

State of California
The Resources Agency
DEPARTMENT OF FISH AND GAME

KING (CHINOOK) SALMON SPAWNING STOCKS IN
CALIFORNIA'S CENTRAL VALLEY, 1976

Edited by

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Anadromous Fisheries Branch

Anadromous Fisheries Branch
Administrative Report No. 78-19

1978

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ABSTRACT

This report covers the 24th annual inventory of king salmon (Oncorhynchus tshawytscha) spawning populations in the Sacramento-San Joaquin River system. It is a compilation of estimates of fall- and spring-run king salmon spawning populations for every stream in the Sacramento-San Joaquin system which supports a significant spawning run, and partial counts of late-fall- and winter-run king salmon.

Estimates are made from counts of fish entering hatcheries and spawning channels, counts of carcasses and live fish on spawning areas, aerial redd counts, and counts of fish migrating past Red Bluff Diversion Dam.

Estimated 1976 escapement of fall-spawning (fall- plus spring-run) king salmon in the Central Valley is 221,056 fish. This figure is 75% of the historic (1953-1975) average of 295,000 and is up slightly from the 1975 estimate of 218,963.

Tables present fall- and spring-run spawning escapements by stream for 1976, and by major streams for the years 1964 through 1976.

^{1/} Anadromous Fisheries Branch Report No. 78-19.
Submitted for publication 1978.

INTRODUCTION

This report covers the 24th annual California Central Valley king salmon spawning stock inventory.

The California Central Valley (Sacramento-San Joaquin River system) (Figures 1-3) is the principal producer of king salmon caught in California's ocean fisheries. Central Valley king salmon also contribute significantly to the ocean fisheries of Oregon and Washington.

Four different "runs" or "races" of king salmon are recognized in the Central Valley. These are:

(1) The late-fall run. These fish are largely confined to the upper part of the Sacramento's main stem and are usually larger than fish of either the fall or winter runs. Most spawn from January through March.

(2) The winter run. Most spawn in the Sacramento main stem above Red Bluff Dam from April into July.

(3) The spring run. Spring-run salmon were once widespread in the Valley but have disappeared from many of the streams they once utilized. Most spawn in September or early October.

(4) The fall run. These are the most numerous and widely distributed salmon in the Valley. Most Central Valley streams that have regular salmon runs of any type have an annual fall run. Most fall-run fish spawn from the middle of October through December.

Spring and fall runs in the Central Valley have been monitored since 1953. Regular monitoring of the late-fall and winter runs began in 1967, after construction of counting facilities at Red Bluff Diversion Dam. (Most Central Valley late-fall- and winter-run king salmon spawn above the dam.)

For this report, all Central Valley streams known to support sizeable salmon runs were either surveyed, or the numbers of spawners estimated by counting at some point downstream from the spawning areas. Survey effort was concentrated in areas which are known to support the largest runs.

METHODS

Sacramento River from Keswick Dam to Red Bluff Diversion Dam

Estimates of the total numbers of salmon utilizing the Sacramento River and its tributaries upstream from Red Bluff Diversion Dam during 1976 were based on daily counts made by the U. S. Fish and Wildlife Service at Red Bluff Diversion Dam. The counts were obtained by closed circuit television observations of salmon passing through the fishway.

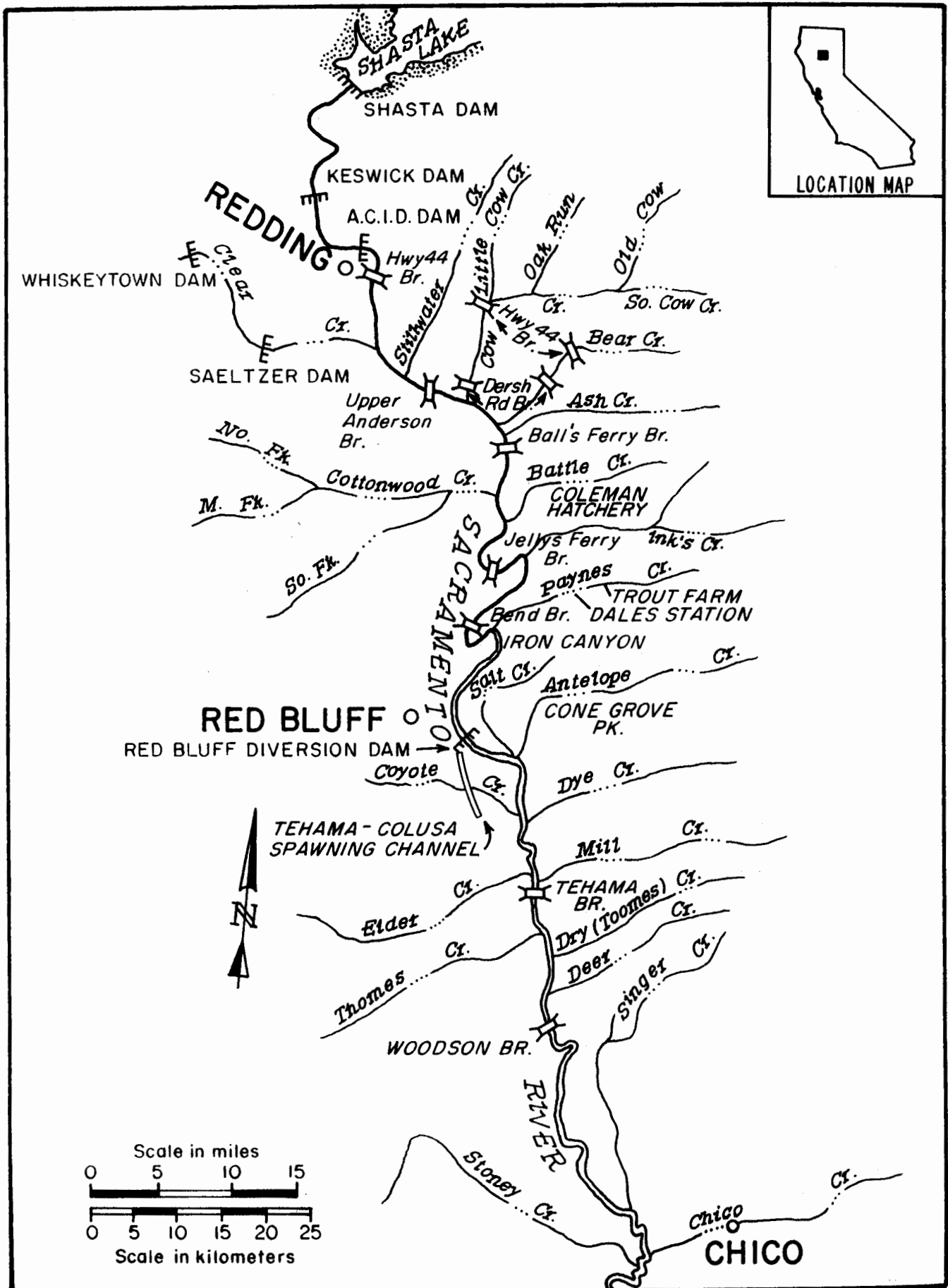


Figure 1. Upper Sacramento River and tributaries above Chico Creek.

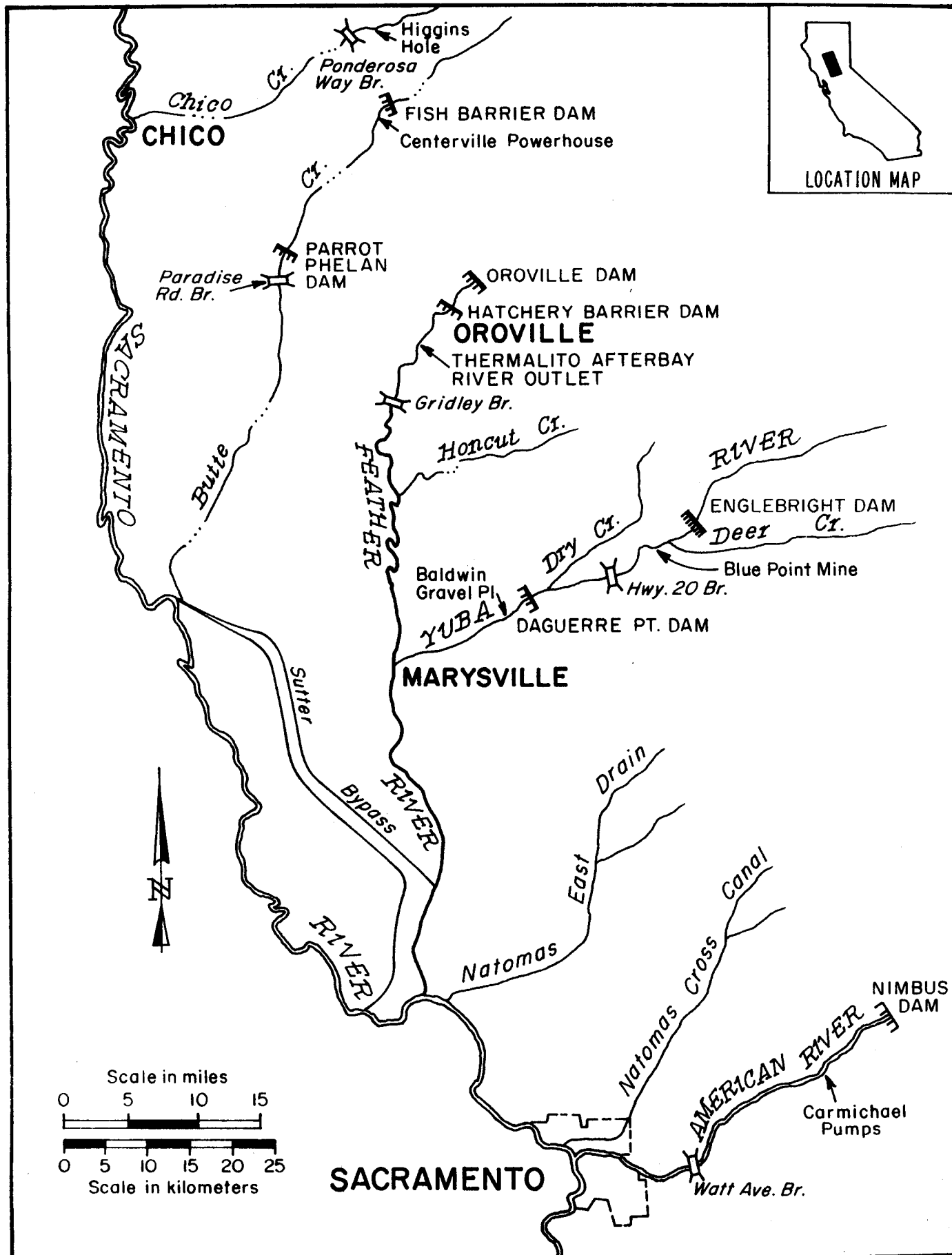


Figure 2. Sacramento River tributaries from Chico Creek south.

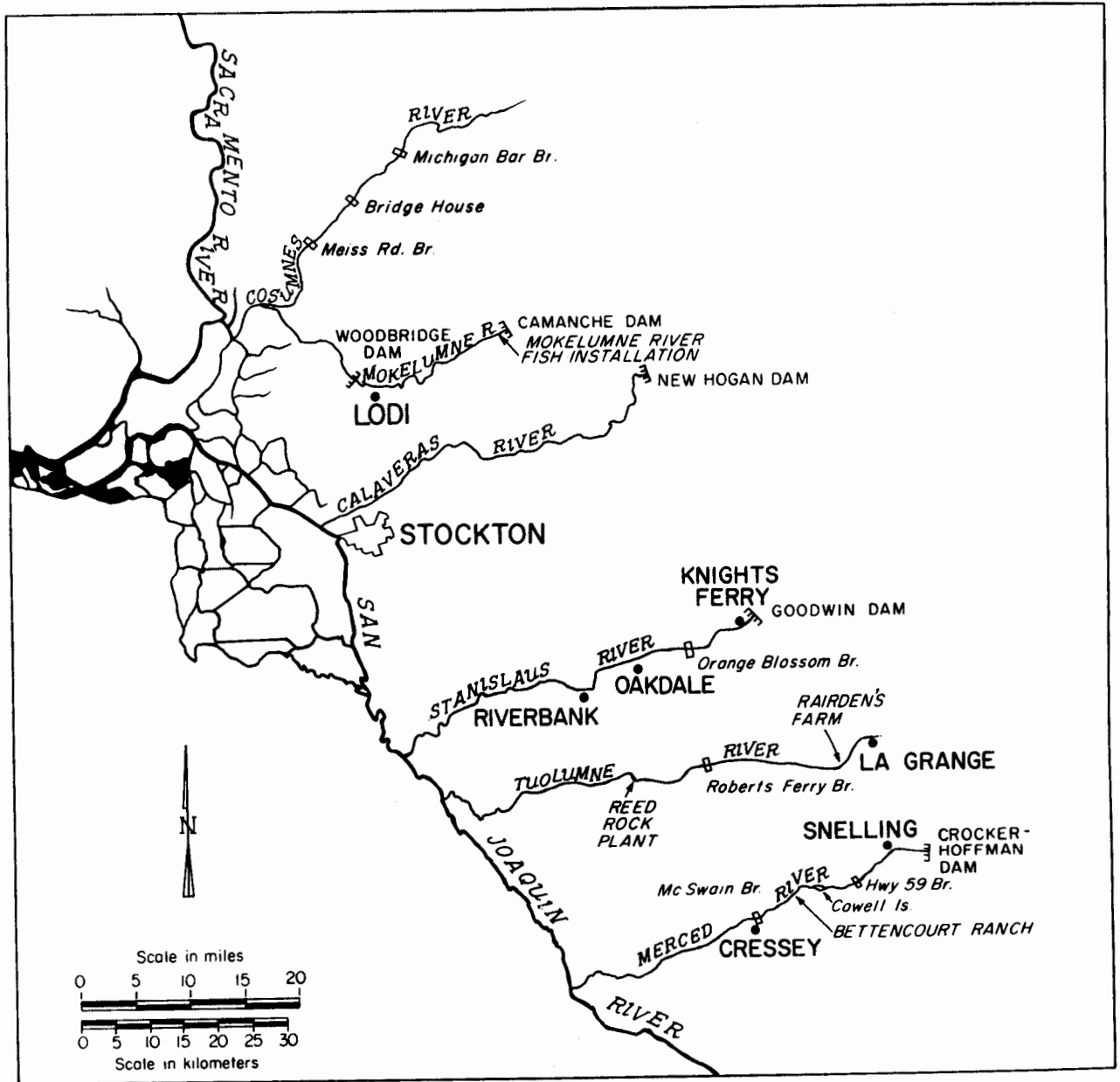


Figure 3. San Joaquin River tributaries.

Weekly counts were adjusted for periods when the fishway remained open but no counts were made: during periods when the river was turbid, when flood conditions made it necessary to open the gates of the dam, and during night hours when no counts were made. Count adjustments for the daytime lapses were made by interpolation. Adjustment for the nighttime hours consisted of multiplying the 14-hour day counts by a "night factor" developed from weekly night counts.

The adjusted weekly counts were then separated into numbers of late-fall-, winter-, spring-, and fall-run salmon according to data obtained at the trapping facility adjacent to the east bank fishway. Examined salmon were assigned to a particular run by estimating when it would spawn by its degree of ripeness.

To convert the adjusted numbers of salmon in each of the four runs passing the dam, into the numbers that actually spawned (spawning populations), the number of salmon landed by sportsmen in the Sacramento River between Keswick Dam and Red Bluff was subtracted from each corresponding run. No attempt was made to measure any other forms of mortality in the upper river prior to spawning; however, evidence indicates that prespawning mortality was somewhat higher than normal during the early fall of 1976, probably due at least in part to high water temperatures.

While a calendar year count includes total annual runs passing the dam for spring-run and fall-run salmon, it represents only part of the total annual runs of late-fall- and winter-run fish, since both of these runs usually begin in one calendar year and finish in the next. Generally, a calendar year count of the late-fall run will include approximately the latter half of one run during the first part of the year, and the first half of the next late-fall run at the end of the year. The same calendar year will usually include most of a winter run early in the year, and the first small portion of the subsequent winter run at the end of the year. Accordingly, the 1975-76 run of late-fall-run salmon (all destined to spawn in 1976) was almost equally divided between 1975 and 1976; only a small portion of the 1975-76 winter-run occurred during 1975.

To arrive at the total numbers of 1976 spawners in these two runs, it was necessary to add the appropriate portion of the 1975 calendar year count and delete that portion of the 1976 count which will spawn in 1977.

Moderate numbers of fall-run salmon spawn in tributaries upstream from Red Bluff. Battle, Bear, Clear, Cottonwood and Cow Creeks were surveyed in 1976, and spawners in other tributaries are included with the main stem estimates.

San Joaquin Tributaries and the Sacramento System below Red Bluff Diversion Dam

The 1975 fall- and spring-run king salmon spawning escapement estimates in the Sacramento River system south of Red Bluff Diversion Dam and in the San Joaquin system were based primarily on spawning bed surveys and carcass counts. In some streams, carcasses were marked and released, and subsequent recovery rates of marked carcasses were a consideration in estimating the populations. The maximum number of survey trips that money and manpower limitations permitted was made on each stream. Unless otherwise stated (or if only one survey trip was made), all counted carcasses were cut in half to prevent recounting on subsequent trips. Surveys were sometimes supplemented by aerial redd counts. Details and special methods are presented under individual stream headings.

SACRAMENTO RIVER SYSTEM FROM
KESWICK DAM TO BUTTE CITY

by

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SUMMARY

An estimated 169,782 king salmon spawned in the Sacramento River and tributaries between Keswick Dam and Butte City during 1976. The total included 15,908 late-fall-run, 33,029 winter-run, 25,095 spring-run and 95,750 fall-run fish (Appendix Table 1). These totals are the spawning populations only, and compare with figures published in previous Central Valley spawning stock reports. To obtain total runs, the freshwater sport catch has to be added to the spawning population estimates.

The fall-run salmon spawning population includes 85,173 fish that spawned in the main stem of the Sacramento River. This total also includes all salmon that spawned in tributaries--except Battle, Bear, Clear, Cottonwood and Cow Creeks--between Keswick Dam and Red Bluff Diversion Dam, as well as 2,149 that were trapped at Keswick Dam and hauled to Coleman National Fish Hatchery, 1,882 trapped at Red Bluff Diversion Dam and hauled to the Tehama-Colusa Spawning Channel, and 1,430 that were allowed to enter the Tehama-Colusa Spawning Channel via Coyote Creek. A total of 5,444 salmon spawned in Battle Creek, including 2,297 that entered Coleman Hatchery and 3,147 that spawned below Coleman Hatchery, and 4,333 spawned in other surveyed tributaries above Red Bluff. A total of 800 fall-run king salmon spawned in tributaries surveyed between Red Bluff Diversion Dam and Chico Creek. A significant number (15,500) of fall-run king salmon are estimated to have spawned in the main stem of the Sacramento River between Woodson Bridge and Butte City in 1976. This area normally has very few spawning salmon.

Due to money and manpower limitations, no spring-run salmon spawning stock surveys were made in the Sacramento River system above Chico Creek during 1976. The total spring-run salmon spawning population estimate of 25,095 is based upon counts at Red Bluff Diversion Dam only, and all spring-run spawners were assigned to the main stem of the Sacramento above Red Bluff.

The late-fall- and winter-run salmon spawning population estimates are for salmon that spawned in the main stem of the Sacramento River between Keswick Dam and Red Bluff Diversion Dam. No estimates were made of the numbers of late-fall- and winter-run salmon that spawned anywhere below Red Bluff.

MAIN STEM SACRAMENTO RIVER

Keswick Dam to Red Bluff Diversion Dam

Late-fall Run

An estimated 15,908 late-fall-run salmon spawned in the Sacramento River upstream from Red Bluff during 1976 (Tables 1, 2 and 3). Included in this total are 94 late-fall-run salmon trapped at Keswick Dam and hauled to Coleman Hatchery to be spawned there. Although some late-fall-run salmon spawn in tributaries to the Sacramento River, no spawning stock surveys were made in these streams and all late-fall-run salmon are considered in this report to have spawned in the main stem.

Data collected during an airplane flight (February 23, 1976) over the main stem of the Sacramento River showed the general salmon redd distribution of late-fall-run salmon between Keswick Dam and Woodson Bridge (Table 4).

Table 1. Calculation of King Salmon Runs and Spawning Populations, Sacramento River System above Red Bluff Diversion Dam, 1976

Run	Fish passing dam in calendar year			Potential 1976 spawners (runs)		Estimated 1975-76 sport catch above dam		Estimated 1976 spawning populations
	1975	1976						
Late-fall run 1975-76	8,866	+ 7,332	=	16,198	-	290	=	15,908
Winter run 1975-76	1,502	+ 33,594	=	35,096	-	2,067	=	33,029
Spring run 1976	0	+ 25,983	=	25,983	-	888	=	25,095
Fall run 1976	0	+ 60,719	=	60,719	-	3,307	=	57,412
Late-fall run 1976-77	0	+ 7,120*		0+		358*		
TOTALS	10,368	134,748		137,996		6,910		131,444

* This run started passing the dam late in 1976, but was not completed in 1976. Additional salmon will be added to both the run and sport catch in early 1977.

+ Fish in this run spawn in 1977, not 1976.

Table 2. Red Bluff Diversion Dam Weekly Adjusted Salmon Counts, January 4, 1976 through January 1, 1977

[illegible]

Table 2 (continued)

Week	Adjusted salmon		Late-fall		Winter run		Spring run		Fall run	
	count	Number sampled	%	run Number	%	Number	%	Number	%	Number
<u>1976</u>										
10/ 3-	9	5,677		372					100.0	5,677
10- 16		5,249		489					100.0	5,249
17- 23		3,956		660					100.0	3,956
24- 30		4,169	1.6	67					98.4	4,102
31-11/ 6		4,080	11.2	457					88.8	3,623
11/ 7-	13	2,766		1,164	20.2	559			79.8	2,207
14- 20		2,434		1,085	18.7	455			81.3	1,979
21- 27		2,155		418	25.1	541			74.9	1,614
28-12/ 4		1,534		278	33.5	514			66.5	1,020
12/ 5-	11	1,552		127	67.7	1,051			32.3	501
12- 18		1,334		76	84.2	1,123			15.8	211
19- 25		729		44	95.6	697			4.4	32
26- 1/ 1		1,859		128	89.1	1,656			10.9	203
										60,719
<hr/>										
TOTAL 1976	134,748	15,889		14,452		33,594		25,983		60,719
(Calendar year)										

* Portion of run passing dam during previous calendar year. For weekly breakdown numbers see 1975 Central Valley Spawning Stock Estimates (Hoopaugh 1978).

☐ Prospective 1976 spawners passing Red Bluff Diversion Dam.

Table 3. Estimated 1976 King Salmon Sport Catch, Sacramento River between Keswick Dam and Red Bluff Diversion Dam

Year/ month	Catch	Late-fall run*		Winter run*		Spring run		Fall run	
		%	Catch	%	Catch	%	Catch	%	Catch
1975									
October ⁺	1,220					0.6	7	99.4	1,213
November ⁺	225	14.2	32					85.8	193
December	93	47.3	44	9.3	9			43.4	40
1976									
January	260	37.3	97	62.7	163				
February	270	21.3	57	78.7	213				
March	832	5.7	47	94.3	785				
April	891	1.4	13	85.2	759	13.3	119		
May	204		290	47.1	96	52.9	108		
June	169			23.3	39	76.7	130		
July	73			3.4	3	92.2	67	4.4	3
August	622					68.9	429	31.1	193
September	1,594				2,067	2.2	35	97.8	1,559
October ⁺	934	0.6	6					99.4	928
November ⁺	619	17.7	110					82.3	509
December	357	67.8	242					32.2	115
									3,307
1976 TOTAL (Calendar year)	6,825		572		2,058		888		3,307

 Total catch from run that spawned in 1976.

* Assignment to a particular run was based on the percentage occurrence in the counts at Red Bluff Diversion Dam.

+ Fall-run salmon hauled to the Tehama-Colusa Spawning Channel were subtracted from the adjusted counts at Red Bluff Diversion Dam before percentages for October and November were calculated.

Table 4. Redd Distribution of Late-fall-run King Salmon,
Sacramento River above Woodson Bridge, 1976

Area	Percent of redds in each area*
Keswick Dam to A.C.I.D. Dam	7.5
A.C.I.D. Dam to Highway 44	30.0
Highway 44 to Upper Anderson Bridge	28.6
Upper Anderson Bridge to Balls Ferry	3.0
Balls Ferry to Jellys Ferry	7.5
Jellys Ferry to Bend Bridge	8.3
Bend Bridge to Red Bluff Diversion Dam	0.8
Red Bluff Diversion Dam to Tehama	13.5
Tehama to Woodson Bridge	0.8
TOTAL	100.0

* Percent of 133 redds observed on one air flight, February 23, 1976.

Winter Run

An estimated 33,029 winter-run salmon spawned in the Sacramento River above Red Bluff in 1976. Although some winter-run salmon have been known to spawn in tributaries such as Battle Creek, this race spawns primarily in the main stem of the Sacramento River.

Spring Run

An estimated 25,095 spring-run salmon spawned in the Sacramento River system above Red Bluff during 1976. This is the largest spring-run counted past Red Bluff Diversion Dam since the dam was constructed in 1967. It probably includes large numbers of spring-run salmon that were unable to enter Mill and Deer Creeks due to low flows in the spring of 1976. Although some spring-run salmon spawn in tributaries to the Sacramento River, no spawning stock surveys were made in these streams and all spring-run salmon are considered in this report to have spawned in the main stem.

Fall Run

An estimated 47,635 fall-run salmon spawned above Red Bluff Diversion Dam in the main stem of the Sacramento River during 1976. This total was arrived at by subtracting 3,307 salmon caught by sportsmen above Red Bluff, 4,333 that spawned in Bear, Clear, Cottonwood and Cow Creeks, and 5,444 salmon that entered Battle Creek, including 2,297 spawned artificially at Coleman Hatchery, from the 60,719 fall-run salmon that migrated past Red Bluff Diversion Dam in 1976. The 2,149 fall-run salmon trapped at Keswick Dam and hauled to Coleman Hatchery, and the 1,882 salmon trapped at Red Bluff Diversion Dam and hauled to the Tehama-Colusa Spawning Channel by the U. S. Fish and Wildlife Service, are included with those salmon that spawned in the main stem above Red Bluff Diversion Dam.

Above Red Bluff Diversion Dam all fall-run salmon that spawned in tributaries other than Battle, Bear, Clear, Cottonwood, and Cow Creeks are combined with those that spawned in the main stem of the Sacramento River. No estimates were made for several other smaller tributaries above Red Bluff which usually account for a portion of the fall-run escapement.

Data collected during three airplane flights (October 12 & 26, and November 5, 1976) over the main stem of the Sacramento River showed the general salmon redd distribution of fall spawning salmon, and indicated the relative numbers of salmon that spawned above Woodson Bridge (Table 5).

Table 5. Redd Distribution of Fall Spawning King Salmon, Main Stem Sacramento River above Woodson Bridge

Area	Percent of redds in each area*
Keswick to A.C.I.D. Dam	3.9
A.C.I.D. Dam to Highway 44	10.6
Highway 44 to Upper Anderson Bridge	17.4
Upper Anderson Bridge to Balls Ferry	10.0
Balls Ferry to Jellys Ferry	14.2
Jellys Ferry to Bend Bridge	11.0
Bend Bridge to Red Bluff Diversion Dam	1.3
Red Bluff Diversion Dam to Tehama	28.0
Tehama to Woodson Bridge	3.6
TOTAL	100.0

* Percent of 1,819 redds observed on three flights: October 12 and 26, and November 5, 1976.

Red Bluff Diversion Dam to Tehama

River Conditions

River flows in the upper Sacramento River during the fall of 1976 were very low and constant. Flows ranged between 71 m³/s (2,500 cfs) on October 25, 1976 and 246 m³/s (8,700 cfs) on January 3, 1977 at Red Bluff Diversion Dam. During the majority of the carcass recovery period (between early October, 1976 and mid-January 1977) flows remained nearly constant at 85 to 113 m³/s (3,000 to 4,000 cfs). These low, steady flows resulted in poor carcass recovery conditions, as many carcasses failed to become lodged.

Late-fall Run

Some late-fall-run salmon usually spawn in this section of the river. The February 23, 1976 airplane flight from Keswick Dam to Vina indicated that 14.3% of all late-fall run salmon spawned in the Sacramento River between Red Bluff Diversion Dam and Woodson Bridge (Table 4). Although no estimate of their numbers was made, from this limited survey, we plan to recheck this distribution in the future if money and manpower limitations permit.

Winter Run

In June 1976, several spawning salmon and a few spawned-out carcasses were observed on the first riffle immediately downstream from Red Bluff Diversion Dam. However, no estimate of the spawning population was made.

Spring Run

Some spring-run salmon normally spawn in this section of the river, and are included in the fall-run total.

Fall Run

An estimated 17,230 fall-run salmon spawned in the main stem of the Sacramento River between Red Bluff Diversion Dam and Tehama during 1976 (Table 6). This total includes 1,430 salmon that entered the Tehama-Colusa Spawning Channel via Coyote Creek.

Spawning stock surveys in the main stem of the Sacramento River between Red Bluff and Tehama began on October 12, 1976 and ended January 4, 1977. During this period twelve complete trips were made and 158 salmon carcasses were recovered. Based on river conditions, carcass counts and total survey effort (including three airplane flights) we estimate that the carcass recovery rate was 1.0%.

Table 6. Fall Spawning King Salmon Population Estimates,
Main Stem Sacramento River, Red Bluff Diversion
Dam to Butte City, 1976

Area	Estimated recovery rate (percent)	Counting trips	Carcasses Recovered	Estimated spawning populations
Red Bluff Diversion Dam to Tehama	1.0	12	158	17,230*
Tehama to Woodson Bridge	1.0	12	48	4,800
Woodson Bridge to Butte City				15,500 ⁺
TOTAL				37,530

* Includes 1,430 salmon that entered the Tehama-Colusa Spawning Channel via Coyote Creek.

⁺ Estimate based on an air flight made November 5, 1976 showing 43.2% of all redds in the section from Red Bluff Diversion Dam to Butte City to be between Woodson Bridge and Butte City (Table 7). Rounded to nearest 500 fish.

Tehama to Woodson Bridge

Late-fall, Winter, and Spring Runs

While it is likely that a few fish from each of these three runs spawned in this river section, no estimate of their total numbers was made.

Fall Run

An estimated 4,800 fall-run salmon spawned in the main stem of the Sacramento River between Tehama and Woodson Bridge during 1976.

Between October 13, 1976 and January 5, 1977 we completed 12 surveys and recovered 48 salmon carcasses. Based on survey effort (including three airplane flights), river conditions and carcass counts, we estimate that the carcass recovery rate was 1.0%.

Woodson Bridge to Butte City

Late-fall, Winter, and Spring Runs

While it is possible that some fish from these runs may have spawned in this river section, no estimate of their total numbers was made.

Fall Run

Due to low flows during fall 1976, a number of riffles in the Sacramento River between Woodson Bridge and Butte City became more attractive than usual. While spawning in this area is usually insignificant, based on an air survey of November 5, 1976, we estimated the spawning population at 15,500 (Tables 6 and 7).

Table 7. Redd Distribution of Fall Spawning King Salmon,
Main Stem Sacramento River above
Butte City, 1976

Area	Percent of redds in each area*
Keswick Dam to A.C.I.D. Dam	4.7
A.C.I.D. Dam to Highway 44	10.3
Highway 44 to Upper Anderson Bridge	9.5
Upper Anderson Bridge to Balls Ferry	5.5
Balls Ferry to Jellys Ferry	12.8
Jellys Ferry to Bend Bridge	10.8
Bend Bridge to Red Bluff Diversion Dam	2.9
Red Bluff Diversion Dam to Tehama	18.8
Tehama to Woodson Bridge	5.9
Woodson Bridge to Ord Ferry	13.3
Ord Ferry to Butte City	5.5
TOTAL	100.0

* Percent of 632 redds observed on November 5, 1976.

SACRAMENTO RIVER TRIBUTARIES

Stream Conditions

Precipitation and run-off in the upper Sacramento Valley were far below normal during fall and winter 1976. Drought conditions existed in most tributaries to the upper Sacramento River. Many tributaries that normally have a small fall run of king salmon were completely dry throughout the spawning period between early October 1976 and mid-January 1977. In many of the smaller tributaries, such as Salt, Thomes, Dye and Singer Creeks, the salmon runs are inclined to fluctuate with the timing and amount of run-off. In early fall of 1976 none of these streams had sufficient flow to support spawning salmon.

In the larger tributaries such as Antelope, Mill and Deer Creeks flows were far below normal and populations of fall-run king salmon were well below recent years. Carcass recovery conditions were generally good.

Clear Creek

Fall Run

Between September 29, 1976 and January 1, 1977, nine survey trips were made on Clear Creek, eight from Highway 99 to the Sacramento River and one from McCormick-Saeltzer Dam to the Sacramento River. A total of 152 salmon carcasses were recovered and 212 redds were observed (some of which were probably counted more than once). The fall run was estimated to be 1,013 (Appendix Table 2).

Cow Creek

Fall Run

Between September 9, 1976 and January 10, 1977, eight survey trips were made on Cow Creek from Highway 44 to the Sacramento River. A total of 109 salmon carcasses were recovered and 337 redds were observed (some of which were probably counted more than once). The fall run was estimated to be 726.

Bear Creek

Fall Run

Eight survey trips were made on lower Bear Creek between County Road Bridge (A-17) and the Sacramento River, from September 28, 1976 through January 5, 1977. A total of 25 carcasses were recovered, and 102 redds were observed (some of which were probably counted more than once). The fall run was estimated to be 167.

Cottonwood Creek

Fall Run

Between September 9, 1976 and January 6, 1977, ten survey trips were made on Cottonwood Creek from three miles above Highway I-5 to the Sacramento River. A total of 364 carcasses were recovered and 1,021 redds were observed (some of which were probably counted more than once). The fall run in this lower portion of Cottonwood Creek was estimated to be 2,427.

Battle Creek

Late-fall Run

A few late-fall-run salmon were observed in spawning condition in Battle Creek during February, March and April of 1976, but no estimate of their numbers was made.

Winter Run

In past years some winter-run salmon have been observed spawning downstream from Coleman Hatchery in June. No population estimate was made in 1976.

Spring Run

In high flow years a few spring-run salmon are observed on upper Battle Creek near Darrah Springs Fish Hatchery. No survey was made this year and no estimate of the spawning population was made.

Fall Run

An estimated 5,444 fall-run salmon spawned in Battle Creek during 1976 (Appendix Table 2). This total includes 2,297 salmon that entered Coleman Hatchery and were spawned artificially, and 3,147 that spawned in Battle Creek between Coleman Hatchery and the Sacramento River. It does not include 2,149 fall-run salmon trapped at Keswick Dam on the upper Sacramento River and hauled to Coleman Hatchery for artificial spawning.

Carcass recovery data were used to estimate the numbers of salmon that spawned in Battle Creek below Coleman Hatchery. Fourteen trips were made on lower Battle Creek, from September 28, 1976 through January 7, 1977, and on Gover's irrigation ditch from September 28, 1976 through January 6, 1977. Carcass recovery conditions were generally very good throughout the recovery period. A total of 1,739 carcasses were recovered (1,643 in Battle Creek and 96 in Gover's ditch), at an estimated overall efficiency rate of 55% in Battle Creek and 60% in Gover's ditch.

Antelope Creek

Spring Run

Spring-run salmon enter Antelope Creek fairly regularly but the population size is unknown. No estimate was made.

Fall Run

Between September 30, 1976 and January 13, 1977, six survey trips were made on the main fork of Antelope Creek from the canyon mouth (USGS gaging station) to Highway 99-E. Three carcasses were recovered, 25 redds were observed, and the fall run was estimated at 60 fish. No carcasses or live salmon were observed in New Creek or Craig Creek.

Coyote Creek

Late-fall Run

Some late-fall-run salmon were observed spawning in Coyote Creek in February and March 1976 but no estimate was made of the total numbers that might have spawned there. Spawners were observed from the Tehama-Colusa Fish Facility selection station to one-half mile downstream.

Winter Run

Some winter-run salmon ascended Coyote Creek in May 1976 and were observed attempting to enter the Tehama-Colusa Spawning Channel. No estimate of numbers was made.

Fall Run

Four survey trips were made between November 18, 1976 and January 13, 1977. Twenty-four carcasses were recovered and 13 live salmon were observed. The total estimated fall-run salmon population that spawned in Coyote Creek in 1976 was 160.

Coyote Creek probably had the largest flow at its mouth of any tributary to the Sacramento River between Red Bluff and Chico Creek during the fall of 1976. An average daily flow of $14.2 \text{ m}^3/\text{s}$ (500 cfs) was released into Coyote Creek from the Tehama-Colusa Fish Facility between September and December, 1976. A total of 1,668 salmon were handled at the terminal selection station of which 238 were rejected and 1,430 were accepted into the spawning channels. Those fish accepted into the spawning channels are included in population estimates for the main stem of the Sacramento River below Red Bluff.

Dye Creek

Fall Run

Two survey trips were made of Dye Creek between September 30, 1976 and December 14, 1976, from 500 yards upstream from Highway 99-E downstream to the Sacramento River. No salmon carcasses were recovered, no live fish were seen and it is assumed that no fall-run salmon spawned in Dye Creek in 1976.

Mill Creek

Late-fall Run

A few late-fall-run salmon were observed in Mill Creek during March 1976, but no estimate was made.

Winter Run

No estimate was made. During previous years small numbers of winter-run salmon have been observed spawning between Ward and Clough Dams, usually in June.

Spring Run

Due to money and manpower limitations no complete surveys were made for spring-run salmon on upper Mill Creek. One incomplete inspection trip was made on September 29, 1976. A total of 87 live fish were noted but no complete estimate was made.

Fall Run

Six survey trips were made on lower Mill Creek, from the Los Molinos Mutual Water Company's upper diversion dam to its confluence with the Sacramento River, between September 30, 1976 and January 27, 1977. A total of 49 carcasses was recovered. The fall run was estimated to be 245 salmon.

Thomes Creek

Fall Run

One survey trip was made on Thomes Creek on October 19, 1976 and no salmon were observed. The area covered was 3 miles on either side of the Highway 99-W bridge. It is assumed that no salmon spawned in Thomes Creek.

Dry (Toomes) Creek

Late-fall Run

A few late-fall-run salmon often spawn in Dry Creek if water conditions are suitable. No estimate was made.

Fall Run

Two survey trips were made on Dry Creek in early January 1977, from Lone Pine to the Sacramento River. Only two salmon were observed--one live and one dead. It is estimated that 20 salmon spawned in Dry Creek.

Deer Creek

Spring Run

Due to money and manpower limitations no complete surveys were made for spring-run salmon on upper Deer Creek. On September 30, the area between A Line Bridge and Lower Deer Creek Falls was surveyed and 42 live salmon, 21 redds and 2 carcasses were observed. No estimate of the spawning population was made.

Fall Run

Seven survey trips were made on lower Deer Creek between September 30, 1976 and January 5, 1977. The area covered was from the mouth upstream to the county road bridge, located about 3.2 km (2 miles) upstream from the Stanford-Vina Dam. A total of 63 salmon carcasses was recovered and 195 redds were counted. The estimated fall run totaled 315 spawners.

Singer Creek

Fall Run

One survey trip was made in Singer Creek on January 26, 1977. The area covered was from two miles above the Lassen Road crossing downstream to Highway 99-E. No carcasses were recovered and no live fish were seen. No fall-run salmon were known to have spawned in Singer Creek in 1976.

Sacramento River Tributaries, Chico Creek and Southward (Figure 2)

Chico Creek

Spring Run

No counts or estimates were made.

Fall Run

No counts or estimates were made.

Butte Creek

by

Richard Flint
Region 2

General Information

Extremely low water and early diversions greatly inhibited upstream migration of spring-run salmon, and probably resulted in a significant loss of downstream migrants of both spring and fall runs. All ladders were in place by April 26, and salmon were seen at Adams, Gorrill, Quandt, and Howard Slough Dams. The only flow past Gorrill Dam was leakage. Downstream migrants were seen at Howard Slough on April 28 and in ladders or below the dams at Adams and Gorrill on May 4. The migrants were 10-13 cm (4-5 inches) long.

Spring Run

Butte Creek was surveyed from Centerville Powerhouse to the Skyway on September 30 and October 1. Recovery conditions were only fair. The peak of spawning seemed to have occurred a week earlier as most redds were algae covered. We counted seven multiple and four single redds, and 13 live and five dead salmon. The minimum number of fish accounted for was 18. Estimated total escapement was 46 fish (Appendix Table 3).

Fall Run

Counts were made on November 2 and December 8 from Highway 99-E to Gorrill Dam. A total of 21 live and 121 dead salmon were seen. A fall salmon was seen above Durham Mutual Dam on December 13, four days after the east ladder was reopened. Estimated total escapement was 640 salmon. In addition to those fish that spawned

in Butte Creek, approximately 500 fish migrated up Western Canal. Two hundred sixty-three were rescued and moved to the Feather River and the remainder lost, primarily to poachers.

Feather River

by

Richard Flint
Region 2

Spring Run

On September 22, 1976 a salmon carcass survey was made from the hatchery downstream to Thermalito Outfall. Although no marked spring-run carcasses were observed, some of the early spawning fish appeared to be spring-run. Feather River Hatchery received 699 spring-run salmon including nine marked fish.

Fall Run

Salmon carcasses were counted in the Feather River from the hatchery downstream to the Thermalito Outfall on September 22, and weekly from October 4 through 27. Spawning was generally earlier than usual, with the first redds noted September 22, and heavy spawning activity by October 4. A total of 1,327 carcasses were counted, with no marks recovered. The Feather River Hatchery received 5,198 fall-run fish, including 37 which were marked.

The estimated total spawning fall-run salmon, based on comparison of carcass recovery and hatchery counts with past years is 62,000 fish.

Yuba River

by

Ronald Rogers
Region 2

Fall Run

The Yuba River survey was not conducted in the usual manner this year. In September a weir and fish trap designed to trap all upstream migrant salmon and steelhead was placed near the lower end of the spawning area. The location was between Hallwood Avenue and Plantz Road (section 4 of surveys on previous years).

The water flow was about $8.5 \text{ m}^3/\text{s}$ (300 cfs) below Daguerre Point Dam up to September 15. The flow was about $17 \text{ m}^3/\text{s}$ (600 cfs) through December.

The number of salmon counted between September 19 and December 31 at the weir was 1,372. The sex ratio of dead salmon lodged on the weir from upstream was 117 males/85 females = 1.38. Examination of these 202 dead fish showed that 31 males and six females were smaller than 51.3 cm (20.2 inches). Between that length and 60.7 cm (23.9 inches) were 17 males and 13 females. Over 60.7 cm we had 69 males and 66 females. The peak of the run was in the week of October 31.

The U.S. Corps of Engineers operated an electronic fish counter in the Daguerre Point Dam fish ladder. The counter recorded 1,829 upstream migrating fish during the mid-September through December period. No information is available on the species distribution of the fish.

An unusually high proportion of the salmon were found spawning about 1/2 km (1/3 mile) below the weir. Suspicions that the weir caused this were not substantiated by observations. We did not see large numbers of salmon milling below the weir, marginal spawning habitat was not used, and the proportion of dead unspawned fish was not high (1.9%). A higher percentage of the dead fish found against the weir were ripe (3.7%).

A spawning stock survey was begun on November 14 to estimate the number of fish spawning below the weir. Seven weeks were sampled but the last two weeks in December were combined making six sampling periods. The method of estimating the population was the same as the previous three years. In this method fresh carcasses are marked and returned to running water for observation of the marked to unmarked ratios in subsequent time periods (Table 8).

By adding the number of salmon counted at the weir (1,372) to the number estimated below the weir (2,407) the minimum estimated escapement is 3,779. An additional, but unknown, number passed through holes in the weir. Some of the carcasses from fish which spawned early below the weir probably disappeared before the carcass survey began.

Table 8. Summary of Tagging and Recoveries With Weekly Population Estimates below the Weir; Yuba River 1976

Number	Dates	Recovery period number						Recoveries		Population estimate
		1	2	3	4	5	6	Tags	Fish checked*	
1	11/14-20	For tagging only--no recoveries.							460	460
2	11/21-27	10						10	596	864
3	11/28- 12/4	1	5					6	113	404
4	12/5-11		3	4				7	125	343
5	12/12-18			1				1	112	202
6	12/19-30					3		3	42	196
TOTALS								27	1,448	2,469+
Total tags recovered										
		11	3	5	0	3	0			
Total tags released										
		16	32	9	7	14	0			

* Includes tagged fish.

+ Number of fish tagged from period two on must be subtracted giving 2,469 - 62 = 2,407.

American River

by

Robert Reavis
Region 2

Fall Run

The 1976 American River fall-run king salmon spawning inventory was started on November 5 and completed on December 30. During the inventory water conditions were ideal for recovery of carcasses. Transparency ranged from 1.5 to 2.4 m (5 to 8 ft). Flows were 22.7 m³/s (800 cfs) until December 8 and 51 m³/s (1,800 cfs) from December 9.

During 1976, unlike previous years, only the section of stream between the Nimbus Racks and the Sunrise Boulevard bridge was surveyed. This section was the upper portion of past inventories when the entire area between the Nimbus Racks and Watt Avenue was surveyed.

Spawning escapement for the section of stream between the Nimbus Racks and the Sunrise Boulevard Bridge was estimated at 13,686 using a method by Schaefer (1951) as reported by Taylor (1974b) (Table 9). Assuming sections inventoried accommodated 60% of the total run (from previous surveys), I estimated total escapement for the river at 22,810.

Table 9. Summary of Tag and Recovery Data With Weekly Population Estimates, American River from Nimbus Dam to Sunrise Boulevard, 1976.

Recovery period	11/5	11/12	11/19	11/26	12/3	12/10	12/17	12/22	Tags rec.	Fish rec.*	Pop. est.
11/12	2								2	99	792
11/19		10							10	321	1,156
11/26			15						15	474	1,811
12/ 3			2	19					21	683	2,201
12/10				5	10				15	636	3,354
12/17				1	1	10			12	352	1,625
12/22					1	7	9		17	285	1,484
12/30							5	3	8	184	1,722
TOTAL										3,034	14,145+
Total marks recovered	2	10	17	25	12	17	14	3	100		
Total marks	16	36	65	79	76	78	78	47			

* Includes tagged fish.

+ Number of fish tagged from period two on must be subtracted giving 14,145-459=13,686.

Lower San Joaquin River Tributaries

Cosumnes River

by

Robert Reavis
Region 2

Fall Run

Due to the drought there was no flow in the lower Cosumnes River.

Mokelumne River

by

Marcus Sazaki
Region 2

Fall Run

Seven salmon spawning survey trips were conducted this year on the Mokelumne River. Conditions were unusually good for recovering carcasses, with flows of approximately $3.1 \text{ m}^3/\text{s}$ (110 cfs), clear weather, and water transparency ranging from 1.5 to 2.4 m (4.9 to 8.2 ft).

Flows in the river below Woodbridge Diversion were virtually nonexistent until the dam boards were pulled beginning on October 29. Even with the increased flow there were few live salmon or carcasses observed early in the survey, much less than the same relative period in 1974 and 1975. This may have been caused by unseasonably high water temperature (15.6 C [60 F] on November 10). At our request, flows were increased for 24 hours on November 29 and December 7 from 3.2 to $6.0 \text{ m}^3/\text{s}$ (113 to 213 cfs) and 3.1 to $5.9 \text{ m}^3/\text{s}$ (108 to 208 cfs) respectively. Subsequently, we saw approximately ten times as many live salmon and carcasses. In addition to migrating late this year, salmon were observed spawning farther downstream than at any time in the previous two years.

During the surveys, 191 carcasses were seen and 462 live fish sighted. Utilizing a 45% recovery rate for carcasses, the estimated number of salmon which spawned in the survey area was 455, including 31 live salmon which were observed on the last survey trip. An additional eighteen salmon spawned in the spawning channel at the Mokelumne River Fish Installation, giving a total estimate of 473 (Appendix Table 4).

Calaveras River

by

Marcus Sazaki
Region 2

Winter Run

King salmon were first observed attempting to migrate up the Calaveras River in February. From that time until mid-April, flows to tidewater were virtually nonexistent. Unscheduled spillage of water from irrigation check dams on the Old Calaveras River channel attracted substantial numbers of salmon to the lowermost dam during the last half of April and as many of these fish as possible (477) were rescued and trucked upstream and released above the Bellota Weir.

The total 1976 run was probably not less than 500 fish.

Stanislaus River

by

Maurice Fjelstad
Region 4

The estimated 1976 salmon run on the Stanislaus River was 600 fish, half of the 1975 run and the third lowest of record.

Five carcass recovery surveys were conducted between November 17 and December 31, 1976. The survey area was divided into four sections as follows:

- Section 1 - Goodwin Dam to Knights Ferry
- 2 - Knights Ferry to Orange Blossom Bridge
- 3 - Orange Blossom Bridge to Oakdale
- 4 - Oakdale to Riverbank

Extremely low precipitation and runoff in the Stanislaus River drainage during the winter of 1975-76 left nearly all reservoirs almost empty. The result was the Oakdale and South San Joaquin Irrigation Districts were unable to release more than 1.1 m³/s (40 cfs) during the salmon spawning season. The flow averaged 0.7 m³/s (25 cfs) during November and December.

We examined some 95 carcasses, of which 94 were tagged. Fourteen tagged carcasses were recovered on later surveys. Recovery conditions were good and we are unable to explain the low tag recovery rate.

Tuolumne River

by

Maurice Fjelstad
Region 4

An estimated 1,700 salmon spawned in the Tuolumne River this season. This approximated the 1975 estimated run of 1,600 fish.

Five survey trips were made between November 15 and December 29, 1976. The survey was partitioned into three sections as follows:

- Section 1 - La Grange to Rairden's Ranch
- Section 2 - Rairden's Ranch to Roberts Ferry Bridge
- Section 3 - Roberts Ferry Bridge to Reed Rock Plant.

We examined 336 carcasses, tagged 330 and recovered 61 tagged carcasses on later trips.

Because of the drought, the "dry year" fish water reservation of 64,040 acre feet instead of the normal 123,210 acre feet was in effect. The November and December flows of about 5.7 m³/s (200 cfs) (instead of the normal 10.9 m³/s (385 cfs)) appeared to meet the spawning needs for the number of salmon observed. The usual high power releases did not occur.

Merced River

by

Maurice Fjelstad
Region 4

The Merced River salmon run was estimated at 1,900 fish, including an estimated 700 fish that used the spawning channel at the Merced River Fish Facilities.

Between November 11, 1976 and January 5, 1977, five survey trips were made from Crocker-Huffman Dam to the Highway 59 bridge. Surveys further downstream were precluded by extensive growths of water hyacinth.

Because of the drought, spawning flows were considerably lower than normal. The reduced storage in McClure Reservoir precluded the Merced Irrigation District from releasing extra water which usually breaches the cobble diversion dams downstream. As a result, these dams continued to divert more water than usual.

We tagged 294 of 315 carcasses examined. Eighty-one tags were recovered on later surveys. Approximately 260 redds were counted within the spawning channel. Merced River Fish Facilities personnel recovered 270 carcasses.

SUMMARY

During 1976 the California Department of Fish and Game conducted its 24th annual king salmon spawning stock inventory of the Sacramento-San Joaquin River system.

This report deals with the four races of king salmon recognized in the Central Valley: late-fall, winter, spring and fall runs.

In the San Joaquin system and the lower Sacramento River system, spawning stock estimates were done by the California Department of Fish and Game. These estimates were based on carcass counts, aerial redd counts, and live fish counts. Estimates for the Sacramento River above Red Bluff Diversion Dam were based primarily on U. S. Fish and Wildlife Service counts of fish passing the dam, and on Department of Fish and Game sampling at the dam.

The estimated 1976 Central Valley king salmon spawning escapement was 270,493 fish (Table 10).

Table 10. Sacramento-San Joaquin System King Salmon
Spawning Population, 1976

Spawning area	Late-fall run	Winter run	Spring run	Fall run	Combined
Sacramento main stem*	15,908	33,029	25,095	85,173	159,205
Sacramento tributaries			745	105,370	106,115
San Joaquin tributaries		500		4,673	5,173
TOTALS	15,908	33,529	25,840	195,216	270,493

* Includes some fish spawning in tributaries above Red Bluff Dam.

Fall- and spring-run salmon spawn at about the same time, hence these two races cannot always be distinguished on the spawning grounds. However, estimates for the combined fall and spring runs are available for the comparison of all years since 1953 (Taylor, 1974a). The 1976 fall-spawning (fall- plus spring-run) population in California's Central Valley was 221,056 fish. This figure is 75% of the historic (1953-75) average of 295,000 and is up slightly from last year's estimate of 218,963.

Above Red Bluff Diversion Dam, the fall-spawning escapement of 78,484 was up approximately 8,000 fish from last year. This is still the seventh consecutive year that fall-spawning runs were far below the 1964-69 average of 129,000 (Appendix Table 5).

As in recent years, the lesser escapement above Red Bluff was partially offset by increasing spawning escapements in the lower Sacramento River. The estimated 37,530 king salmon which spawned in the Sacramento River below Red Bluff

(including 1,430 which entered the Tehama-Colusa Spawning Channel via Coyote Creek) was the highest number ever recorded since estimates have been made for this section.

Spawning escapements in the Yuba and American Rivers were down approximately one-third from 1975. Feather River escapements were up approximately 50%.

Runs in the San Joaquin system totaled 5,173 fish, considerably below the 19,991 average for the previous 12 years.

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Appendix Table 1. Summary of King Salmon Spawning Population Estimates,
Sacramento River System, Keswick Dam to
Butte City, 1976*

	Late-fall run	Winter run	Spring run	Fall run	Area Total
<u>Sacramento River, Main Stem</u>					
Keswick Dam; salmon hauled to Coleman Hatchery.	94			2,149	2,243
Tehama-Colusa Spawning Channel; salmon hauled from Red Bluff Diversion Dam fish trap.				1,882	1,882
Keswick Dam to Red Bluff Diversion Dam.	15,814	33,029	25,095	43,612	117,550
Tehama-Colusa Spawning Channel; salmon that entered via Coyote Creek.				1,430	1,430
Red Bluff Diversion Dam to Butte City.				36,100	36,100
<u>Total, Main Stem</u>	<u>15,908</u>	<u>33,029</u>	<u>25,095</u>	<u>85,173</u>	<u>159,205</u>
<u>Sacramento River Tributaries</u>					
Tributaries; Keswick Dam to Red Bluff Diversion Dam ⁺				9,777	9,777
Tributaries; Red Bluff Diversion Dam to Chico Creek.			No est.	800	800
<u>Total, Tributaries</u>			<u>No est.</u>	<u>10,577</u>	<u>10,577</u>
<u>TOTAL, SPAWNING POPULATIONS</u>	<u>15,908</u>	<u>33,029</u>	<u>25,095</u>	<u>95,750</u>	<u>169,782</u>

* Spawning population equals total run minus sport catch.

⁺ All salmon that might have spawned in tributaries above Red Bluff, which were not surveyed, are included with main stem Sacramento River estimates above Red Bluff.

Appendix Table 2. Fall-run King Salmon Spawning Population Estimates
Sacramento River Tributaries above Chico Creek,
1976*

Area	Stream	Recovery rate (percent)	Number of counting trips	Carcasses recovered	Estimated spawning population	
					Creek total	Area total
Keswick Dam to Red Bluff	Clear Creek	15	9	152	1,013	
	Cow Creek	15	8	109	726	
	Bear Creek	15	8	25	167	
	Cottonwood Creek	15	10	364	2,427	
	Battle Creek					
	Coleman Hatchery				2,297	
	Below Coleman	55	14	1,643	2,987	
	Gover's Ditch	60	9	96	160	
	Total, Battle Cr.				5,444	
						9,777
Red Bluff to Woodson Br.	Antelope Creek	5	6	3	60	
	Coyote Creek	15	4	24	160	
	Dye Creek	-	2	0	0	
	Mill Creek	20	6	49	245	
	Thomes Creek	-	1	0	0	
	Dry (Toomes) Creek	5	2	1	20	
	Deer Creek	20	7	63	315	
	Singer Creek	-	1	0	0	
						800
TOTAL, Keswick to Woodson Bridge						10,577

* No fall-run salmon spawning estimates were made for other tributaries. No spring-run salmon spawning estimates were made for any tributary.

Appendix Table 3. Fall- and Spring-run King Salmon Counts and Population Estimates, Lower Sacramento River Tributaries (Chico Creek and South) 1976

Stream or stream section	Number of counting trips	Carcasses counted	Population estimates		
			Spring run	Fall run	Total
Chico Creek (Total)	0	0	No est.	No est.	No est.
Butte Creek (Total)			(46)	(640)	681
Centerville Powerhouse to Skyway Bridge	1	5	46	No est.	
Durham Mutual Dam to Western Canal Dam	2	121	No est.	640	
Feather River (Total)			(699)	(62,000)	62,699
Oroville Barrier to Thermalito Outlet	5	1,327	No est.	56,802	
Feather River Hatchery			699	5,198	
Yuba River (Total)				(3,779)	3,779
Above trap site				1,372	
Below trap site	7	1,448		2,407	
American River (Total)				(28,374)	28,374
Nimbus Racks to Watt Avenue Bridge	9			22,810	
Above Nimbus Racks				349	
Nimbus Hatchery				5,215	

Appendix Table 4. Fall-run King Salmon Counts and Population Estimates,
San Joaquin River Tributaries, 1975

	Counting trips	Carcasses counted	Estimated spawning population	
			Fall run	Winter run
Cosumnes River	0			
Mokelumne River (Total)		(209)	(473)	
Camanche Dam to	7	191	455	
Elliot Road				
Mokelumne River Fish		18	18	
Installation				
Calaveras River (Total)				(500)
Stanislaus River (Total)		(95)	(600)	
Goodwin Dam to	0			
Knight's Ferry				
Knight's Ferry to	3	9		
Orange Blossom Bridge				
Orange Blossom Bridge to	5	40		
Oakdale				
Oakdale to	5	46		
Riverbank				
Tuolumne River (Total)			(1,700)	
LaGrange to	6	(336)		
Rairden's Ranch				
Rairden's Ranch to	11			
Robert's Ferry Bridge				
Robert's Ferry Bridge to	5			
Reed's Rock Plant				
Merced River (Total)			(1,900)	
Crocker-Huffman Dam to	5	315	1,200	
Highway 59 Bridge				
Merced River Spawning		270	700	
Channel				
TOTAL, San Joaquin Tributaries			4,673	500

Appendix Table 5. Sacramento-San Joaquin Valley King Salmon Spawning Stock Estimates, 1964-1976, in Thousands of Fish

Year	Sacramento River system above Red Bluff, excluding Battle Creek				Battle Creek	Sacramento main stem below Red Bluff	Feather River		Yuba River	American River	Cosumnes River	Mokelumne River	Stanislaus River	Tuolumne River	Merced River	Others ^{a/} All races combined
	Fall	Spring	Late fall	Winter	Fall	Fall	Fall	Spring	Fall	Fall	Fall	Fall	Fall	Fall	Fall	Fall
1964	150 ^{b/}	c/	c/	c/	16	6	38 ^{b/}	3	35	59	2	2	4	2	0.04	7
1965	107 ^{b/}	c/	c/	c/	9	2	23 ^{b/}	0.7	10	39	0.8	1.3	2	3	0.09	2
1966	124 ^{b/}	c/	c/	c/	3	3	21 ^{b/}	0.3	8	27	0.6	0.7	3	5	0.04	1
1967	84 ^{b/}	c/	c/	c/	5	9	12 ^{b/}	0.1	24	23	0.5	3	12	7	0.6	1
1968	116 ^{b/}	c/	c/	c/	6	12	18 ^{b/}	0.2	7	31	1.5	1.7	6	9	0.5	2
1969	130	20	c/	c/	6	18	61 ^{b/}	0.3	5	47	4	3	12	32	0.6	5
1970	70	4	c/	c/	7	6	62 ^{b/}	0.2	13	37	0.6	5	9	18	5	5
1971	59	6	17	53	5	23	47 ^{b/}	0.5	6	52	0.5	5	14	22	4	5
1972	36	7	33	28	5	15	47 ^{b/}	0.3	9	25	1.6	1.1	4	5	3	3
1973	44	7	22	23	8	17	74 ^{b/}	0.2	24	95	0.9	3	1.2	2	1.1	6
1974	49	4	6	19	4	28	66	0.2	18	62	0.3	1.4	0.8	1.1	2	8
1975	55	10	18	23	5	36	43	0.7	6	40	0.7	1.9	1.2	1.6	2.4	15
1976	57	25	16	33	5	36	62	0.7	4	28	0	0.5	0.6	1.7	1.9	1
1977																

^{a/} This includes streams which a few hundred king salmon enter most years (e.g., Mill, Deer, and Dye Creeks) as well as streams which king salmon enter only in wet years (e.g., Dry and Singer Creeks, and the Calaveras River).

^{b/} Some spring-run fish may have been included in the fall-run estimate.

^{c/} No estimate.

1978

1979