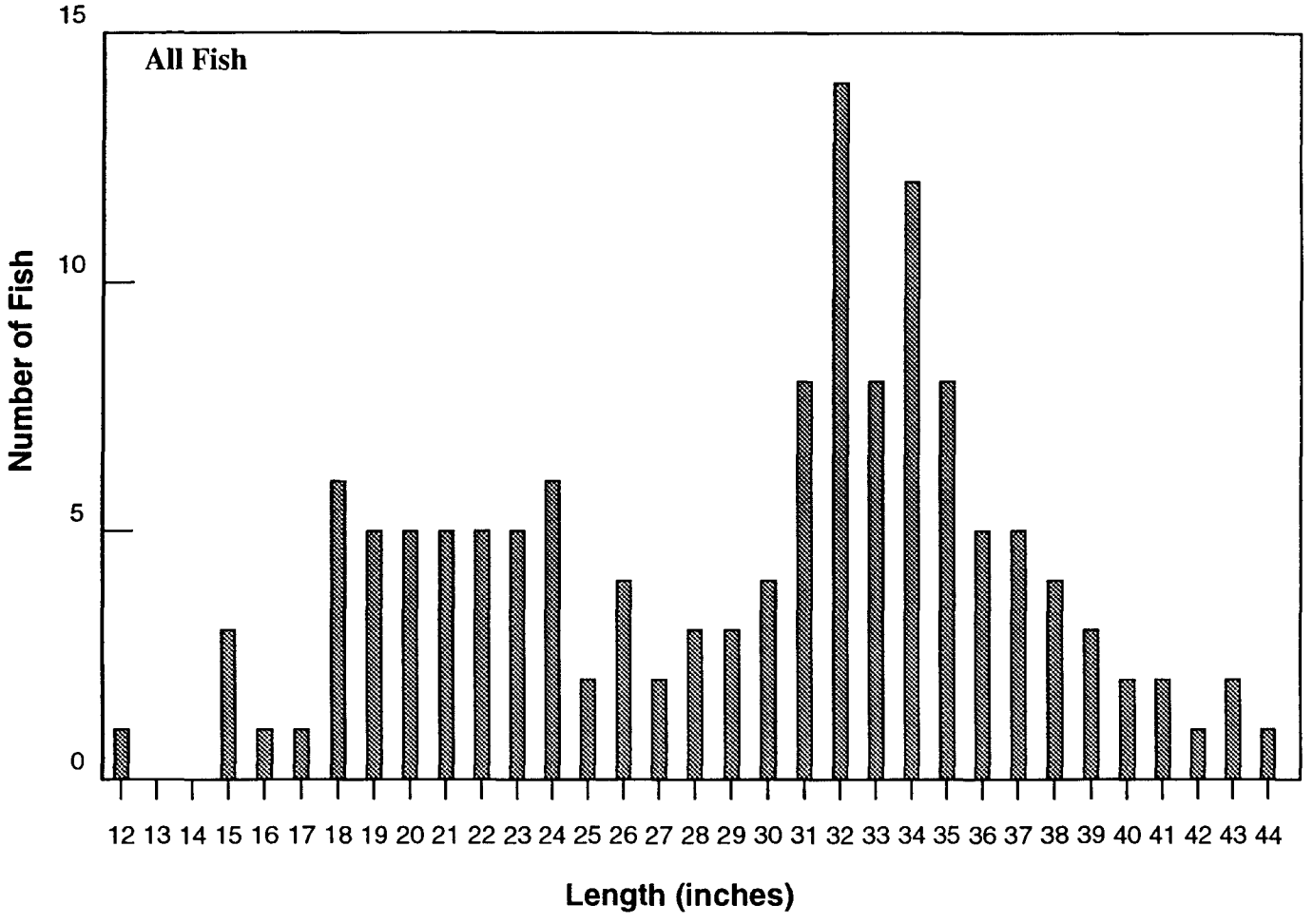
Salmon carcasses were classified as adults if they were greater than 25.5 inches long (fork length), or as grilse if they were less than 25.5 inches long. This cutoff length was determined from length-frequency data acquired from the chinook salmon collected on the Yuba River in the beginning of the 1999 season (Figure 2). The length-frequency distribution indicated that the 25.5-inch cutoff length was a reasonable criterion, although there was apparently some overlap in adult and grilse lengths.

RESULTS

River Conditions

Figure 3 presents the daily average Yuba River flows during the 1999 chinook salmon spawning season. Yuba River flows below Englebright Dam (Smartville gage) averaged close to 1,100 cubic feet per second (cfs) during the survey period, and were relatively stable throughout the spawning season. Yuba River flows near Marysville (Marysville gage) averaged 852 cfs during October, decreased to an average of 725 cfs in November, and then increased to an average of 759 cfs in December.

Mean daily water temperatures at Smartville and at Parks Bar were consistently between 50 and 55°F from September to December (Figure 4). Mean daily water temperatures at the Marysville gage were between 58 and 59°F in early October, decreased to just below 55°F in November, and declined to around 51°F by early December (Figure 4). Water visibility ranged from 3 to 12 feet during the spawning surveys but typically averaged 8 feet, which made it easier to locate fish in the pool habitat.



Jones & Stokes

Figure 2
Length Frequencies of Fish
Collected in the First Three Weeks of Surveys

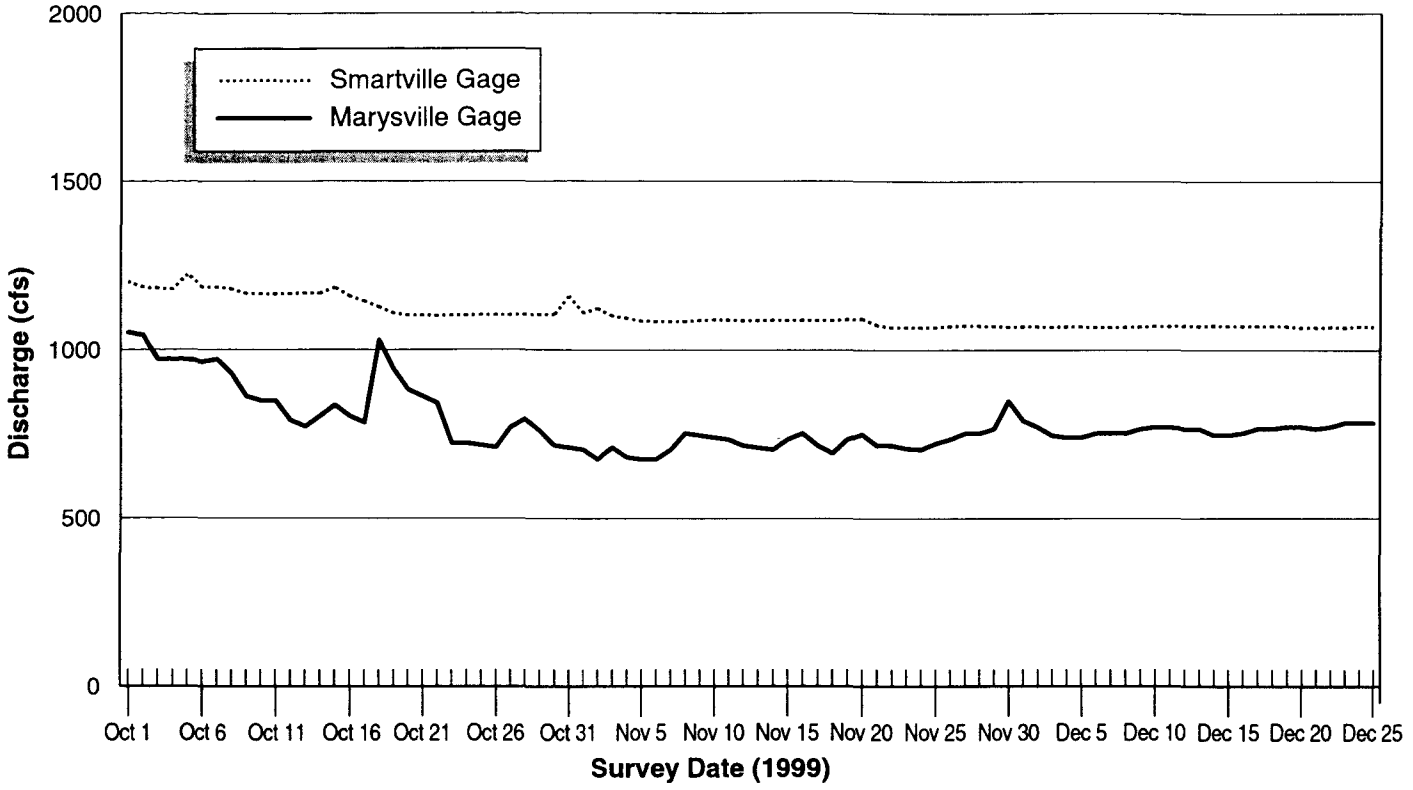
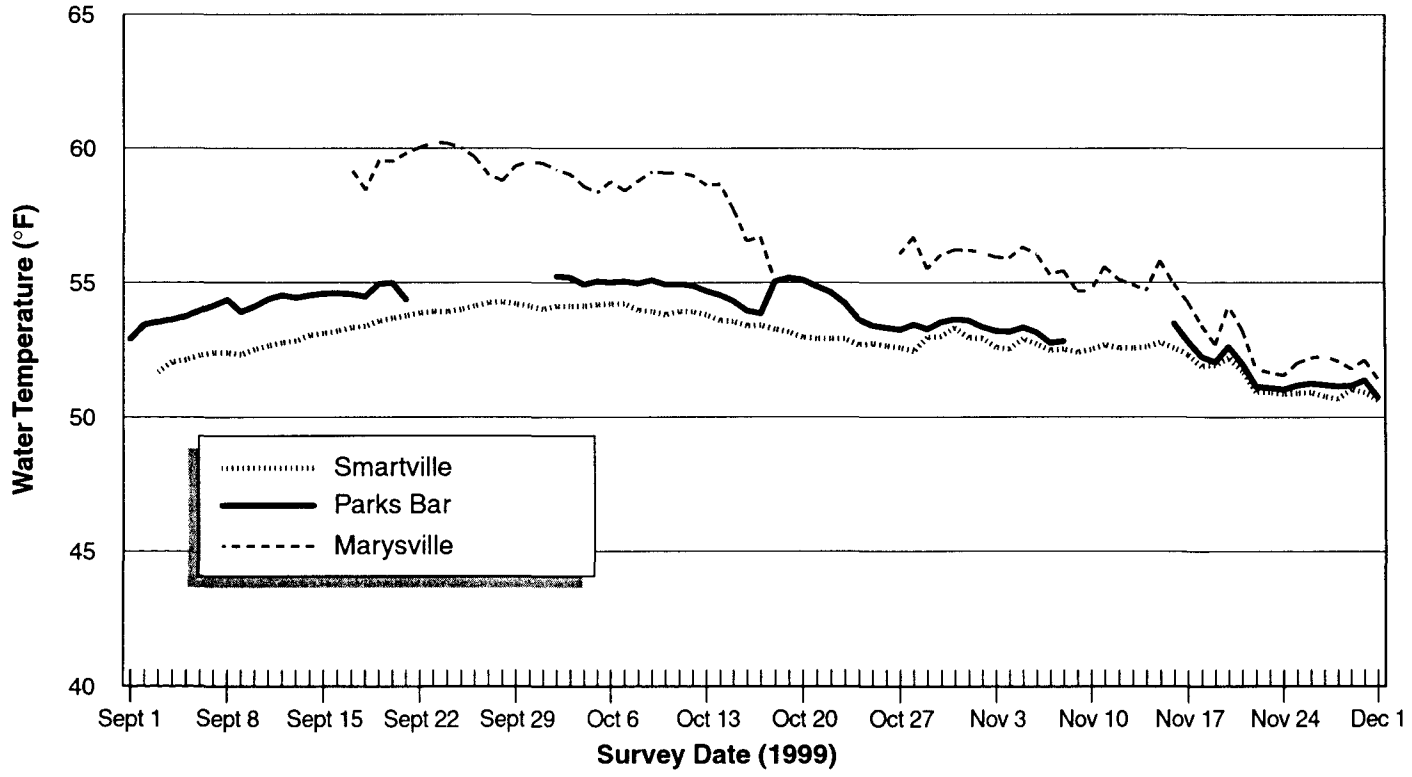


Figure 3
Daily Yuba River Flows Measured at the Smartville and Marysville Gages, October 1 - December 25, 1999



Jones & Stokes

Figure 4
Mean Daily Yuba River Water Temperatures Measured at Parks Bar, Smartville, and Marysville, September 1 - December 1, 1999

Spawning Escapement, Timing, and Distribution

An estimated 23,067 chinook salmon (17,853 adults and 5,214 grilse) spawned in the Yuba River in fall 1999 (Table 1). The spreadsheets used to compute the 1999 spawning escapement estimates are presented in Tables A-1 through A-12 in Appendix A.

Table 1. 1999 Yuba River Chinook Salmon Spawning Escapement Estimates by Reach and Age Class

Survey Reach	Adults	Grilse	Total	Percentage
Rose Bar	4,256	675	4,931	21.4%
Parks Bar	5,185	2,276	7,461	32.4%
Daguerre	8,412	2,263	10,675	46.2%
Total	17,853	5,214	23,067	100.0%

Results from redd surveys conducted by DFG above Daguerre Point Dam indicated that spawning started in early September. It is assumed that these early spawning fish are spring-run chinook salmon that arrived in the spring and oversummered in the lower Yuba River. However, because of broad spatial and temporal overlap in spring- and fall-run chinook salmon spawning, separate estimates of spawning escapement for these two races cannot be made.

Chinook salmon typically begin spawning as water temperatures approach 56° F. Water temperatures recorded at Smartville and at Parks Bar were within the optimal spawning temperature range in early September. Water temperatures remained fairly constant between September and December, ranging from 56–51° F. Water temperatures at the Marysville gage (approximately 6.8 miles downstream of Daguerre Point Dam) reached 56° F in mid-October. Spawning peaked in the second and third weeks of October in both the Rose Bar and Parks Bar Reaches, and a week later in the Daguerre Reach after temperatures reached 56° F (Figure 5).

The Rose Bar Reach is approximately 3.99 miles in length. An estimated 21.4% of the run (4,931 fish) spawned in the Rose Bar Reach (Table 1); therefore, about 1,236 fish spawned per mile.

The Parks Bar Reach is approximately 6.34 miles in length. An estimated 32.4% of the run (7,461 fish) spawned in the Parks Bar Reach (Table 1), therefore, about 1,177 fish spawned per mile.

The Daguerre Reach is approximately 9.22 miles in length; however, the lower portion of the surveyed reach (approaching Simpson Lane) is relatively deep with fine-grained sediments that are generally unsuitable for spawning. About 6 miles of the surveyed portion of this reach contain spawning habitat. An estimated 46.2% of the run (10,675 fish) spawned in the Daguerre Reach; therefore, about 1,779 fish spawned per river mile.

Run Composition

Adult male and female salmon comprised 41% and 59%, respectively, of the fresh adult carcasses observed during the 1999 surveys (Table 1). Grilse salmon comprised 15% of the total number of fresh carcasses and 22.6% of the total estimated population. The sex of grilse could not be reliably determined in the field, but typically the majority of grilse are male. Spring-run chinook salmon may have been included in the surveys, but there is no way to visually separate the two runs of chinook salmon.

Hatchery Fish

Nine coded-wire-tagged salmon were recovered from the Yuba River during the 1999 surveys and delivered to DFG for decoding. All the hatchery fish were recovered by the end of October.

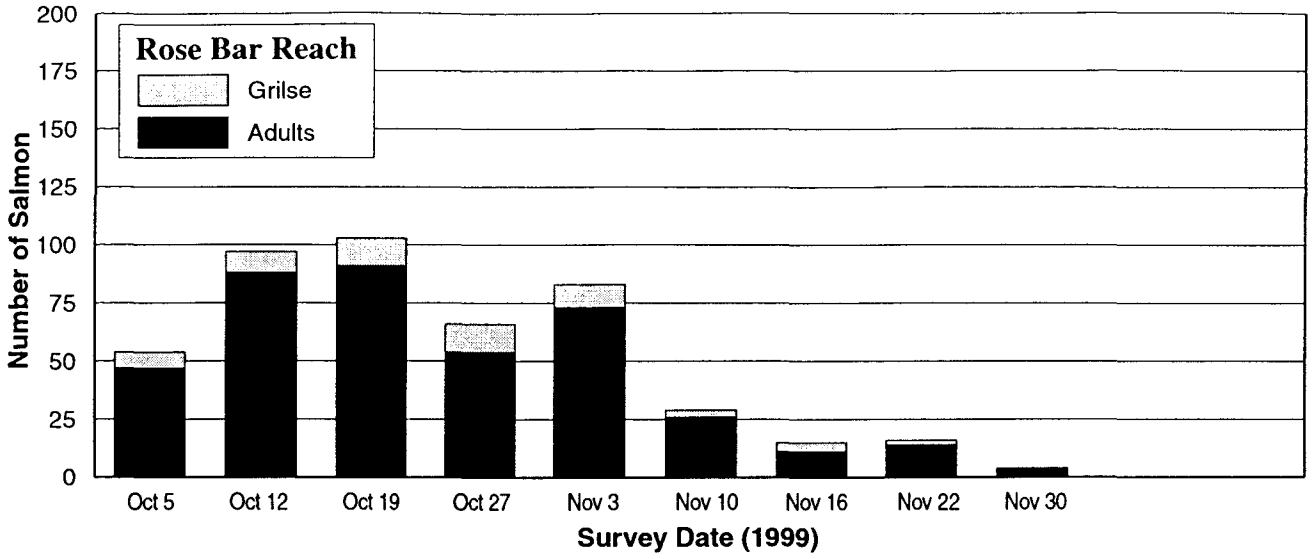
Recovery Rates

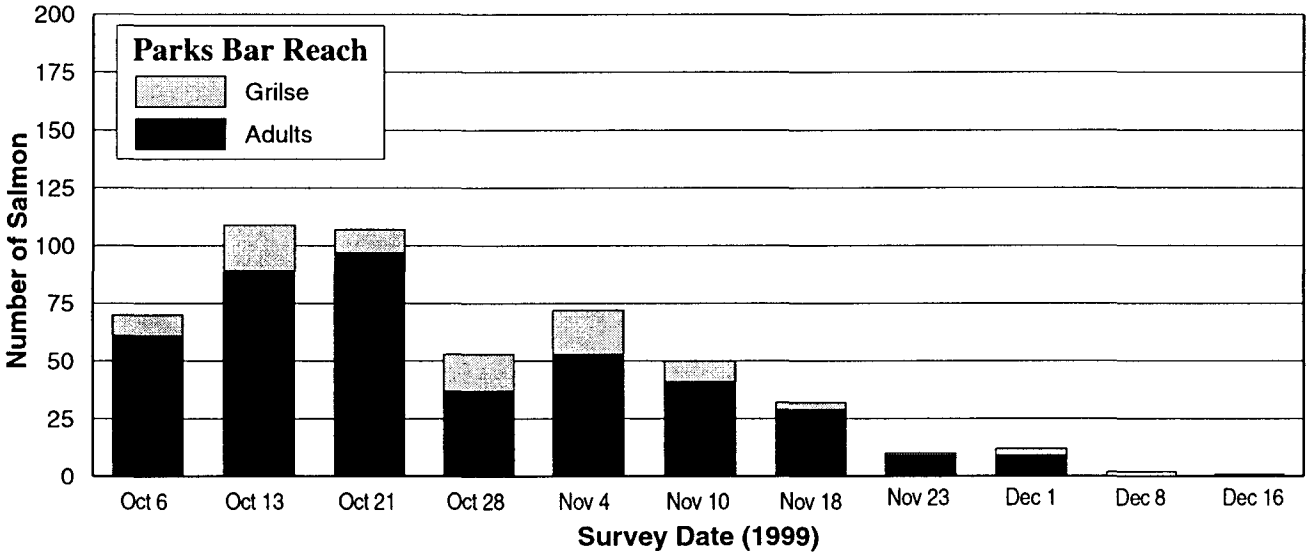
The weekly recovery rates of tagged adult salmon carcasses (i.e., the percentage of tagged carcasses that were recovered) averaged 49% in the Rose Bar Reach, 50% in the Parks Bar Reach, and 32% in the Daguerre Reach with an overall recovery rate of 42.7% for all reaches. The recovery rates of tagged grilse averaged 29% in the Rose Bar Reach, 23% in the Parks Bar Reach, and 17% in the Daguerre Reach with an overall recovery rate of 22.2% for all reaches.

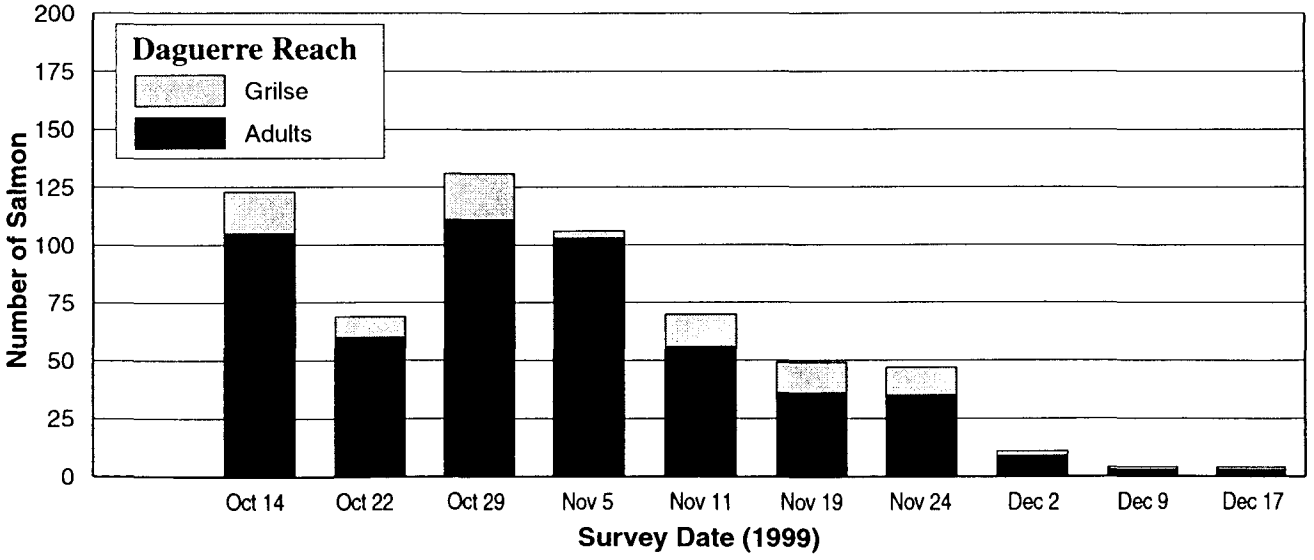
Some salmon die before spawning each year. Over 20% of the female carcasses observed in 1998 were determined to be unspawned. Therefore, counts were made of all unspawned females (including grilse females) throughout the 1999 season. Unspawned salmon are brightly colored, appear to be in good condition, and have no apparent signs of disease, trauma, or physical injury. Approximately 20% of the adult females and 5% of the grilse females appeared to have died before spawning in the 1999 spawning season.

RECENT TRENDS IN ABUNDANCE

Chinook salmon spawning escapement in the lower Yuba River has increased substantially since 1993 and was well above the historical average from 1996 through 1999 (Table 2 and Figure 6). Annual spawning escapement before (1953–1971) and after (1972–Present) construction of the New Bullards Bar reservoir has ranged from 1,000 fish in 1957 to more than 39,000 fish in 1982, with an average of approximately13,000 fish. The large spawning escapements in recent years raised the average to 15,119 fish for the period after construction of New Bullards Bar reservoir (Table 2 and Figure 6).







Jones & Stokes

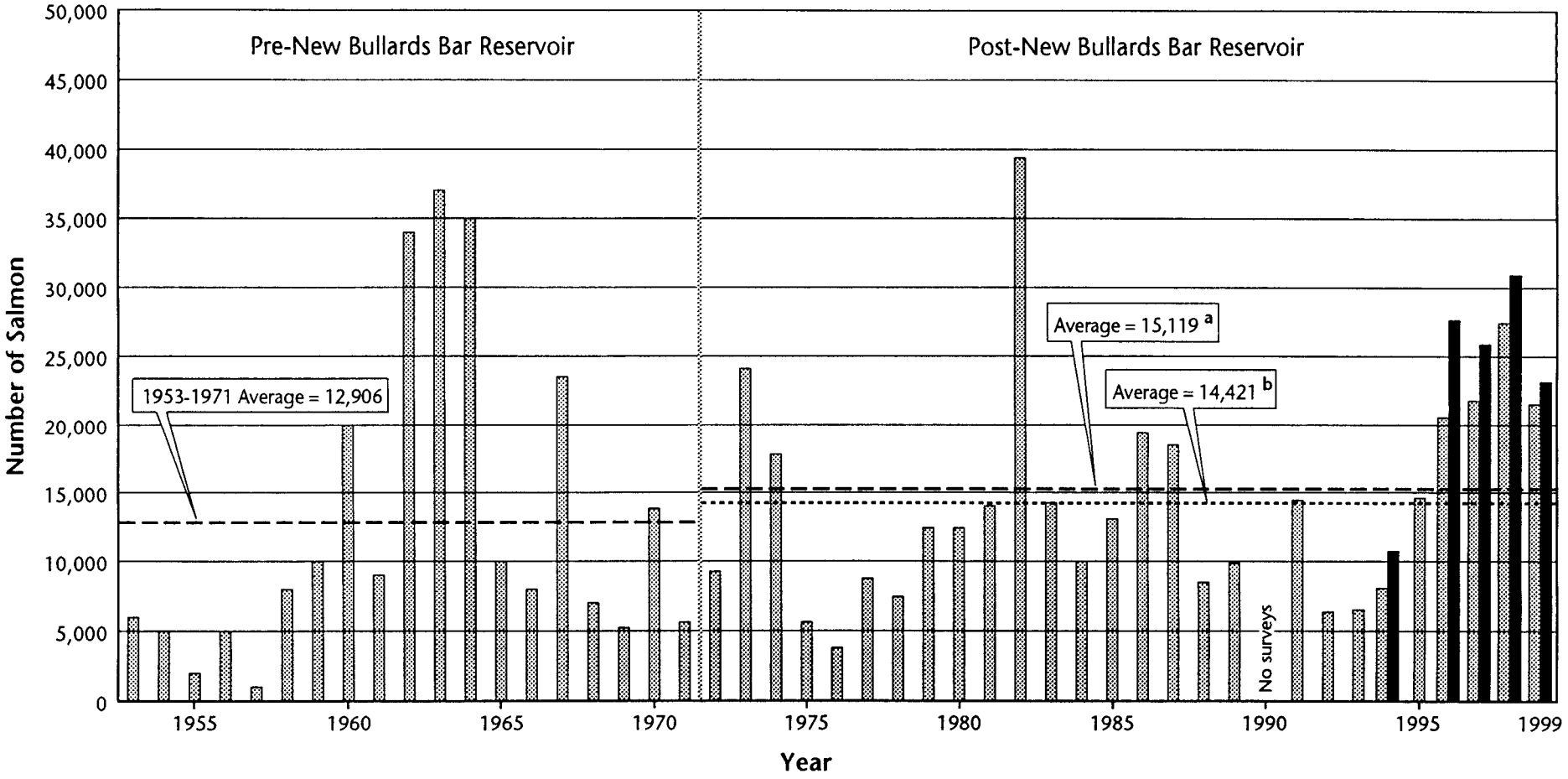
Figure 5
Weekly Counts of Fresh Salmon Carcasses by Survey Reach, 1999

Table 2. Annual Fall-Run Chinook Salmon Spawning Escapement in the Yuba River during Pre- (1953-1971) and Post- (1972-Present) New Bullards Bar Reservoir Periods

Year	Pre-Reservoir Escapement	Year	Post-Reservoir Escapement
53	6,000	72	9,258
54	5,000	73	24,119
55	2,000	74	17,809
56	5,000	75	5,641
57	1,000	76	3,779
58	8,000	77	8,722
59	10,000	78	7,416
60	20,000	79	12,430
61	9,000	80	12,406
62	34,000	81	14,025
63	37,000	82	39,367
64	35,000	83	14,256
65	10,000	84	9,965
66	8,000	85	13,066
67	23,500	86	19,406
68	7,000	87	18,510
69	5,230	88	8,501
70	13,830	89	9,837
71	5,650	90	--
		91	14,413
		92	6,361
		93	6,516
		94	10,691
		95	14,561
		96	27,520
		97	25,778
		98	30,802
		99	23,067
Average	12,906	Average	15,119

-- No carcass surveys conducted

Sources: 1953-1966 Hallock (n.d.)
1967-1989 Mills and Fisher (1994)
1991-1998 Jones & Stokes Associates (1992, 1995,1996, 1997, 1998, 1999)



[a] Average post-NBB spawning escapement based on actual estimates of spawning escapement in Rose Bar reach in 1994 and 1995–1999 (dark bars).

[b] Average post-NBB spawning escapement based on assumptions that 15.5% of spawning escapement spawned in Rose Bar reach in 1994 and 1995–1999.

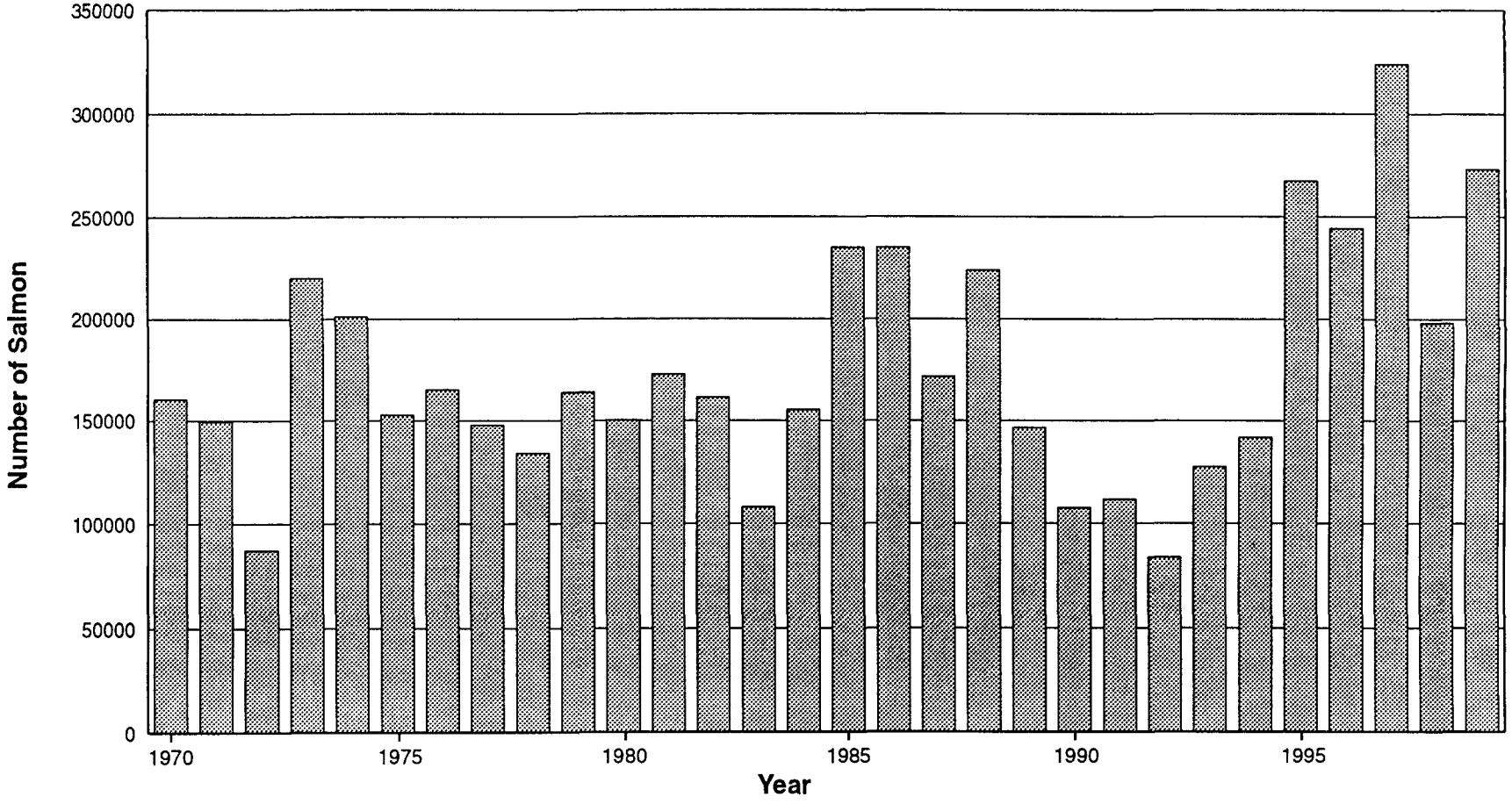
SOURCES:
1953-1966: Hallock (n.d.)
1967-1989: Mills and Fisher (1994)
1991-1999: Jones & Stokes Associates (1992-2000).

Jones & Stokes

Figure 6
Annual Fall-Run Chinook Salmon Spawning Escapement in the Lower Yuba River during Pre- (1953-1971) and Post- (1972-1999) New Bullards Bar (NBB) Reservoir Periods

Preliminary estimates of annual fall-run chinook salmon spawning escapement in the mainstem Sacramento River and its major tributaries (including the Yuba River) in recent years indicate a less-marked, but similar, trend since the early 1990s (Figure 7). The number of commercial and sport landings of Central Valley chinook salmon in the ocean has increased since 1990 (Pacific Fisheries Management Council 2000). The increase in the number of ocean landings and the concurrent increase in spawning escapements in recent years indicate that overall salmon abundance in the Central Valley has increased since the early 1990s. Ocean harvest rates (i.e., the proportion of salmon caught in the ocean) have not changed substantially since the early 1990s and have decreased somewhat since 1996. Restrictions in ocean harvest rate have likely contributed to higher escapement in recent years.

The lower Yuba River continues to exhibit exceptionally high rates of natural salmon production, particularly in view of the absence of a hatchery, which contributes substantially to salmon populations in other major Central Valley tributaries (e.g., the Feather and American Rivers).



SOURCE:
Pacific Fishery Management Council (2000)

Jones & Stokes

Figure 7
Annual Hatchery and Natural Spawning Escapement of Sacramento River Chinook Salmon

CITATIONS

Printed References

Boydstun, L. B. 1994. Analysis of two mark-recapture methods to estimate the fall chinook salmon (*Oncorhynchus tshawytscha*) spawning run in Bogus Creek, California. California Fish and Game 80(1):1-13.

Jones & Stokes Associates. 1992. 1991 fall-run chinook salmon spawning escapement in the Yuba River. June. (JSA 91-219.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1994. 1992 fall-run chinook salmon spawning escapement in the Yuba River. February. (JSA 91-219.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1995. 1993 and 1994 fall chinook salmon spawning escapements in the Yuba River. February. (JSA 94-223.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1996. 1995 fall chinook salmon spawning escapements in the Yuba River. July. (JSA 95-076.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1997. 1996 fall chinook salmon spawning escapements in the Yuba River. July. (JSA 95-076.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1998. 1997 fall-run chinook salmon spawning escapements in the Yuba River. June 12, 1998. (JSA 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

_____. 1999. 1998 fall-run chinook salmon spawning escapements in the Yuba River. March 23, 1999. (JSA 97-238.) Sacramento, CA. Prepared for Yuba County Water Agency, Marysville, CA.

Pacific Fisheries Management Council. 2000. Review of the 1999 ocean salmon fisheries. Portland, OR.

Schaefer, M. B. 1951. Estimation of size of animal populations by marking experiments. Volume 52. (Fishery Bulletin 69.) U.S. Fish and Wildlife Service. Washington, DC.

Personal Communication

Konnoff, D. L. Fishery biologist. California Department of Fish and Game, Rancho Cordova, CA. January 27, 1988 - memorandum to DFG files regarding 1987 Yuba River chinook salmon spawning stock estimate.

Appendix A. Spawning Escapement Estimate Tables

Table A-1. Weekly Recoveries of Adult Salmon Carcasses in the Rose Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)									Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 5	Oct 12	Oct 19	Oct 27	Nov 3	Nov 10	Nov 16	Nov 22	Nov 30		
Oct 12	24									24	419
Oct 19	3	26								29	405
Oct 27	0	6	50							56	542
Nov 3	0	1	4	24						29	427
Nov 10	0	0	0	6	16					22	164
Nov 16	0	0	0	0	11	11				22	153
Nov 22	0	0	0	0	4	5	3			12	92
Nov 30	0	0	0	0	0	0	1	2		3	42
Tagged Carcass	27	33	54	30	31	16	4	2	0	197	
Total Carcasses	47	88	91	54	73	26	11	14	0	404	
Ri/Mi	0.57	0.38	0.59	0.56	0.42	0.62	0.36	0.14		0.49	

Table A-2. Weekly Population Estimates of Adult Salmon in the Rose Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)								Total
	Oct 5	Oct 12	Oct 19	Oct 27	Nov 3	Nov 10	Nov 16	Nov 22	
Oct 12	729								729
Oct 19	73	968							1041
Oct 27	0	155	816						971
Nov 3	0	39	99	636					774
Nov 10	0	0	0	81	281				362
Nov 16	0	0	0	0	180	124			304
Nov 22	0	0	0	0	72	62	63		197
Nov 30	0	0	0	0	0	0	39	196	235
Total	802	1162	915	717	533	186	102	196	4613
Adj. Total									4256

Table A-3. Weekly Recoveries of Grilse Salmon Carcasses in the Rose Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)									Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 5	Oct 12	Oct 19	Oct 27	Nov 3	Nov 10	Nov 16	Nov 22	Nov 30		
Oct 12	2									2	57
Oct 19	1	0								1	55
Oct 27	0	2	6							8	90
Nov 3	0	1	2	1						4	58
Nov 10	0	0	0	0	1					1	14
Nov 16	0	0	0	0	0	0				0	10
Nov 22	0	0	0	0	0	0	1			1	11
Nov 30	0	0	0	0	0	0	0	0		0	11
Tagged Carcasses Recovered (Ri)	3	3	8	1	1	0	1	0	0	17	
Total Carcasses Tagged (Mi)	7	9	12	12	10	3	4	2	0	59	
Ri/Mi	0.43	0.33	0.67	0.08	0.10	0.00	0.25	0.00	0.00	0.29	

Table A-4. Weekly Population Estimates of Grilse Salmon in the Rose Bar Reach, 1998

Week of Recovery (j)	Week of Tagging (i)								
	Oct 5	Oct 12	Oct 19	Oct 27	Nov 3	Nov 10	Nov 16	Nov 22	Total
Oct 12	86								86
Oct 19	83	0							83
Oct 27	0	34	101						135
Nov 3	0	0	44	174					218
Nov 10	0	0	0	0	140				140
Nov 16	0	0	0	0	0	0			10
Nov 22	0	0	0	0	0	0	44		44
Nov 30	0	0	0	0	0	0	0	0	11
Total	169	34	145	174	140	0	44	0	727
Adj. Total									675

Table A-5. Weekly Recoveries of Adult Salmon Carcasses in the Parks Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)											Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 6	Oct 13	Oct 21	Oct 28	Nov 4	Nov 11	Nov 18	Nov 24	Dec 1	Dec 8	Dec 16		
Oct 13	30											30	446
Oct 21	14	38										52	665
Oct 28	0	1	34									35	510
Nov 4	0	0	13	17								30	541
Nov 11	0	0	8	1	14							23	263
Nov 18	0	0	2	1	4	15						22	255
Nov 24	0	0	0	0	4	2	8					14	162
Dec 1	0	0	0	0	0	0	2	3				5	66
Dec 8	0	1	0	0	0	0	0	0	0			1	42
Dec 16	0	0	0	0	0	0	0	0	0	0		0	16
Tagged Carcasses Recovered (Ri)	44	40	57	19	22	17	10	3	0	0		212	
Total Carcasses Tagged (Mi)	61	89	97	37	53	41	29	9	9	0		425	
Ri/Mi	0.72	0.45	0.59	0.51	0.42	0.41	0.34	0.33	0.00	0.00		0.50	

Table A-6. Weekly Population Estimates of Adult Salmon in the Parks Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)											Total
	Oct 7	Oct 14	Oct 21	Oct 28	Nov 4	Nov 11	Nov 18	Nov 24	Dec 3	Dec 8	Dec 15	
Oct 14	618											618
Oct 21	248	1081										1329
Oct 28	0	32	843									875
Nov 4	0	0	399	597								996
Nov 11	0	0	156	22	386							564
Nov 18	0	0	0	23	112	419						554
Nov 24	0	0	0	0	0	56	268					324
Dec 3	0	0	0	0	0	0	77	119				196
Dec 8	0	93	0	0	0	0	0	0	0			93
Dec 15	0	0	0	0	0	0	0	0	0	0		16
Total	866	1206	1398	642	498	475	345	119	0	0		5549
Adj. Total												5185

Table A-7. Weekly Recoveries of Grilse Salmon Carcasses in the Parks Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)											Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 6	Oct 13	Oct 21	Oct 28	Nov 4	Nov 11	Nov 18	Nov 24	Dec 1	Dec 8	Dec 16		
Oct 13	1											1	74
Oct 21	1	4										5	138
Oct 28	0	1	2									3	107
Nov 4	0	0	0	3								3	105
Nov 11	0	0	0	1	5							6	63
Nov 18	0	0	0	0	0	1						1	48
Nov 24	0	0	0	0	0	0	0					0	24
Dec 1	0	0	0	0	0	0	0	1				1	11
Dec 8	0	0	0	0	0	0	0	0	0			0	8
Dec 16	0	0	0	0	0	0	0	0	0	0		0	1
Tagged Carcasses Recovered (Ri)	2	5	2	4	5	1	0	1	0	0	0	20	
Total Carcasses Tagged (Mi)	9	20	10	16	19	9	3	1	3	0		87	
Ri/Mi	0.22	0.25	0.20	0.25	0.26	0.11	0.00	1.00	0.00	0.00		0.23	

Table A-8. Weekly Population Estimates of Grilse Salmon in the Parks Bar Reach, 1999

Week of Recovery (j)	Week of Tagging (i)											
	Oct 7	Oct 14	Oct 21	Oct 28	Nov 4	Nov 11	Nov 18	Nov 24	Dec 3	Dec 8	Dec 16	Total
Oct 14	0											74
Oct 21	124	442										566
Oct 28	0	143	357									500
Nov 4	0	0	0	420								420
Nov 11	0	0	0	42	200							242
Nov 18	0	0	0	0	0	432						432
Nov 24	0	0	0	0	0	0	0					24
Dec 3	0	0	0	0	0	0	0	99				99
Dec 8	0	0	0	0	0	0	0	0	0			8
Dec 16	0	0	0	0	0	0	0	0	0	0		1
Total	124	585	357	462	200	432	0	99	0	0		2357
Adj. Total												2276

Table A-9. Weekly Recoveries of Adult Salmon Carcasses in the Daguerre Point Reach, 1999

Week of Recovery (j)	Week of Tagging										Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 14	Oct 22	Oct 29	Nov 5	Nov 11	Nov 19	Nov 25	Dec 2	Dec 9	Dec 17		
Oct 22	24										24	601
Oct 29	4	21									25	583
Nov 5	1	1	45								47	634
Nov 11	0	0	5	9							14	287
Nov 19	0	0	0	4	18						22	303
Nov 25	0	0	0	5	4	14					23	281
Dec 2	0	0	0	0	0	4	2				6	97
Dec 9	0	0	0	0	0	0	1	4			5	119
Dec 17	0	0	0	0	0	0	0	0	0		0	9
Tagged Carcasses Recovered (Ri)	29	22	50	18	22	18	3	4	0	0	166	
Total Carcasses Tagged (Mi)	105	60	111	103	56	36	35	9	3	0	518	
Ri/Mi	0.28	0.37	0.45	0.17	0.39	0.50	0.09	0.44	0.00	0.00	0.32	

Table A-10. Weekly Population Estimates of Adult Salmon in the Daguerre Point Reach, 1999

Week of Recovery (j)	Week of Tagging										Total
	Oct 15	Oct 22	Oct 29	Nov 5	Nov 12	Nov 19	Nov 25	Dec 2	Dec 9	Dec 16	
Oct 22	2176										2176
Oct 29	338	1336									1674
Nov 5	49	37	1348								1434
Nov 12	0	0	228	1056							1284
Nov 19	0	0	0	315	631						946
Nov 25	0	0	0	350	124	342					816
Dec 2	0	0	0	0	0	0	377				377
Dec 9	0	0	0	0	0	0	0	214			214
Dec 16	0	0	0	0	0	0	0	0	0		9
Total	2563	1373	1576	1721	755	342	377	214	119		8930
Adj. Total											8412

Table A-11. Weekly Recoveries of Grilse Salmon Carcasses in the Daguerre Point Reach, 1999

Week of Recovery (j)	Week of Tagging										Tagged Carcasses Recovered (Rj)	Total Carcasses Recovered (Cj)
	Oct 14	Oct 22	Oct 29	Nov 5	Nov 12	Nov 19	Nov 24	Dec 2	Dec 9	Dec 17		
Oct 22	3										3	99
Oct 29	0	1									1	87
Nov 5	0	0	6								6	117
Nov 12	0	0	0	1							1	66
Nov 19	0	0	0	0	2						2	58
Nov 24	0	0	0	0	3	0					3	64
Dec 2	0	0	0	0	0	0	0				0	17
Dec 9	0	0	0	0	0	0	0	0			0	13
Dec 17	0	0	0	0	0	0	0	0	0		0	1
Tagged Carcasses Recovered (Ri)	3	1	6	1	5	0	0	0	0	0	16	
Total Carcasses Tagged (Mi)	18	9	20	3	14	13	12	3	0		92	
Ri/Mi	0.17	0.11	0.30	0.33	0.36	0.00	0.00	0.00	0.00	0.00	0.17	

Table A-12. Weekly Population Estimates of Grilse Salmon in the Daguerre Point Reach, 1999

Week of Recovery (j)	Week of Tagging										Total
	Oct 14	Oct 22	Oct 29	Nov 5	Nov 12	Nov 19	Nov 24	Dec 2	Dec 9	Dec 17	
Oct 22	594										594
Oct 29	0	783									783
Nov 5	0	0	390								390
Nov 12	0	0	0	198							198
Nov 19	0	0	0	0	162						162
Nov 24	0	0	0	0	179	0					179
Dec 2	0	0	0	0	0	0	0				17
Dec 9	0	0	0	0	0	0	0	0			13
Dec 17	0	0	0	0	0	0	0	0	0		1
Total	594	783	390	198	341	0	0	0	0	0	2337
Adj. Total											2263