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KING (CHINOOK) SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1975

Edited by

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Administrative Report No. 77-12

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KING (CHINOOK) SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1975[1/]

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ABSTRACT

This report covers the 23rd 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 carcasses and live fish on spawning areas, aerial redd counts, and counts of fish migrating past Red Bluff Diversion Dam.

A total of 261,303 salmon spawned in the Central Valley in 1975: 252,978 in the Sacramento River system, and 8,325 in the San Joaquin River system.

The estimated 1975 escapement of fall-spawning (fall- plus spring-run) king salmon in the Central Valley is 218,963 fish. This figure is 73% of the historic (1953-1974) average of 298,000 and is down 10% from the 1974 estimate of 244,054.

1/ Anadromous Fisheries Branch Administrative Report No. 77-12. Submitted for publication 1976.

INTRODUCTION

This report covers the 23rd annual California Central Valley king salmon spawning stock inventory.

The California Central Valley (Sacramento-San Joaquin River system) 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 fun. 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. Spawning occurs 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 of them spawn in September or early October in the Sacramento River system.

(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.

Counts and estimates of fall- and spring-run salmon spawning escapements for some streams within the Sacramento-San Joaquin River system are available, though primarily on an intermittent basis, since 1940. However, it was not until 1953 that the escapement data became complete enough to permit an estimate for the entire valley. Regular monitering 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 1975 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[2/].

2/ The video tape recording system used in previous years has been discontinued.

A portion of the passing fish are regularly diverted to a trapping facility adjacent to the east bank fishway, examined for state of sexual maturity, and released. Each salmon examined was assigned to a particular run by estimating when it would spawn.

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 "night factor" consisted of multiplying the day counts by 1.042 (Hallock, IN Taylor, 1973).

The adjusted weekly counts were then separated into numbers of late-fall-, winter-, spring-, and fall-run salmon according to the data gathered from the fish examined at the dam.

The sport catch above Red Bluff was subtracted from the adjusted counts to obtain estimates of spawning populations.

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. More details and special methods are presented under individual stream headings.

SACRAMENTO RIVER SYSTEM FROM KESWICK DAM TO WOODSON BRIDGE (FIGURE 1)

by

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SUMMARY

An estimated 162,453 king salmon spawned in the Sacramento River system between Keswick Dam and Woodson Bridge during 1975. This total includes 19,261 late-fall-, 22,579 winter-, 22,234 spring- and 98,379 fall-run fish (Table 1). The fall-run included 91,296 that spawned in the main stem of the Sacramento and 7,083 that spawned in tributaries. The spring run included 10,234 that spawned in the Sacramento River between Keswick Dam and Red Bluff Diversion Dam and 12,000 that spawned in tributaries downstream from Red Bluff Diversion Dam. The late-fall- and winter-run spawning population estimates are primarily for salmon that spawned in the main stem of the Sacramento River between Keswick Dam and Red Bluff Diversion Dam.

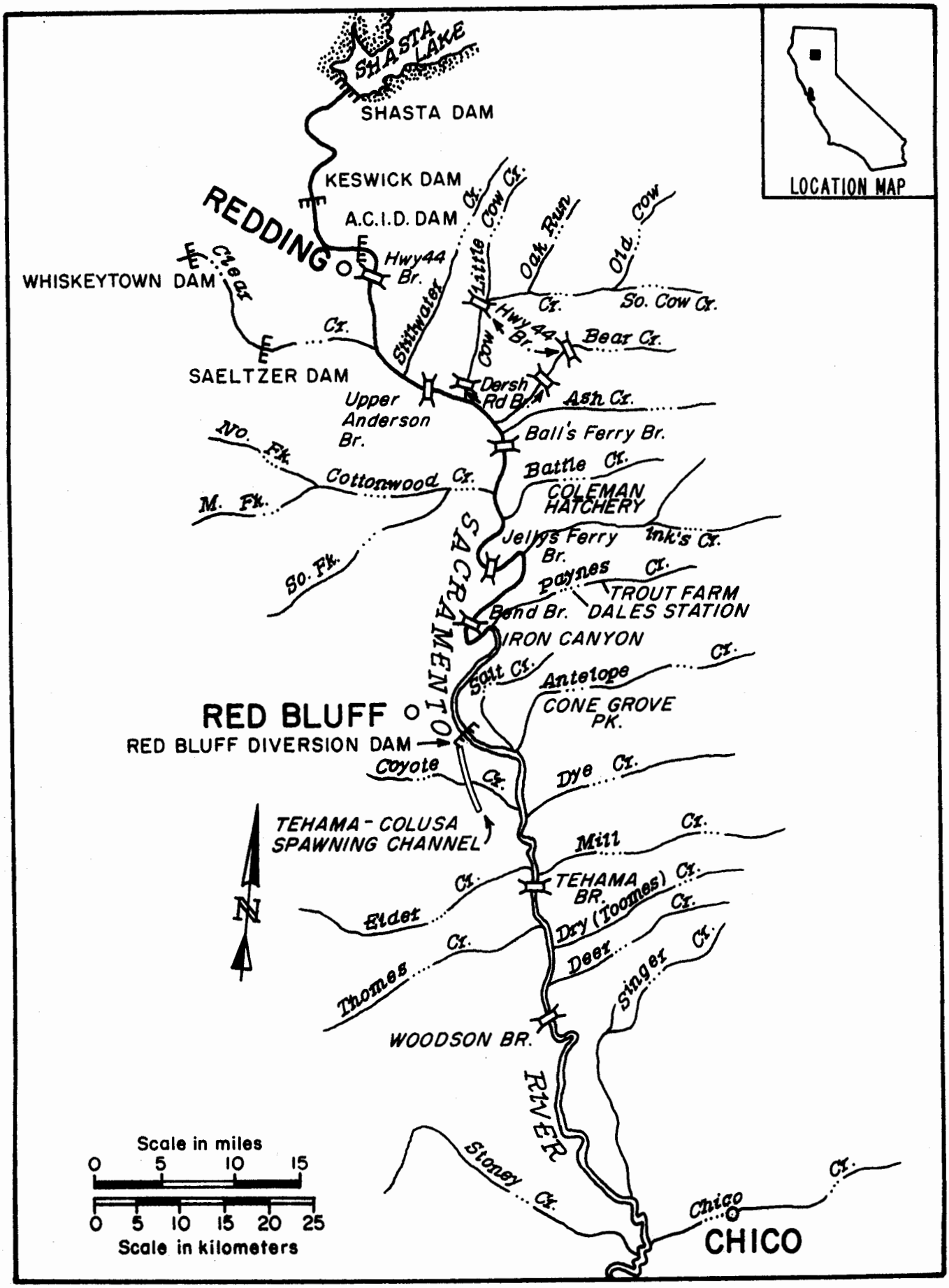

Figure 1. Upper Sacramento River and tributaries above Chico Creek.

Table 1. Summary of King Salmon Spawning Population Estimates, Sacramento River System, Keswick Dam to Woodson Bridge, 1975*

	Late-fall run	Winter run	Spring run	Fall run	Area total
Sacramento River, Main Stem					
Keswick Dam; salmon hauled to Coleman Hatchery.	937			881	
Tehama-Colusa Spawning Channel; salmon hauled from Red Bluff Diversion Dam fish trap.				1,973	
Keswick Dam to Red Bluff Diversion Dam, including all tributaries except Battle Creek.	18,324	22,579	10,234	52,248	
Tehama-Colusa Spawning Channel; salmon that entered via Coyote Creek.				1,994	
Red Bluff Diversion Dam to Tehama				29,467	
Tehama to Woodson Bridge				4,733	
Total, Main Stem	19,261	22,579	10,234	91,296	143,370
Sacramento River Tributaries					
Battle Creek				4,857	
Tributaries; Keswick Dam to Red Bluff Diversion Dam (except Battle Creek).	No estimate--included with main stem salmon above Red Bluff.				
Tributaries; Red Bluff Diversion Dam to Chico Creek.			12,000	2,226	
Total Tributaries			12,000	7,083	19,083
TOTAL, SPAWNING POPULATIONS	19,261	22,579	22,234	98,379	162,453

* Spawning population equals total run minus sport catch.

The Distribution of Salmon in the Upper Sacramento River

Although some late-fall-, winter- and spring-run salmon spawn in upper Sacramento River tributaries, no surveys were conducted in tributaries above Red Bluff during the period they may have been spawning there. Therefore, they are included in the main-stem estimates above Red Bluff.

All fall-run salmon spawning above the dam in tributaries other than Battle Creek, are also combined in this report with those spawning in the main stem of the Sacramento River. Battle Creek (in the area utilized by fall-run salmon) was the only tributary surveyed above the dam in 1975.

Data collected during four airplane flights (October 14 & 23, November 6 and December 18) 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 in different river sections above Woodson Bridge (Table 2).

Table 2. Redd Distribution of Fall Spawning King Salmon, Sacramento River, Keswick Dam to Woodson Bridge, 1975

Area	Percent of redds in each area*
Keswick Dam to A.C.I.D. Dam	2.2
A.C.I.D. Dam to Highway 44	9.6
Highway 44 to Upper Anderson Bridge	10.9
Upper Anderson Bridge to Balls Ferry	12.5
Balls Ferry to Jellys Ferry	16.8
Jellys Ferry to Bend Bridge	10.0
Bend Bridge to Red Bluff Diversion Dam	.6
Red Bluff Diversion Dam to Tehama	32.8
Tehama to Woodson Bridge	4.6
Total	100.0

* Percent of 1,603 redds observed on four flights October 14, October 23, November 6, and December 18, 1975.

Sacramento River King Salmon Counts And Runs at Red Bluff Diversion Dam

From December 29, 1974 through January 3, 1976 100,667 king salmon were counted as they passed Red Bluff Diversion Dam. Adjusting for periods of no counting and for numbers of salmon trapped and hauled by the U. S. Fish and Wildlife Service to the Tehama-Colusa Spawning Channel increased this total to 116,965 (Table 3). During this same period 17,256 salmon were examined and released at the trapping facility located at the east bank fishway of the Diversion Dam. The sampling results indicated that the adjusted total calendar year count consisted of 18,552 late-fall-, 24,619 winter-, 10,703 spring-, and 63,091 fall-run salmon.

While the calendar year count represents total annual runs passing the dam for spring- and fall-run salmon, it includes only a part of the total annual runs of late-fall- and winter-run salmon, since some fish of these two races start

Table 3. Red Bluff Diversion Dam Weekly Adjusted Salmon Counts, December 29, 1974 through January 3, 1976

Week	Adjusted salmon count	Number sampled	Late-fall run %	Late-fall run Number	Winter run %	Winter run Number	Spring run %	Spring run Number	Fall run %	Fall run Number
1974										
10/20-12/28				9,973*		313*				
1975										
12/29- 1/ 4	2,334	214	86.9	2,028	13.1	306				
1/ 5- 1/11	3,523	504	84.7	2,984	15.3	539				
12- 18	1,687	327	41.3	697	58.7	990				
19- 25	827	70	41.4	342	58.6	485				
26- 2/ 1	339	8	62.5	212	37.5	127				
2/ 2- 2/ 8	1,775	542	66.1	1,173	33.9	602				
9- 15	1,047**	24	54.2	567	45.8	480				
16- 22	318	0	26.7**	85	73.3**	233				
23- 3/ 1	1,514	126	21.4	324	78.6	1,190				
3/ 2- 3/ 8	1,808	169	5.3	96	94.7	1,712				
9- 15	445	24	45.8	204	54.2	241				
16- 22	952**	0	14.4**	137	85.6**	815				
23- 29	1,292	0	16.8**	217	83.2**	1,075				
30- 4/ 5	1,459	167	19.2	280	80.8	1,179				
4/ 6- 12	2,151	179	7.3	157	72.6	1,562	20.1	432		
13- 19	2,072	228	1.8	37	61.8	1,281	36.4	754		
20- 26	2,038	72	4.2	85	62.5	1,274	33.3	679		
27- 5/ 3	2,347	351	2.6	61	80.0	1,878	17.4	408		
5/ 4- 5/10	1,100	186			78.5	864	21.5	236		
11- 17	1,626	357		19,659	81.0	1,317	19.0	309		
18- 24	1,012	107			74.8	757	25.2	255		
25- 31	2,087	269			91.1	1,901	8.9	186		
6/ 1- 6/ 7	1,112	55			61.8	687	38.2	425		
8- 14	1,222	215			69.3	847	30.7	375		
15- 21	716	141			52.5	376	47.5	340		
22- 28	602	155			36.1	217	63.9	385		
29- 7/ 5	325	60			18.3	59	81.7	266		
7/ 6- 7/12	570	92			13.0	74	87.0	496		
13- 19	406	78			9.0	37	76.9	312	14.1	57
20- 26	443	76			2.6	12	54.0	239	43.4	192
27- 8/ 2	541	43					41.9	227	58.1	314
						23,430				

Table 3. (continued)

Week	Adjusted salmon count	Number sampled	Late-fall run %	Late-fall run Number	Winter run %	Winter run Number	Spring run %	Spring run Number	Fall run %	Fall run Number
1975										
8/ 3- 8/ 9	396	160					42.5	168	57.5	228
10- 16	1,041	313					39.6	412	60.4	629
17- 23	2,581	380					31.8	821	68.2	1,760
24- 30	2,411	273					30.4	733	69.6	1,678
31- 9/ 6	4,658	935					18.0	838	82.0	3,820
9/ 7- 9/13	4,816	952					18.8	905	81.2	3,911
14- 20	4,451	794					8.2	365	91.8	4,086
21- 27	5,491	1,027					2.5	137	97.5	5,354
28-10/ 4	7,177	1,164							100.0	7,177
10/ 5-10/11	8,245	1,630						10,703	100.0	8,245
12- 18	4,416	790							100.0	4,416
19- 25	4,079	818							100.0	4,079
26-11/ 1	4,758	904	2.5	119					97.5	4,639
11/ 2-11/ 8	3,176	711	12.7	403					87.3	2,773
9- 15	2,638	557	12.4	327					87.6	2,311
16- 22	1,782	211	6.6	118					93.4	1,664
23- 29	2,159	202	8.4	181					91.6	1,978
30-12/ 6	3,082	323	28.8	888					71.2	2,194
12/ 7-12/13	1,596	0	38.6**	616	0.7**	11			60.7	969
14- 20	1,389	84	76.2	1,058	3.6	50			20.2	281
21- 27	5,375	94	81.9	4,402	14.9	801			3.2	172
28- 1/ 3	1,558	95	48.4	754	41.1	640			10.5	164
TOTALS 1975	116,965	17,256		18,552		24,619		10,703		63,091

* Portion of run passing dam during previous calendar year. For weekly breakdown of numbers see 1974 Central Valley Spawning Stock Estimates (Taylor 1976).

** Determined by interpolation.

Prospective 1975 spawners passing Red Bluff Diversion Dam.

passing the dam in one calendar year and complete their run during the following calendar year. In effect, a calendar year count of either late-fall- or winter-run salmon usually gives only the latter part of one annual run and the early part of next year's run. The 1974-75 run of late-fall-run salmon (all destined to spawn in 1975) was almost equally divided between 1974 and 1975. However, only a small portion of the 1974-75 winter-run occurred during 1974.

To arrive at the total numbers of salmon that passed the dam in each of the four runs which were destined to spawn during 1975, it was necessary with two runs to include the appropriate portion of the 1974 calendar year counts. For both the late-fall run (since October 20, 1974) and winter run (since December 15, 1974) a portion of the 1974 calendar year counts was brought forward. Similarly, the portion of the 1975-76 late-fall and winter runs which occurred in 1975 are included in the calendar year count, but not in the 1975 spawning estimate. When this was done, the numbers of salmon in each of the four runs that passed the dam (and which were destined to spawn during 1975) became 19,659 late-fall-, 23,430 winter-, 10,703 spring-, and 63,091 fall-run salmon (Table 3). These numbers represent the sizes of the four 1975 salmon runs that passed Red Bluff Diversion Dam, but not their spawning populations.

To convert the adjusted counts at Red Bluff Diversion Dam into actual numbers of king salmon that spawned above the dam during any calendar year (spawning populations), it is necessary to use the annual run count rather than the calendar year count, and then to subtract the mortality that occurred between the time salmon passed the dam and the time they spawned. The only mortality measured in 1975 was the sport catch. Other mortality factors were considered insignificant.

KING SALMON SPAWNING POPULATIONS
KESWICK DAM TO RED BLUFF DIVERSION DAM, 1975

Main Stem Sacramento River, and Tributaries Except Battle Creek

Late-fall Run

An estimated 19,261 late-fall-run salmon spawned in the Sacramento River upstream from Red Bluff during 1975 (Table 4). This total was arrived at by subtracting the estimated sport catch of late-fall-run salmon (398) landed by sportsmen above Red Bluff from the 19,659 late-fall-run salmon counted as they passed Red Bluff Diversion Dam between October 20, 1974 and May 3, 1975. Included in this total are 937 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 the tributaries upstream from Red Bluff during the time they were spawning. All late-fall-run salmon are included in the main stem of the Sacramento River estimate.

Winter Run

An estimated 22,579 winter-run salmon spawned in the Sacramento River above Red Bluff in 1975. This total was arrived at by subtracting an estimated 851 winter-run salmon caught by sportsmen above Red Bluff from the 23,430 winter-run salmon

Table 4. Calculation of King Salmon Runs and Spawning Populations, Sacramento River System above Red Bluff Diversion Dam, 1975

Run	Fish passing dam in calendar year 1974	1975		Potential 1975 spawners		Estimated 1974-75 sport catch above dam		Estimated 1975 spawning populations
Late-fall run 1974-75	9,973	+ 9,686	+	19,659	-	398	=	19,261
Winter run 1974-75	313	+ 23,117	+	23,430	-	851	=	22,579
Spring run 1975		10,703		10,703	-	469	=	10,234
Fall run 1975		63,091		63,091	-	3,132	=	59,959
Late-fall run 1975-76		8,866*		0**		76*		
Winter run 1975-76		1,502*		0**		9*		
TOTALS	10,286	116,965		116,883		4,935		112,033

* This run started passing the dam late in 1975, but was not completed in 1975.
** Fish in this run spawn in 1976, not 1975.

counted as they passed Red Bluff Diversion Dam between December 15, 1974 and July 26, 1975. 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 10,234 spring-run salmon spawned in the Sacramento River system above Red Bluff during 1975. This figure was arrived at by subtracting an estimated 469 salmon caught by sportsmen above Red Bluff during 1975 from the 10,703 spring-run salmon counted past Red Bluff Diversion Dam between April 6 and September 27, 1975. No spring-run salmon spawning stock surveys were made in tributaries above Red Bluff during 1975 and spring-run salmon that spawned in these tributaries are included in the main stem Sacramento River estimate.

Fall Run

An estimated 55,102 fall-run salmon spawned in the main stem of the Sacramento River and in tributaries other than Battle Creek, during 1975. This total was arrived at by subtracting an estimated 3,132 salmon caught by sportsmen above Red Bluff, and 4,857 salmon that entered Battle Creek, including 2,431 spawned artificially at Coleman Hatchery, from the 63,091 fall-run salmon that migrated past Red Bluff Diversion Dam in 1975. The 881 fall-run salmon trapped at Keswick Dam and hauled to Coleman Hatchery, and the 1,973 salmon trapped at Red Bluff Diversion Dam and hauled to the Tehama-Colusa Spawning Channel by the U. S. Fish and Wildlife Service, are also included with those salmon that spawned above Red Bluff Diversion Dam.

During 1975 Battle Creek was the only tributary surveyed above Red Bluff Diversion Dam and all fall-run salmon that spawned in tributaries other than Battle Creek are combined with those that spawned in the main stem Sacramento River. Some spawning was noted during a few spot checks of Paynes and Cow Creeks.

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 1975, 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. Few, if any, utilized Battle Creek in 1975.

Spring Run

A very few (less than 10) spring-run salmon were observed on upper Battle Creek near Darrah Springs Fish Hatchery after high run-off periods during June, 1975. No estimate of spawning populations was made.

Fall Run

An estimated 4,857 fall-run salmon spawned in Battle Creek during 1975. This total includes 2,431 salmon that entered Coleman Hatchery and were spawned artificially, and 2,426 that spawned in Battle Creek between Coleman Hatchery and the Sacramento River.

Battle Creek, below Coleman Hatchery, was the only tributary upstream from Red Bluff Diversion Dam which was surveyed in 1975. Carcass recovery data was used to estimate the numbers of salmon that spawned in this area. Sixteen trips were made on lower Battle Creek, from October 3, 1975 through January 17, 1976, and on Gover's irrigation ditch from October 4, 1975 through January 18, 1976. Carcass recovery conditions were generally very good throughout the recovery period. There were 1,388 carcasses recovered (1,301 in Battle Creek and 87 in Gover's ditch), at an estimated overall efficiency rate of 56% in Battle Creek and 85% in Gover's ditch. Efficiency rates were estimated by tagging and recovering tagged carcasses throughout the season. We tagged 1,378 carcasses (hog rings attached to lower jaw): 1,294 in Battle Creek and 84 in Gover's ditch.

SACRAMENTO RIVER KING SALMON SPAWNING POPULATIONS RED BLUFF DIVERSION DAM TO WOODSON BRIDGE[3/]

River Conditions

River flows in the upper Sacramento River during the fall of 1975 were generally good for salmon carcass recovery, and slightly better than in 1974. Maximum flow for the carcass recovery period (between early October, 1975 and mid-January, 1976) was reached on December 6, 1976 with 510 m^3/s (18,000 cfs) at Red Bluff Diversion Dam. Except for this one date, river flows remained between 156 m^3/s (5,500 cfs) and 368 m^3/s (13,000 cfs). There were, however, minor fluctuations in river flows (about 85 m^3/s or 3,000 cfs) which helped to beach or lodge more carcasses than in 1974.

Red Bluff Diversion Dam to Tehama

Late-fall Run

Some late-fall-run salmon usually spawn in this section of the river. However, no estimate of their numbers, or of the extent of their spawning area was made.

Winter Run

In May and June, during past years, winter-run salmon have been observed spawning in this section of the Sacramento River. In June, 1975, 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.

3/ Although some salmon normally spawn each fall in the Sacramento River as far downstream as the mouth of Chico Creek, no surveys were made below Woodson Bridge during 1975.

Spring Run

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

Fall Run

An estimated 31,461 fall-run salmon spawned in the main stem of the Sacramento River between Red Bluff Diversion Dam and Tehama during 1975. This total includes 1,994 salmon that entered the Tehama-Colusa Spawning Channel via Coyote Creek (Table 1).

Spawning stock surveys in the main stem of the Sacramento River between Red Bluff and Tehama began on October 7, 1975 and ended January 14, 1976. During this period 15 complete trips were made and 442 salmon carcasses were recovered. Based on river conditions, carcass counts, and total survey effort (including four airplane flights), we estimated that the carcass recovery rate was 1.5%.

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 4,733 fall-run salmon spawned in the main stem of the Sacramento River between Tehama and Woodson Bridge during 1975 (Table 1).

Spawning stock surveys in the main stem of the Sacramento River between Tehama and Woodson Bridge began on October 8, 1975 and ended January 15, 1976. During this period 15 complete recovery trips were made and 71 salmon carcasses were recovered. Based on survey effort (including three airplane flights), river conditions and carcass counts, we estimated that the carcass recovery rate was 1.5%.

KING SALMON SPAWNING POPULATIONS, SACRAMENTO RIVER TRIBUTARIES BELOW RED BLUFF DIVERSION DAM

Stream Conditions

Rainfall in the upper Sacramento Valley was far below normal during the fall and winter of 1975, and near-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 October and December, 1975. Others, such as Salt, Dry (Toomes), and Singer Creeks, had an inadequate flow for spawning salmon.

Antelope, Mill and Deer Creeks usually have higher and more consistent flow than the streams mentioned above, and largely "took up the slack" in providing spawning habitat for fall-run salmon. Therefore, the total number of fall-run salmon that spawned in the tributary streams between Red Bluff and Chico Creek was very

nearly equal for both 1974 and 1975 (2,324 and 2,226 respectively), in spite of the extremely dry winter in 1975. Carcass recovery conditions were very good in all tributaries during the fall of 1975.

Salt Creek

Late-fall Run

No estimate was made of any late-fall-run fish which may have spawned in Salt Creek during early 1975.

Fall Run

Two survey trips were made on Salt Creek between November 14 and November 21, 1975. No water was observed in the survey area between the canyon mouth downstream to Highway 99E.

Antelope Creek

Spring Run

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

Fall Run

Between October 9, 1975 and January 16, 1976, 10 survey trips were made on the main fork of Antelope Creek from the canyon mouth (USGS Gaging Station) to Highway 99E. Fourteen survey trips were also made on the lower overflow branches of Antelope Creek: 13 on Craig Creek and one on New Creek. There were 36 carcasses recovered, and the fall run was estimated at 360 fish including 90 in Antelope Creek and 270 in Craig Creek. No carcasses or live salmon were observed in New Creek.

Coyote Creek

Late-fall Run

Some late-fall-run salmon were observed spawning in Coyote Creek in March 1975, but no estimate was made of the total. Those observed were immediately downstream from the Tehama-Colusa Fish Facility terminal selection station.

Winter Run

Some winter-run salmon ascended Coyote Creek in May, 1975 and were observed attempting to enter the Tehama-Colusa Spawning Channel. No estimate was made.

Fall Run

Eleven survey trips were made between October 9, 1975 and January 15, 1976. Forty carcasses were recovered and 11 live salmon were observed. An estimated 160 fall-run salmon spawned in Coyote Creek in 1975.

Coyote Creek probably had the greatest flow at its mouth of any tributary to the Sacramento River between Red Bluff and Chico Creek during the fall of 1975. An average flow of 19.8 m^3/s (700 cfs) was released into Coyote Creek from the Tehama-Colusa Fish Facility between September and December, 1975. There were 2,252 salmon handled at the terminal selection station including 1,994 that were admitted into the spawning channel. Those fish accepted into the spawning channel are included in the population estimates for the main stem of the Sacramento River between Red Bluff Diversion and Tehama.

Dye Creek

Fall Run

Eight survey trips were made on Dye Creek between October 9, 1975 and January 15, 1976. The area covered was from Highway 99E downstream to the Sacramento River. No salmon carcasses were recovered, no live fish were seen, and no fall-run estimate was made.

Mill Creek

Late-fall Run

A few late-fall-run salmon were observed in Mill Creek during March 1975, but no estimate was made.

Winter Run

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

Spring Run

Between September 4 and October 21, 1975, nine pack survey trips were made through upper Mill Creek between the upper end of Childs Meadows and the mouth of Little Mill Creek. A total of 13 days was spent surveying upper Mill Creek Canyon. Recovery and observation conditions were excellent with 12 carcasses recovered, and 330 live salmon observed.

The upper limit of the spring-run spawning activity was observed to be about 3.2 km (2 miles) upstream from the Hanna Ranch in Childs Meadow. The elevation in this stream section is about 1,371 m (4,500 ft) above sea level which is probably the highest elevation at which salmon (or any anadromous fish) spawn in California. The spring run in Mill Creek was estimated to be 3,500 during 1975.

Fall Run

Seventeen 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 October 9, 1975 and January 29, 1976. There were 302 carcasses recovered. The fall run was estimated to be 1,208 salmon.

Thomes Creek

During the fall of 1975, 8.5 m^3/s (300 cfs) of water was released from the Tehama-Colusa Canal into normally dry Thomes Creek. This is "excess" water beyond the 19.8 m^3/s (700 cfs) released down Coyote Creek which is needed to achieve spawning velocities in the upper portion of the Tehama-Colusa Fish Facility's dual purpose canal.

Four survey trips were made between November 25 and December 15, 1977, from the Tehama-Colusa Canal to the mouth of Thomes Creek. Seventeen carcasses were recovered and three live fish observed. The total spawning population was estimated to be 170 salmon.

It is anticipated that the upstream portion of the dual purpose canal will again be used as an artificial spawning channel during the fall of 1976 and that the resultant increased flow into Thomes Creek will attract a number of spawning fall-run salmon in subsequent years. This may result in a naturalized fall-run king salmon population in Thomes Creek, which has been historically dry in the early fall.

Dry (Toomes) Creek

Late-fall Run

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

Fall Run

Nine survey trips were made on Dry Creek between November and December 29, 1975. The area covered was from the canyon mouth (Favinger Place) to the Tehama-Vina Road. No live salmon or carcasses were observed. No estimate of the fall run was made.

Deer Creek

Spring Run

Spring-run salmon were observed in Deer Creek Canyon, from one mile below the Pacific Gas and Electric Company power line crossing (about 16.1 km (10 miles) upstream from Highway 99E) to upper Deer Creek Falls. Recovery conditions were excellent during the survey and the creek was usually clear. There were 936 live salmon observed and 268 carcasses recovered. The spring run was estimated to be 8,500 fish, the largest spring run in Deer Creek in recent years.

Fall Run

Seventeen survey trips were made on Lower Deer Creek, between October 9, 1975 and January 15, 1976. The primary recovery area was between the mouth of Deer Creek and the County Road Bridge, located about 3.2 km (2 miles) upstream from the Stanford-Vina Dam. There were 82 carcasses recovered and 14 live salmon observed. The estimated fall run totaled 328 spawners.

Singer Creek

Fall Run

Six survey trips were made on Singer Creek between October 23 and November 24, 1975. The area covered was from 3.2 km (2 miles) above the Lassen Road crossing downstream to the confluence of Singer and Pine Creeks. No carcasses were recovered and no live fish were seen. No fall-run salmon were known to have spawned in Singer Creek in 1975.

Elder and Stony Creeks

Fall Run

Fall-run salmon are known to spawn in both of these creeks, and both were surveyed on December 12, 1975, from Interstate Highway 5 to their mouths. No carcasses and no live salmon were observed, however salmon could have spawned upstream from Interstate Highway 5.

SACRAMENTO RIVER AND TRIBUTARIES, CHICO CREEK AND SOUTHWARD (Figure 2)

Summary

An estimated 90,525 king salmon spawned in four major lower Sacramento River tributaries in 1975 (Table 5). These included 1,341 spring-run and 89,184 fall-run fish.

Chico Creek

Spring Run

No survey.

Butte Creek

by

Richard Flint
Region 2

General

The ladder on the Sutter National Wildlife Refuge Weir in the west channel of the Sutter Bypass was completed and put into operation in late November 1974. This ladder apparently greatly enhanced the up-migration conditions in Butte Creek, for despite very low water all winter, all runs of salmon increased in number from past years. The Parrott-Phelan Ladder was opened in March and kept

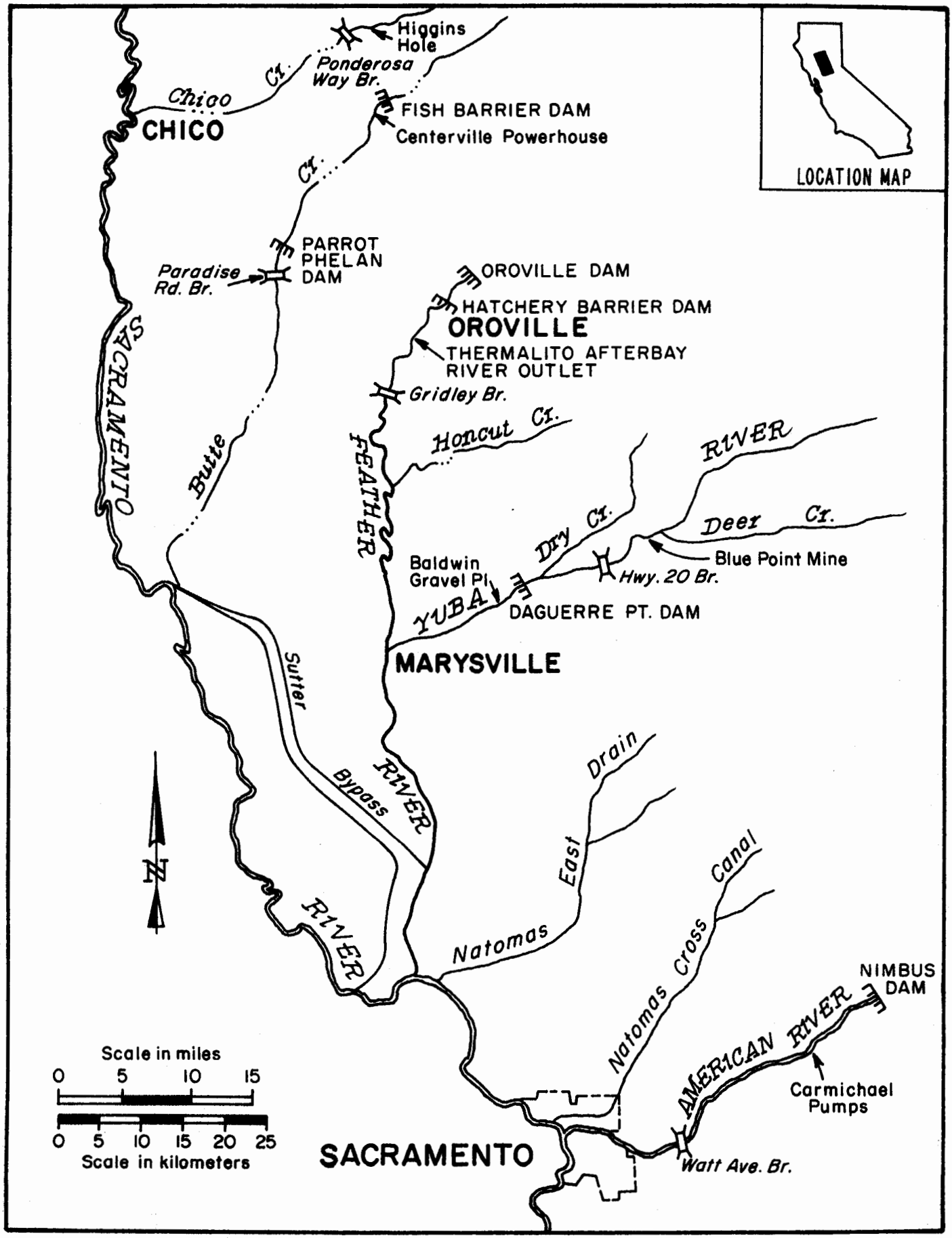

Figure 2. Sacramento River tributaries from Chico Creek south.

Table 5. Summary of Fall- and Spring-run King Salmon Counts and Population Estimates, Lower Sacramento Tributaries (Chico Creek and South) 1975

	Number of counting trips	Carcasses counted	Spring run	Fall run	Total
Butte Creek (Total)	3	(251)	(650)	(1,000)	1,650
Centerville Powerhouse to Skyway Bridge	1	73	650		
Highway 99 to Gorrill Dam	2	178		1,000	
Feather River (Total)	11	(7,884)	(691)	(43,000)	43,691
Oroville Barrier to Thermalito Outlet	11	7,884		37,735*	
Feather River Hatchery			691	5,265	
Yuba River (Total)	10	(2,106)		(5,641)	5,641
Blue Point Mine to Highway 20 Bridge	10	62			
Highway 20 Bridge to Daguerre Point Dam	10	355			
Daguerre Point Dam to Hallwood Avenue	10	946			
Hallwood Avenue to Plantz Road	10	359			
Plantz Road to Marysville Dump	10	384			
American River (Total)	8	(7,147)		(39,543)	39,543
Nimbus Racks to Watt Avenue Bridge	8	6,186		30,930	
Above Nimbus Racks		961		1,201	
Nimbus Hatchery				7,412	
TOTAL, Lower Sacramento River Tributaries			1,341	89,184	90,525

* Barrier Dam to Honcut Creek

passable the remainder of the year. A center chute and water collector was added to the Gorrill (Newhall Land Co.) Dam that apparently ended the passage problem there for fall-run salmon.

Spring Run

Butte Creek was surveyed September 29 and 30 from Centerville Powerhouse to the Skyway Bridge. Weather and recovery conditions were good. We saw 216 live and 73 dead salmon, and 99 multiple and 31 single redds. Estimated total escapement was 650 fish (Table 5).

Fall Run

I observed spawning fish on October 15, about 20 days earlier than recorded in the past. Counts were made on November 21 and December 12 from Highway 99 to Gorrill Dam. A total of 178 dead and 20 live salmon was recorded. Fall-run spawning escapement was estimated at 1,000 fish.

Late-fall Run

Salmon were reported trapped below Parrott-Phelan ladder in late January, but rising water enabled them to swim up over the dam before a count could be made. No attempt was made to estimate the run size.

Feather River

by

Richard Flint
Region 2

Spring Run

No attempt was made to count spring-run salmon in the river. The number counted into the hatchery was 691.

Fall Run

The Feather River was surveyed from the upper Thermalito Bridge to the Afterbay outlet for 11 weeks, from October 14 through December 23, 1975. There were 7,884 carcasses recovered. Based on the past relationships of the number of fish spawning in the surveyed area with the numbers spawning in the unsurveyed spawning areas, it is estimated that 37,735 salmon spawned in the Feather River. An additional 5,265 fall-run salmon were counted into the Feather River Hatchery. The total estimated run was 43,000 fish (Table 5).

Yuba River

by

Ronald Rogers
Region 2

Fall Run

The Yuba River survey was conducted from October 22 through December 31, 1975. The survey area included five sections as follows:

Section Number	Description
1	Rose Bar (Blue Point Mine) to Highway 20 Bridge.
2	Highway 20 Bridge to Daguerre Point Dam.
3	Daguerre Point Dam to Hallwood Avenue.
4	Hallwood Avenue to Plantz Road.
5	Plantz Road to Marysville Dump.

Salmon can no longer enter the Yuba Goldfields.

Ten survey trips were made during which we marked fresh carcasses and returned them to running water for future recovery. A modified Schaefer (1951) method for estimating a changing population (Taylor, 1974) was used to develop the population estimate of 5,641 (Table 5).

The water flow remained at 85 m^3/s (3,000 cfs) through the first eight recovery periods. On December 15 it was reduced to 70.8 m^3/s (2,500 cfs). Three more reductions of 7.1 m^3/s (250 cfs) each brought the flow to 49.6 m^3/s (1,750 cfs) by December 29. These reductions lowered the water level about 20 cm (8 inches), hampering late salmon spawning.

Despite high and sometimes cloudy water, recovery was improved this year by using a boat below Highway 20 Bridge. Carcass recovery was less efficient above the bridge. Because the estimated number spawning in each section is based on percentages of observed carcasses, the relative number of spawners going above the bridge is underestimated.

American River

by

Robert Reavis
Region 2

Fall Run

The 1975 survey was started on October 29 and completed on December 30. During this period eight complete survey trips were made. Throughout the survey clear weather and water conditions permitted a high recovery rate for carcasses. Flows varied from 68 m^3/s (2,400 cfs) to 70.8 m^3/s (3,000 cfs). A seasonal total of 6,186 carcasses was counted between the Nimbus Racks and Watt Avenue Bridge. Assuming a 20% recovery rate, there was an estimated run of 30,930 king salmon spawning below the Nimbus Racks. A total of 7,412 king salmon entered Nimbus

Hatchery. There were 961 fish counted on the Nimbus Racks. Assuming an 85% recovery rate, an estimated 1,201 salmon escaped above the Nimbus Racks. The estimated total for all king salmon migrating into the American River was 39,543 (Table 5).

Immediately after the spawning season, unusually dry weather conditions resulted in a reduction of flow from 85.0 m^3/s (3,000 cfs) down to 42.5 m^3/s (1,500 cfs). This reduction occurred within a 30-day period after spawning had stopped. During this critical period, these reduced flows will result in an increased mortality of eggs and larvae.

SAN JOAQUIN RIVER TRIBUTARIES
(Figure 3)

Summary

An estimated 8,325 king salmon spawned in six major San Joaquin River tributaries in 1975 (Table 6). These included 500 winter-run and 7,825 fall-run fish.

Cosumnes River

by

Robert Reavis
Region 2

Fall Run

Except for brief periods of rain, flows in the Cosumnes River were only 1.4 m^3/s (50 cfs) during the king salmon run. These low flows probably reduced the number of adult salmon able to migrate upstream and spawn.

There were 145 carcasses counted during the three survey trips. Recovery conditions were ideal with low and clear water. A 20% recovery rate was assumed, making an estimated total run of 725 king salmon.

Mokelumne River

by

Marcus Sazaki
Region 2

Fall Run

Ten weekly trips were made on the Mokelumne River salmon survey this year beginning on October 30. Initial river flows were 51 m^3/s (1,800 cfs) and decreased steadily to 9.9 m^3/s (350 cfs) by the middle of the survey period. The last day the flow was 5 m^3/s (175 cfs). Water clarity was good, ranging from 4-12 ft.

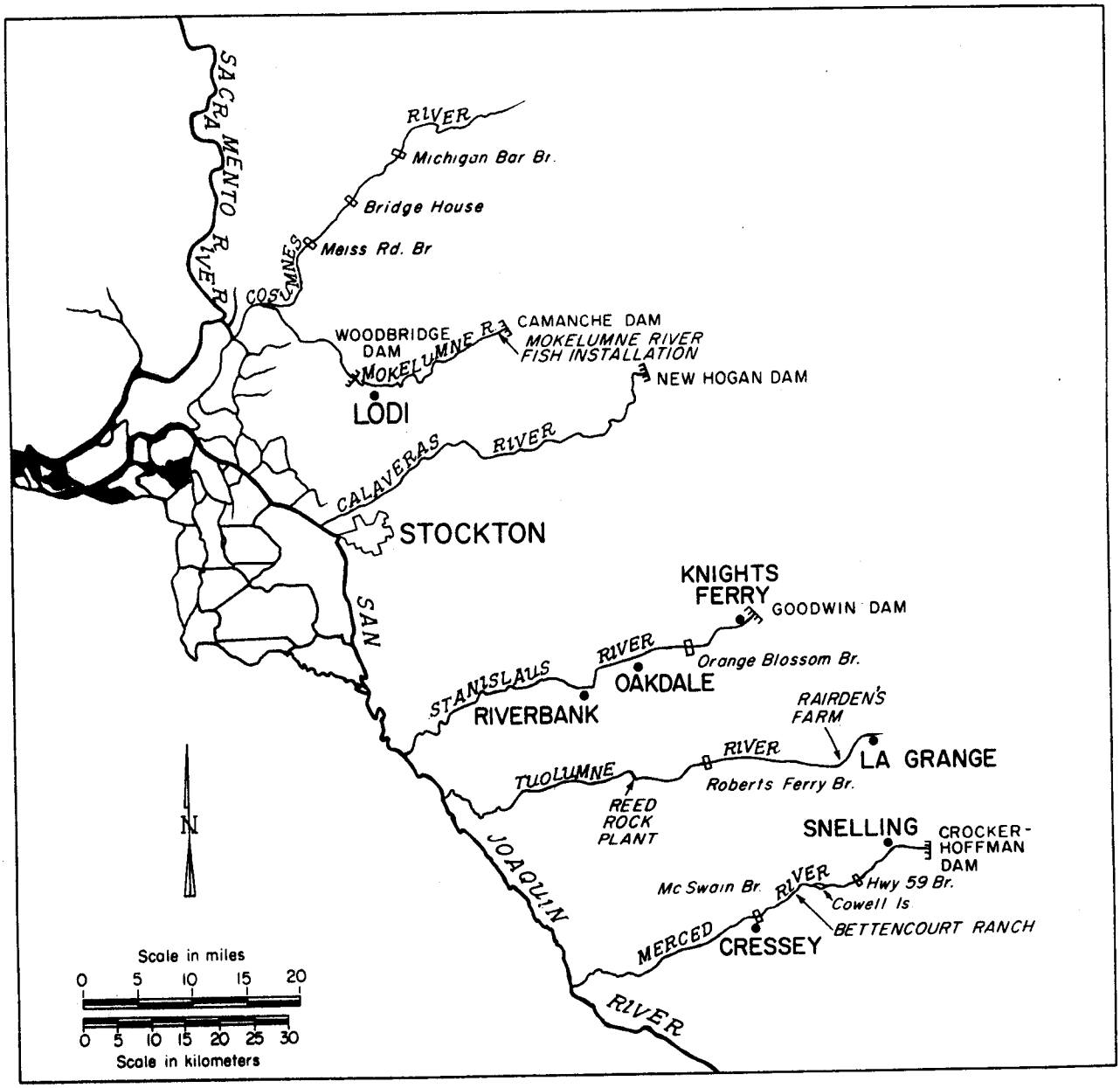
SACRAMENTO RIVER
COSUMNES
RIVER
Michigan Bar Br.
Bridge House
Meiss Rd. Br
WOODBRIDGE DAM
MOKELUMNE R.
CAMANCHE DAM
MOKELUMNE RIVER FISH INSTALLATION
NEW HOGAN DAM
LODI
CALAVERAS RIVER
STOCKTON
SAN
KNIGHTS FERRY
GOODWIN DAM
STANISLAUS RIVER
Orange Blossom Br.
OAKDALE
RIVERBANK
RAIRDEN'S FARM
LA GRANGE
TUOLUMNE RIVER
Roberts Ferry Br.
REED ROCK PLANT
SNELLING
CROCKER-HOFFMAN DAM
Mc Swain Br.
Hwy 59 Br.
Cowell Is.
BETTENCOURT RANCH
MERCED RIVER
CRESSEY
JOAQUIN RIVER
N
Scale in miles
0 5 10 15 20
0 5 10 15 20 25 30
Scale in kilometers

Table 6. Summary of 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 (Total)		(145)	(725)	
Michigan Bar to Bridgehouse	3	57		
Bridgehouse to Meiss Road	3	88		
Mokelumne River (Total)		(748)	(1,900)	
Camanche Dam to Elliot Road	10	349	1,501	
Mokelumne River Fish Installation		399	399	
Calaveras River (Total)				(500)
Stanislaus River (Total)		(181)	(1,200)	
Goodwin Dam to Knight's Ferry	2	8		
Knight's Ferry to Orange Blossom Bridge	4	108		
Orange Blossom Bridge to Oakdale	4	65		
Oakdale to Riverbank	1	0		
Tuolumne River (Total)		(130)	(1,600)	
LaGrange to Rairden's Ranch	5	75		
Rairden's Ranch to Robert's Ferry Bridge	5	31		
Robert's Ferry Bridge to Reed's Rock Plant	5	24		
Merced River (Total)		(585)	(2,400)	
Crocker-Huffman Dam to Highway 59 Bridge	6	198		
Highway 59 Bridge to Bettencourt's Ranch	6	71		
Bettencourt's Ranch to Cressy	1	1		
Merced River Spawning Channel		315	700	
TOTAL, San Joaquin Tributaries			7,825	500

The survey area was the same as last year, extending from the Mokelumne River Fish Installation to Elliot Road bridge.

Of the 349 carcasses observed, 85 were tagged and released, with 21 tags eventually recovered. Seven tags were recovered two weeks after release, one tag three weeks after, and one tag four weeks after.

Based upon a 24.7% recovery rate for tagged carcasses, it is estimated that the number of spawners using the river was 1,501.

Combined with the 399 king salmon that entered the spawning channel, the estimated run is 1,900.

Calaveras River

by

Marcus Sazaki
Region 2

Winter Run

In the end of January king salmon adults were observed stranded in the lower reaches of the river system. Timely and substantial amounts of rain made the river passable to these fish which local wardens estimated numbered about 200.

Streamside surveys were conducted in April and May and salmon were observed spawning in the riffle areas just below New Hogan Dam. At least five adult salmon were reported caught by anglers on opening day of trout season. In early June SCUBA divers observed at least 150 salmon in the pool below the dam outlet and 16 carcasses further downstream.

Based on these observations, it is estimated that the winter run of salmon in the Calaveras River in 1975 was about 500.

Stanislaus River

by

James Horton
Region 4

The estimated 1975 salmon run on the Stanislaus River was 1,200 fish, quite low compared to the most recent 10-year average of 6,475, but up slightly from last year's low of 750 fish.

Four carcass recovery surveys were conducted between November 10, 1975 and December 19, 1975. The survey area was divided into four sections as follows:

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

Streamflows ranged from 3.1 m^3/s (110 cfs) at the start of the survey to 8.8 m^3/s (310 cfs) at the end.

We examined 181 carcasses of which we tagged 163. Twenty-six tagged carcasses were recovered on later surveys.

Tuolumne River

by

James Horton
Region 4

An estimated 1,600 king salmon spawned in the Tuolumne River this season. This is up slightly from last year's escapement of 1,150 fish.

On five survey trips between November 6, 1975, and December 31, 1975, we examined 130 carcasses. We tagged 125 carcasses and recovered 8 on subsequent trips.

Our survey was partitioned into three sections as follows:

Section 1 - LaGrange to Rairden's Ranch.
Section 2 - Rairden's Ranch to Robert's Ferry Bridge.
Section 3 - Robert's Ferry Bridge to Reed Rock Plant.

Streamflows during the 45-day period November 5 through December 19 ranged from about 14.2 m^3/s (500 cfs) early in the period to about 25.5 m^3/s (900 cfs) later. The river fluctuated greatly before and after the 45-day period.

Merced River

by

James Horton
Region 4

The Merced River salmon run was estimated at 2,400 fish, including an estimated 700 fish that used the spawning channel at the Merced River Fish Facilities.

The survey was conducted between November 4, 1975, and January 6, 1976, and was partitioned as follows:

Section 1 - Crocker-Huffman Dam to Highway 59 Bridge.
Section 2 - Highway 59 Bridge to Bettencourt's Ranch.
Section 3 - Bettencourt's Ranch to Cressey.

Streamflows were 8.5-14.2 m^3/s (300-500 cfs) throughout the survey. We examined 270 carcasses and tagged 231 carcasses of which 31 tags were recovered on later surveys. Approximately 300 redds were counted within the spawning channel. Personnel at the Merced River Fish Facility recovered 315 carcasses.

SUMMARY

During 1975 the California Department of Fish and Game conducted its 23rd 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 and lower Sacramento River systems, spawning stock 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 1975 Central Valley king salmon spawning escapement was 261,303 fish (Table 7).

Table 7. Summary of Sacramento-San Joaquin System King Salmon Spawning Populations, 1975

Spawning area	Late-fall run	Winter-run	Spring run	Fall run	Combined
Sacramento main stem*	19,261	22,579	10,234	91,296	143,370
Sacramento tributaries			13,341	96,267	109,608
San Joaquin tributaries		500		7,825	8,325
TOTALS	19,261	23,079	23,575	195,388	261,303

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

Fall- and spring-run salmon spawning overlaps almost two weeks in early October, 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, 1973). The 1975 fall-spawning (fall- plus spring-run) population in California's Central Valley was 218,963 fish. This figure is 73% of the historic (1953-74) average of 298,000 and is down 10% from last year's estimate of 244,054.

Above Red Bluff Diversion Dam, the fall-spawning escapement of 70,193 was up approximately 13,000 fish from last year. This is still the sixth consecutive year that fall-spawning runs in this area were far below the 1964-69 average of 129,000 (Table 8).

Table 8. Sacramento–San Joaquin Valley King Salmon Spawning Stock Estimates, 1964-1975, in Thousands of Fish

	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]
Year	Fall	Spring	Late fall	Winter	Fall	Fall	Fall	Spring	Fall	Fall	Fall	Fall	Fall	Fall	Fall	All races combined
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

[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.

As in recent years, the lesser escapement above Red Bluff was partially offset by increasing spawning escapements in the lower Sacramento River. The estimated 36,194 king salmon which spawned in the Sacramento River below Red Bluff in 1975 (including 1,994 which entered the Tehama-Colusa Spawning Channel via Coyote Creek) was the highest number ever recorded in this section.

Spawning escapements in the Feather, Yuba and American Rivers in 1975 were down approximately one-third from 1974.

Runs in the San Joaquin system totaled 8,325 fish in 1975, up approximately one-third from 1974, but still considerably below the 21,052 average for the previous 11 years.

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