

State of California
The Resources Agency
Department of Fish and Game
Anadromous Fisheries Branch
and
Regions 2 and 4

KING (CHINOOK) SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1971¹/

Edited by

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With a Summary of Counts at Red Bluff Diversion Dam
November, 1969 to April, 1972,
by Richard J. Hallock, Anadromous Fisheries Branch

SUMMARY

During 1971, the California Department of Fish and Game conducted its 19th king (chinook) salmon spawning stock inventory of the Sacramento-San Joaquin River system.

Four races, or runs, of king salmon are discussed in this report: fall-, late fall-, winter-, and spring-run. Only the fall and spring runs were included in the reports of this series prior to 1970. Caution should therefore be exercised in comparing the total 1971 estimate with those of prior years.

The estimates prior to 1971 involved carcass counts, aerial redd counts, live fish counts, and occasionally a tag and recovery program. Water conditions and manpower limitations usually made it impractical to keep the surveys going after early January and the late-fall and winter runs could not be included. In the Sacramento-San Joaquin system south of Red Bluff the methods and limitations remain unchanged. Fish spawning after the first of the year are still missed in estimates for areas south of Red Bluff but there are not enough of them to make the omission important.

New methods are used for the Sacramento River north of Red Bluff Diversion Dam. Estimates of the total salmon passing the dam are based on counts made by the U. S. Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife. The Department of Fish and Game has been regularly sampling at the dam to determine the proportion of fish in each of the four runs.

¹/ Anadromous Fisheries Branch Administrative Report No. (73-2).
Submitted September, 1972.

An estimated 247,900 spring- and fall-run king salmon spawned in the Sacramento-San Joaquin River system in 1971, compared to 243,165 in 1970, an increase over last year of two percent.

An additional 28,976 late fall-run, and 54,348 winter-run salmon passed Red Bluff Diversion Dam in the calendar year 1971. Thus the total estimated 1971 king salmon spawning population in the Sacramento-San Joaquin River system was 331,224 (Table 1).

The late-fall and winter runs normally include some fish which pass Red Bluff Dam both before and after January 1, so a calendar year includes fish from two runs. The 1970-71 late-fall run was 16,741 fish and the 1970-71 winter run was 53,089.

Any mortality which might have occurred above Red Bluff Diversion Dam (in all runs) between the time salmon pass the dam and the time they spawn has not been subtracted from the spawning populations.

Population estimates for the three major spawning areas in the Central Valley, during the 1971 calendar year, are as follows:

Table 1

Summary, King Salmon Runs of the Sacramento-San Joaquin River System, 1970-71 Runs and 1971 Calendar Year

Spawning area	Spring run	Fall run	Late-fall run	Winter run	Combined
Sacramento Main Stem					
Calendar year 1971	5,830 ^{2/}	81,844 ^{3/}	28,976 ^{4/}	54,348 ^{4/}	170,998
1970-71 run	same ^{5/}	same ^{5/}	16,741	53,089	157,504
Sacramento Tributaries 1971	3,451	111,918	-	-	115,369
San Joaquin Tributaries 1971 including Mokelumne System	-	44,857	-	-	44,857
TOTAL - Calendar year 1971					331,224
TOTAL - 1970-71 run					317,730

^{2/} Includes a small number of salmon which spawned in the tributary streams above Red Bluff Diversion Dam.

^{3/} Includes a small number of salmon which spawned in the main stem below Red Bluff Diversion Dam.

^{4/} Excludes a small number of salmon which spawned in the main stem below Red Bluff Diversion Dam.

^{5/} All fish in this run entered and spawned in 1971.

"A Summary of Counts at Red Bluff Diversion Dam, November, 1969 to April, 1972", by Richard J. Hallock is appended to this report. Hallock compares the numbers of spring-, fall-, late fall-, and winter-run king salmon migrating past the dam over the 2½ year period.

INTRODUCTION

This report covers the 19th Annual Central Valley King (Chinook) Salmon Spawning Stock Inventory. The salmon runs of the Sacramento-San Joaquin River system discussed are:

- 1) The fall run. These are the most numerous and the most ubiquitous salmon in the Valley. All but two streams that have regular salmon runs of any type have an annual fall run. Most of these fish spawn from the middle of October through December.
- 2) The late-fall run. These fish are largely confined to the upper part of the Sacramento's main stem. They are usually larger than fish of either the fall or winter run. Spawning is mostly from January through March.
- 3) The winter run. These fish are almost entirely confined to the main stem of the Sacramento and most of them spawn above Red Bluff Dam. Spawning is from April into July.
- 4) The spring run. Spring-run salmon were once quite 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 FORMER YEARS, THE DEPARTMENT OF FISH AND GAME'S ANNUAL ESTIMATES OF SPAWNING ESCAPEMENT IN THE CENTRAL VALLEY INCLUDED ONLY SPRING- AND FALL-RUN FISH. Late fall- and winter-run fish were not included in estimates prior to 1970 because they spawned in January and later; money and manpower limitations prevented extending the surveys much beyond January 1. Salmon populations in the San Joaquin River system are now almost entirely fall-run. Spring-run salmon were once abundant in the San Joaquin but are now almost extinct there.

The construction of Red Bluff Diversion Dam has made it possible to count the salmon as they migrate upstream past the dam. The U. S. Bureau of Sport Fisheries and Wildlife has been counting these fish whenever water conditions have permitted. During the fall, water flows are usually low and clear enough so that a reliable count can be made. After the first of the year high flows are often so muddy that the counters are unable to see the fish and sometimes flood conditions make it necessary to open the gates of the dam. When the gates are open salmon may be passing through the dam rather than the fishway. Thus there are prolonged periods when no counting can be done. This paper includes the results of efforts by the Department of Fish and Game to estimate the total number passing the dam and to identify them as fall-run, late fall-, winter-, and spring-run fish.

The 1971 counts of late fall- and winter-run fish which appear in this report are in addition to anything that has appeared in reports of this series prior to 1970^{6/}.

The counts of spring- and fall-run fish above Red Bluff Dam roughly correspond to the earlier estimates covering the same area but there is one important difference. The estimates were of the number of fish which had spawned. The counts are of fish which will be subject to fishing and natural mortality before spawning. Such mortality is certainly influenced by the length of time a fish spends in the upper river. Some fall-run fish probably spawn as soon as two weeks after passing the dam; at the other extreme some spring-run individuals may wait almost half a year.

It is anticipated that future Central Valley spawning stock inventories will follow the 1971 format. Except when flood conditions interfere this will assure a continuous record of fall- and spring-run king salmon in the entire Central Valley, plus a record of winter- and late fall-run fish above Red Bluff Diversion Dam.

Comparing 1971 with Earlier Spawning Seasons

For the main stem of the Sacramento River the 1971 fall-run spawning escapement of 81,844 was far below the 1953-71 average of 158,000.

By comparison the major Sacramento tributaries did quite well. The American River had an escapement of 52,000 compared to its 32,000 average for 1953-71. The Feather River had 47,000 as compared with a 41,000 average. The Mokelumne River and all San Joaquin tributary runs were above average.

The Central Valley as a whole had a fall- plus spring-run escapement of 248,000 as compared with a 1953-71 yearly average of 308,000 and a 1962-71 yearly average of 250,000. (Annual totals by streams are in Appendix Table 1.)

METHODS

The estimated numbers of fall- and spring-run salmon that spawned in the Sacramento River system south of Red Bluff Diversion Dam and in the San Joaquin system are based primarily on spawning-bed surveys and carcass counts. Sometimes this is supplemented by redd counts from an airplane. Although these methods may not be as accurate as a counting station, they are now the most economical methods for large-scale statewide programs.

^{6/} The combined 1970 late-fall and winter runs were called "winter run" and discussed in "KING (CHINOOK) SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1970", edited by R. S. Menchen (Anadromous Fisheries Branch Administrative Report No. 72-2).

In this report the basis for estimating the number of salmon that utilized the Sacramento River and its tributaries upstream from Red Bluff was the counting program of the U. S. Fish & Wildlife Service at the Red Bluff Diversion Dam. Salmon were counted by closed circuit television as they negotiated the two fishways at the dam. These counts were adjusted by interpolations for periods when no counts were made but when the fishway remained open. From January 3 through July 14, 1971, counting was done by monitoring television sets 16 hours per day; 6:00 a.m. until 10:00 p.m. Occasional test counts, made between 10:00 p.m. and 6:00 a.m., indicated the 16-hour count should be increased by 4.2% to approximate a 24-hour count. Therefore, the 16-hour daytime counts were multiplied by 1.042. After July 14, 1971, 24-hour counts were made using a video tape recording system.

The adjusted weekly counts were separated into numbers of late fall-, winter-, spring-, and fall-run salmon according to data gathered by regularly examining and releasing a portion of these salmon in the trapping facility adjacent to the east bank fishway. Assigning a salmon to a particular run was accomplished by estimating when it would spawn from its appearance at the time it passed the dam.

Regions 2 and 4 personnel surveyed streams in their respective areas and prepared individual reports. Anadromous Fisheries Branch personnel surveyed streams in Region 1, served as liason among the regions to assure uniformity of methods, and compiled the regional reports into this annual report.

SACRAMENTO RIVER SYSTEM--KESWICK DAM TO CHICO CREEK
(Figure 1)

by

Richard J. Hallock
Anadromous Fisheries Branch

Sacramento River above Red Bluff Diversion Dam
Including All Tributaries Except Battle Creek

From January 3, 1971 through January 1, 1972, 138,510 king salmon were counted as they passed Red Bluff Diversion Dam. Adjusting for periods of no counting gave an estimate of 153,072 (Appendix Table 7b). During this same period 16,030 salmon were examined and released at the trapping facility in the east bank fishway of the dam. The sampling results indicated that the adjusted total included 5,830 spring-, 63,918 fall-, 28,976 late fall-, and 54,348 winter-run salmon.

Spring Run

Only 5,830 spring-run salmon passed Red Bluff Diversion Dam in 1971. A few entered some tributaries, but we have no estimate of their numbers. All 5,830 are being included with the main-stem spawners (Appendix Table 2).

The entire spring run above Red Bluff passed the dam during the 1971 calendar year.

Fall Run

During 1971, the fall run past Red Bluff was 63,918 fish. Of these, an estimated 5,289 entered Battle Creek. THE REMAINING 58,629 ARE INCLUDED IN THIS REPORT IN THE TOTAL NUMBER OF FALL SPAWNERS UTILIZING THE MAIN STEM PLUS TRIBUTARIES OTHER THAN BATTLE CREEK, even though 4,741 were trapped at Red Bluff Diversion Dam and transferred to the Tehama-Colusa Spawning Channel and 1,641 were trapped at Keswick Dam and trucked to Coleman National Fish Hatchery. (Trapping was by the U. S. Bureau of Sport Fisheries and Wildlife.)

Salmon which spawned in tributaries other than Battle Creek are combined with those which spawned in the main stem of the Sacramento because no surveys were made in the "other tributaries" during 1971 which would have provided data for separating them. Data from past years indicate the variability of annual numbers spawning in "other tributaries" is so great (2 to 14%, 1965-69) that an estimate for those spawning there in 1971 was not attempted (Table 2).

Deducting the artificially spawned fish leaves 52,247 fall-run fish available to spawn in the main stem and tributaries other than Battle Creek. The 5,830 spring-run fish which had passed the dam were also available to spawn in the fall in the main stem and some of the tributaries. The entire fall run above Red Bluff passed the dam during the 1971 calendar year.

Table 2

Fall Spawning King Salmon
(Fall-Run Plus Spring-Run)
Above Red Bluff Diversion Dam, 1965-1969

Year	Total	Main stem	Battle Creek	Other tributaries
1965	112,879	98,900	9,194	4,785
1966	123,300	107,900	3,300	12,100
1967	78,100	71,370	5,210	1,520
1968	119,266	95,600	6,476	17,190
1969	153,793	134,600	5,826	13,367
TOTALS	587,338	508,370	30,006	48,962

Late-Fall Run

In 1971, 28,976 late fall-run salmon passed Red Bluff Diversion Dam. Almost all of these fish are main stem spawners. Some late fall-run spawners use the main stem below Red Bluff Diversion Dam and are not included in this survey.

The late-fall run usually passes the dam from October through April, hence the estimated 28,976 include the later part of the 1970-71 run and the early part of the 1971-72 run (Appendix Table 2).

Winter Run

In 1971, 54,348 winter-run salmon passed Red Bluff Diversion Dam (Appendix Table 2). All of these fish can be considered main stem spawners. A relatively small part of the winter run now spawns below Red Bluff Dam and is not included in this survey.

The winter run usually passes Red Bluff from December through mid-July but the earliest fish of the 1970-71 run did not pass the dam until the week of January 31-February 6, 1971, hence the 54,348 winter fish include all of the 1970-71 run plus the early portion of the 1971-72 run.

Battle Creek

Spring Run

No estimate, although several of these salmon were seen near the Coleman National Fish Hatchery Fish Diversion Dam in June, 1971.

Fall Run

Battle Creek was the only stream above Red Bluff Dam which was surveyed in 1971. The estimate was made from carcass recovery data obtained on Battle Creek (from Coleman Hatchery to the mouth) and was combined with the count at the hatchery to obtain an estimate of the total number of spawners.

Seventeen survey trips were made on Battle Creek from October 17, 1971, through January 8, 1972. Carcass recovery conditions were good on all trips as the water was low and clear. A total of 1,971 carcasses was recovered and the run below the hatchery was estimated to be 3,285. An additional 2,004 salmon entered Coleman Hatchery, bringing the estimated run in Battle Creek to 5,289 (Appendix Table 4).

Late-Fall Run

No estimate, but few, if any, fish are involved.

Winter Run

No estimate, but few, if any, fish are involved.

Sacramento River, Main Stem Below Red Bluff Diversion Dam

Spawning stock surveys in the main Sacramento River downstream from Red Bluff Diversion Dam began October 21, 1971, and ended January 13, 1972. The area surveyed extended from the dam downstream to Woodson Bridge (Squaw Hill Bridge) near Corning. Some salmon normally spawn as far downstream as Hamilton City and below, but the numbers that utilize spawning gravels below Woodson Bridge have been small in recent years, and were ignored in 1971.

The 1971 fall flows in the upper Sacramento River were ideal for salmon carcass recovery, perhaps the best since this type survey was initiated. During most of the survey period the mean weekly flow of the Sacramento River at Bend was between 6,000 and 9,000 cubic feet per second, and the water was clear.

A total of 573 carcasses was counted between Red Bluff Diversion Dam and Woodson Bridge during 15 counting trips; 470 between Red Bluff and Tehama and 103 between Tehama and Woodson Bridge. Based on survey effort, water conditions, and carcass counts, it is estimated that the number of fall spawners in the main stem of the Sacramento River between Red Bluff Diversion Dam and Woodson Bridge was 23,215, including 295 that entered the Fish and Wildlife Service's Tehama-Colusa spawning facility via Coyote Creek (Appendix Table 2).

Sacramento River Tributaries--Red Bluff to Chico Creek

Rainfall in the upper Sacramento Valley was extremely low during the fall of 1971, and at Red Bluff it was the lowest on record. In general, all upper Sacramento River tributaries were low and clear during most of the survey period which extended from September 20, 1971, through January 8, 1972. Some tributaries such as Dry (Toomes), Singer, and Dye Creeks did not have sufficient flow for salmon to enter, while others such as Mill, Deer, and Antelope Creeks had barely enough for fish to reach the spawning beds. These unfortunate stream conditions did make salmon carcass recovery very efficient.

Antelope Creek

Fall Run

Seven survey trips were made on Antelope Creek between the canyon mouth (United States Geological Survey gaging station) and Highway 99-E from November 16, 1971, through January 4, 1972. Carcass recovery conditions were excellent due to low, clear water. Forty-two carcasses were recovered. The fall run was estimated to be 205 (Appendix Table 4).

Spring Run

No estimate was made. Spring-run salmon are known to enter Antelope Creek but the population size is unknown.

Mill Creek

Fall Run

Nine survey trips were made on Mill Creek from the Los Molinos Mutual Water Company's upper dam to its confluence with the Sacramento River between November 9 and December 27, 1971. Due to low flows, salmon were late in arriving on the spawning beds. Salmon carcass recovery conditions were excellent during the entire survey period. A total of 245 carcasses was recovered. The fall run was estimated to be 980 salmon (Appendix Table 4).

Spring Run

Eleven days were spent (September 27-29, October 4-7, and 12-15) surveying upper Mill Creek from 3 miles above Black Rock downstream to the mouth of Little Mill Creek. This effort resulted in one complete trip through the rugged Mill Creek Canyon area. The water was low and clear; carcass recovery conditions were good. The counts totaled 110 live salmon, 4 dead salmon, and 115 salmon redds. The spring run was estimated to be 1,000 fish in this stream section (Appendix Table 4). An unknown number of spring-run salmon spawned even higher in Mill Creek, between the area surveyed and Childs Meadows. Region I personnel reported that on October 9, 1971, 5 dead salmon, 2 live salmon, and 2 salmon redds were observed in a 2-mile section of Mill Creek just upstream from the Highway 36 road crossing at Childs Meadows.

Deer Creek

Fall Run

Seven survey trips were made on lower Deer Creek, between November 9, 1971, and January 3, 1972. The area covered was from the mouth of the creek to the county road bridge, which is about 2 miles above Stanford-Vina Dam. The creek was low and clear; recovery conditions were excellent. Sixty-two salmon carcasses were recovered. The fall run was estimated to be 248 fish (Appendix Table 4).

Spring Run

Ten days were spent (September 13-17 and 20-24, 1971) surveying upper Deer Creek from the Ponderosa Way road crossing to Deer Creek Meadows. This area of Deer Creek is in a rugged canyon and quite difficult to survey. The total effort resulted in one complete coverage of the area. The water was low and clear and carcass recovery conditions were good. A total of 85 live salmon and 122 redds were observed. The spring run was estimated to be 1,500 fish (Appendix Table 4). No salmon were found between upper Deer Creek Falls and Deer Creek Meadows. Salmon were reported spawning below the Ponderosa Way road crossing in the area not surveyed.

Dye Creek

Fall Run

Three survey trips were made on Dye Creek: November 19, and December 26 and 28. The area covered was from Highway 99-E upstream to $1\frac{1}{2}$ miles above the Shasta Boulevard road crossing. The water was very low and clear; recovery conditions were good. One carcass and 3 live fish were observed. The fall run was estimated to be 100 fish (Appendix Table 4).

Spring Run

None.

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

Chico Creek and Butte Creek

by

Richard Flint
Region 2

Chico Creek

Fall Run

No estimate.

The fall run in Chico Creek is zero in some years and very small in the others.

Spring Run

Chico Creek was walked from above the falls above Higgins Hole down to Ponderosa Bridge on October 19, spot checked at the Forest Service suspension bridge (Telephone Bridge) above Higgins Hole, October 28, and walked out from Ponderosa Bridge to Bidwell Park on November 5. No carcasses, live fish, redds, or other signs of salmon were found.

There is little gravel in the surveyed area, but there are numerous deep holes. In the past, salmon have been seen at the Telephone Bridge, so the falls above Ponderosa are not always a barrier. Some winter-run, and possibly some spring-run salmon were trapped in the Lindo Channel during the winter.

Butte Creek

Fall Run

A bankline check of fall-spawning salmon was made on November 20 from Gorrill Dam (a total barrier to migration) to below the western canal bypass below Nelson West Road. Lighting was bad and visibility limited. Total count was 123 king salmon as follows:

Gorrill Dam to Iron Bridge	44 live	13 carcasses	57 total
Iron Bridge to PG&E Dam	30 "	20 "	50 "
PG&E Dam to Nelson West Road	12 "	1 "	13 "
Below Nelson West Road	2 "	1 "	3 "

There were about 24-30 fish seen which appeared to be under 24 inches. The estimated run was 615 fish (Appendix Table 5).

Spring Run

Butte Creek was surveyed on September 30 and October 1, October 14-15, and October 20 between Centerville Powerhouse and the Paradise Highway Bridge. The first 2-day run turned up 2 carcasses, 52 live fish, 86 single redds, and 19 multiple redds. Water was higher than normal, very cold (42 F) from snowfall runoff, and visibility was limited in the area from the covered bridge to the Paradise Highway Bridge. The second run revealed 63 carcasses, 2 skeletons, 15 live fish, 20 new single redds, and 9 new multiple redds. Water was low and clear and the weather cool and partially overcast. The third run was necessary to complete section 2 and revealed 7 new carcasses in the area previously covered. The total count was 72 carcasses, 2 skeletons, 106 single redds, 28 multiple redds, and 15 live fish remaining. Estimated run was 470 salmon (Appendix Table 5).

Feather River

by

Lynn Wixom
Region 2

Fall Run

Eleven weekly survey trips were conducted on the Feather River between Oroville Hatchery barrier and Honcut Creek from October 12 through December 20, 1971. Recovery conditions were good in spite of high flows in the lower river during November and December.

The estimated population of fall-run adult king salmon utilizing the survey area was 43,500 fish. Combining this with 3,541 fish taken at Feather River Hatchery gives a total run of 47,041 fall-run salmon (Appendix Table 5). This total is down from the estimate of 61,525 in 1970 and 60,578 in 1969.

Marked Fish

A total of 300 fin-clipped salmon was recovered during this survey period. As in 1970, most of the marked fish were recovered in the survey area from Oroville to Thermalito Outfall. Ten of the marks were recovered between Thermalito outlet and Gridley Bridge, and none downstream from Gridley Bridge. See following table.

Fin-Clip Marked King Salmon Recovered
During Spawning Stock Survey by
Mark and Sex

Mark	Adult females	Small females	Adult males	Small males
An-LV	-	-	-	1
Ad-RV	3	-	1	6
Ad-RP	150	1	59	1
An-LP	-	-	-	36
Ad-An	13	-	11	-
RP	1	-	-	-
Ad	14	-	3	-

Spring Run

Weekly survey trips were conducted again this year during July and August. Two spring-run king salmon carcasses were found within 1 mile of the hatchery. The number of spring-run salmon entering the hatchery totaled 481.

As in past years, no attempt was made to separate fall-run from spring-run fish during the fall spawning stock survey.

Yuba River

by

Eric Gerstung
Region 2

Fall Run

Carcass recovery conditions were good on the Yuba River this season. The river remained clear and flows did not fluctuate appreciably during the spawning period (1,772 to 2,526 cfs). Seven survey trips were made between Blue Pt. Mine and Hallwood Avenue and 693 carcasses were recovered. One special survey was made between Hallwood Avenue and a point 1.3-miles downstream where an additional 112 carcasses were recovered. The estimated fall king salmon spawning escapement in the Yuba River for 1971 was 5,650 fish (Appendix Table 5), far fewer than the 13,380 estimated in 1970. A poor run in 1968 (7,000 fish), poor fall flows in 1968, and siltation resulting from construction of New Bullards Bar Dam may be responsible for the reduced salmon population in 1971. No marked fish were observed.

Poachers may have removed a significant number of salmon from the Daguerre Point Dam fish ladder during the early part of the 1971 salmon season. The north ladder flow was shut off and the ladder pools were drained on at least three separate occasions.

Spring Run

None.

American River

by

Robert Reavis and Charles Young
Region 2

Fall Run

Three survey trips were made on the American River from Nimbus Hatchery to the Watt Avenue Bridge. The survey procedures were the same as those used in 1970. During these trips, which were taken at two week intervals, only one bank was surveyed for carcasses. A total of 3,064 carcasses were counted. We made the assumption if both banks had been counted on each trip, the total would have been about 6,128 (double 3,064). Based on this, the estimated number of salmon for the section between Watt Avenue Bridge and the Nimbus racks is 40,500. From the upper side of the Nimbus racks, 1,006 carcasses were recovered. Assuming an 85% recovery, there were 1,180 fish above the racks.

There were 10,110 fish entering Nimbus Hatchery, bringing the total population estimate in the American River to 51,790 (Appendix Table 5).

Spring Run

Extinct.

LOWER SAN JOAQUIN RIVER TRIBUTARIES (Figure 3)

Mokelumne River

by

Robert Gervais
Region 2

Fall Run

The trapping facility was put into operation on the Mokelumne River at Woodbridge fish ladder on September 27. The flow in the river at the time was 950 cubic feet per second. During the first week of operation, 57 king salmon were passed through the trap. This would indicate that the upstream migration had been under way before the trap was installed in the ladder. The number is uncertain, but it was probably fewer than 100 salmon. Throughout the fall the flow varied from 1,200 cfs on October 29 to 128 cfs on December 2.

The trap was removed from the ladder on December 13. During the time the trap was in operation a total of 5,091 king salmon were counted through the ladder. Of these 1,885 were males, 2,389 were females, and 817 were grilse. We hauled 925 fish from Woodbridge to the Mokelumne Spawning Channel.

There were still small numbers of fish coming through the ladder when the trap was removed and fish were observed in the ladder subsequent to that date. This would indicate that a few fish went up after the trap was removed, again, probably fewer than 100 fish.

The fish ladders at Woodbridge Dam were nonfunctional during a five-day period beginning in late October while the boards were being removed. This unusually long period was a result of the high flow (1,200 cfs). About 1,000 salmon lay below the dam. Many were killed or injured trying to negotiate the barrier.

If the total of fish counted is added to the fish estimated to have gone up before and after trap installation, a total of approximately 5,200 is obtained for the fall run of 1971 (Appendix Table 6).

Cosumnes River

by

Robert Reavis
Region 2

Fall Run

Three survey trips were made on the Cosumnes River from Michigan Bar to Meiss Road Bridge. A total of 101 carcasses was observed. The estimated 1971 run was 500 fish (Appendix Table 6), down slightly from the 600 estimated in 1970.

The dry fall prevented the fish from moving upstream until late November. The 1971 run was probably reduced because of this condition.

Spring Run

None.

UPPER SAN JOAQUIN RIVER TRIBUTARIES
(Figure 3)

by

Jerry Goertzen
Region 4

Stanislaus River

Fall Run

Salmon were first seen in the Stanislaus River about the middle of October, 1971, and numerous fish were spawning by the first of November. The estimated number of females in 1971 was greater than that of 1970. The total run was up, and the proportion of females was 59%, compared to 31% in 1970. Spawning effectiveness in 1971, however, may have been low. The upstream half of the survey area, from Goodwin Dam to Orange Blossom Bridge received very heavy use, and many of the earlier redds were destroyed by superimposition of the later ones.

Spawning use of gravel was light in the downstream half of the survey area, from Orange Blossom Bridge to Riverbank. Gravel in this area is less suitable for spawning due to heavy silting over the years and the growth of aquatic plants on the riffles.

A trap for capturing adult salmon was installed and operated by Region 4 personnel from Moccasin Creek Fish Hatchery. The trap was located about $\frac{1}{2}$ -mile upstream from the Orange Blossom Bridge and operated from October 29 to November 16, 1971. A total of 514 salmon was trapped. Only 94 females and 62 male salmon were spawned. One female and 2 males died; and 20 grilse, 195 green females, and 140 adult males were released. A total of 495,512 eggs were taken.

From October 13-25, 1971, a pre-season flow of 300 cfs was released. On October 25, the flow was reduced to 50 cfs for installation of the Department trap. Flows were maintained at about 150 cfs from November 2 to November 18 to allow operation of the trap. After the trap was removed on November 19, 1971, the flow increased to 820 cfs with a slight drop to 514 cfs in early December, and back up to 840 cfs by mid-December. By early January the flow was 1,901 cfs which was held until the end of January when it dropped again to 518 cfs.

Water clarity was very good up until the time the trap was removed on November 19; after that the increased flow caused turbidity which lowered the visibility to fair, poor, and eventually very poor by January 4 and 5, 1972, the last trip on the river.

When the river was low and clear the poaching was very heavy. The large number of fish attracted a large number of poachers. Once the trap was pulled and the flow increased, the salmon were difficult to catch so the poaching declined.

Four survey trips were made on the Stanislaus River between Knights Ferry and Riverbank and between Goodwin Dam and Knights Ferry. All surveys were conducted during the period November 17, 1971 to January 5, 1972. The river was high and the water was murky by the time the surveys were started. Carcass recovery conditions were poor.

A total of 726 carcasses was recovered. The spawning population was an estimated 13,621 fish, including 159 which were captured at the Orange Blossom trap and held for spawning (Appendix Table 6). The number of small fish (less than 23-7/8" fl) was small this year, only 7% of the total run. Twenty-two percent of the small fish were females.

Planting of Yearlings

On November 1, 2, and 3, 1971, 50,300 yearling salmon from Moccasin Creek Hatchery (1970 brood, Stanislaus River strain) were planted at Knights Ferry. We saw these fish jumping on every survey trip.

Spring Run

Extinct.

Tuolumne River

Fall Run

We saw the first salmon in the Tuolumne River on October 20, 1971, and in mid-November we counted 2,128 live salmon in the river. Heavy spawning continued until mid-December, when we counted 1,598 redds. A few fish were observed near La Grange as late as January 26, 1972.

The spawning area in the Tuolumne River has deteriorated badly from willow encroachment and diminishing gravel. This season, 1971-72, was the first year of the New Don Pedro Project FPC 2299 license, and the Davis-Grunsky Act grant. In accordance with the DGA grant, approximately 2 miles of the Tuolumne River spawning gravel has been reclaimed for salmon spawning (approximately 1 million square feet) from La Grange Bridge to Basso Bridge. The work was carried out by the Modesto Irrigation District according to specifications set by the Department of Fish and Game. The district has 4 years to complete the required 2.5 million square feet of gravel reclamation.

Although the Tuolumne River run increased from 18,300 fish in 1970 to 21,885 in 1971 (Appendix Table 6), the total use of the reclaimed area in 1971 was 22% less than that of 1970. Only the areas with the greatest velocity flows were heavily used. Salmon sometimes refuse to use gravel the first season after it has been cleaned.

Flows are also specified in the New Don Pedro Project FPC 2299 license. The 1971 flows were held fairly close to specified levels. The normal year minimum flow schedule according to Article 37 of FPC 2299, and flow readings taken from the La Grange gauge, Department of Water Resources, about 1 mile below the La Grange Dam are compared in the following table:

NORMAL YEAR SCHEDULE		LA GRANGE	
Period	cfs	Date	cfs
Preseason			
flushing flow	2,500	October 15	2,585 (for 12 hours)
October 1-15	200		
October 16-31	250	October 19	591
		October 27	582
November	385	November 3	578
		November 15	361
		November 29	361
December 1-15	385	December 13	385
December 16-31	280	December 27	248 (fluctuating)
January	280	January 10	251 (fluctuating)
		January 25	268
		January 31	296

Water was clear until the fluctuating flows started after December 15, 1971. After that date the visibility was generally poor.

Dry Creek, a tributary of the Tuolumne River with its confluence in the city of Modesto, was a problem to the salmon migration again this year. The normal flow in Dry Creek is minimal except during rain runoff or when irrigation canals are diverted into the creek for drainage. Early this season the flow in Dry Creek equalled or surpassed the flow in the main Tuolumne River, so many of the salmon entered Dry Creek. The Tuolumne River is closed to fishing during the salmon run but Dry Creek is not, so fishermen swarmed to the creek to catch the salmon. Spawning area is very limited in Dry Creek. The creek is primarily rain fed so a sufficient flow for salmon hatch and downstream migration is doubtful. A barrier near the mouth of the creek would be a possible solution to this problem. Such a project is now being considered.

Six survey trips were made on the Tuolumne River between La Grange and Reed Rock Plant, from November 15, 1971, to January 26, 1972. Survey conditions were good until December 15, when fluctuating flows made carcass recovery difficult. A total of 2,283 carcasses was recovered. The estimated spawning population was 21,885 fish (Appendix Table 6). The sex composition was 58% females, and 42% males. The number of small fish (less than 23-7/8" tl) was only 7% of the total this year. Sixteen percent of the small fish were females.

Spring Run

Extinct.

Merced River

The early October flow in the Merced River was about 1,000 cfs. By mid-October the flow was 225 cfs at Cressey, and was fairly stable until early January when it was increased to 790 cfs. A post season check on January 31, 1972 showed a flow of 1,164 cfs.

The water hyacinths are becoming a serious problem in the Merced River. With the low warm flows in the summer the plants have ideal growing conditions in the large gravel pools. In some areas the plants covered the river from bank to bank. In mid-October during the flush flow, large rafts of hyacinths broke loose in the pond areas and piled up in the narrow channels, especially where fallen trees or other obstacles caused a constriction. These blocks were so extensive that boat access to portions of the survey area was impossible.

Fall Run

Five survey trips were made on the Merced River between Crocker-Huffman Dam and Cressey Bridge, from November 8, 1971 to January 6, 1972. Survey conditions were good to fair until the last trip on January 6. A total of 924 carcasses was recovered, 148 of which were recovered in the Merced River Spawning Channel. The total estimated spawning population was 3,651 fish, including the 200 estimated in the spawning channel (Appendix Table 6).

Total escapement was down slightly from the 4,800 estimated in 1970. The 1971 sex composition was 55% females and 45% males. Only 8% of the fish were small fish (less than 23-7/8" fl). Forty-three percent of the small fish were females.

Some late-spawning salmon were observed on the Merced River this season. Late-spawning salmon are uncommon in the Merced River. On April 27, three live salmon were seen just below the fish ladder at the spawning channel. Two of them appeared to be spawned-out females near three clearly defined redds. The other one was a fresh-run fish that was trying to enter the spawning channel.

Planting of Yearlings

On October 12, 1971, 86,300 "yearling" salmon (1970 brood Stanislaus River strain) were released to the river from the rearing pond at the spawning channel. An additional 37,200 yearlings from Moccasin Creek Hatchery were planted at the Bettencourt Ranch in mid-October.

Spring Run

Extinct.

A SUMMARY OF SALMON COUNTS AT RED BLUFF DIVERSION DAM,
NOVEMBER 2, 1969 THROUGH APRIL 15, 1972

by

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INTRODUCTION

Through the years, the Department of Fish and Game's annual estimates of the number of king salmon that spawn in the Central Valley have included only those salmon that spawn in the fall, i.e., spring- and fall-run fish. Although salmon populations in the San Joaquin River system are now primarily limited to fall-spawning kings, which are almost entirely fall-run, the Sacramento River system also supports runs of salmon that spawn in the winter and spring. During some years in the upper Sacramento, as many salmon spawn in the winter and spring as spawn in the fall. Those spawning from January through mid-April have been labeled "late fall-run" and those spawning from mid-April through mid-July "winter-run" salmon. With completion of the fish trapping facility at Red Bluff Diversion Dam, it has become feasible to examine a sample of the fish as they pass the dam and from this to estimate the numbers of spring-, fall-, late fall-, and winter-run salmon that spawn in the Sacramento River system above the dam.

This report is a summary of results obtained from U. S. Bureau of Sport Fisheries and Wildlife counts and Department of Fish and Game sampling of king salmon at Red Bluff Diversion Dam. The results allow a comparison of the numbers of the four races of king salmon spawning in the upper Sacramento and the times of their migration past the dam.

Weekly estimates of spawners by race are presented for the period November 2, 1969 through April 15, 1972 (Appendix Tables 7a, 7b, and Figure 4). The weekly estimates for 1970 appeared earlier in "King (Chinook) Salmon Spawning Stocks in California's Central Valley, 1970", edited by R. S. Menchen (AFB Administrative Report No. 72-2). In the earlier report no distinction was made between winter- and late fall-run fish. The 1970 figures have therefore been revised to separate winter- and late fall-run fish when possible.

METHODS

From November 2, 1969 through July 14, 1971, the salmon were counted as they negotiated fishways at the dam. A closed circuit television system monitored both ladders 16 hours per day. The system was not operated for 8 hours each night. The figures were adjusted for "fall back" by the U. S. Fisheries and Wildlife and published weekly. These weekly counts were then adjusted again in this report for the day hours when no counts were made, but when the fishways remained open, and for the night hours by multiplying day counts by 1.042, a figure established from a few scattered night counts by the Fish and Wildlife Service. On July 14, 1971, a video tape recording system was installed, and daily counts were then made on a 24-hour per day basis. No attempts were made to adjust these counts for "fall back" because of technical difficulties with the video tape recording system. Counts made during this latter period are the number of salmon passing over the dam via the fishways which was obtained by interpreting the video tape recordings of fish made as they passed in view of the closed circuit television system camera. The published video tape counts were also adjusted in this report for any hours when the fishways remained open but no counting was done. Most of the lapses in counting were of several hours to two or three days duration and were due to excessive turbidity of the water. One 10-day lapse in counting occurred from December 20 to December 29, 1969. Interpolation for this 10-day lapse and shorter periods probably gives reasonable estimates of numbers of uncounted fish passing the dam. However, one prolonged period of no counting occurred from January 18 to March 14, 1970 (8 weeks). Flows were high and the gates of the dam were open. During this same period in 1971 and 1972 approximately one-half the late-fall plus winter spawners passed the dam. But water conditions were different in 1970 from those in the other two years. No estimate of numbers of fish passing the dam during the 8-week lapse in counting was made.

The adjusted weekly counts were separated into numbers of late fall-, winter-, spring-, and fall-run salmon according to data gathered by regularly anesthetizing and examining a portion of these salmon in the trapping facility adjacent to the east bank fishway. Assigning a salmon to a particular run was accomplished by estimating, from the appearance of the fish, when it would spawn.

RESULTS

The late-fall and winter runs were not separated in late 1969 and early 1970.

The 1969 fall and the 1969-70 late-fall runs began prior to the beginning of the study period (November 2, 1969). In 1970, the late fall- and winter-run counts are incomplete because of the January 18 - March 14 gap

in the counting. The 1971-72 winter and the 1972 spring runs continued migrating past the dam after the end of the study period (April 15, 1972). Numbers presented for these four runs therefore represent only portions of the complete runs.

The estimated numbers of fish in seven different runs, sampled throughout the periods of their migration past the dam, are included in this report; two spring runs (1970 and 1971), two fall runs (1970 and 1971), two late-fall runs (1970-71 and 1971-72), and one winter run (1971) (Appendix Table 8).

The "average" numbers of fish of each run for two consecutive years, for spring, fall, and late-fall runs were 4,741, 69,783, and 24,870 respectively. The one completely counted winter run was 53,089 fish.

Thus, the "average" number of fall spawners per season was 74,524, and that for winter plus spring spawners - 77,959.

Other methods of grouping the data to compare fall spawning numbers with those of winter- and spring-spawning fish include the use of numbers migrating past the dam by year. The choice of a 52-week period beginning in the middle of March allows the comparison of numbers over two years wherein no major lapse in the counting occurred. The numbers of fall spawners and winter plus spring spawners migrating past the dam are shown in the following table.

Period	Total fall spawners (spring run + fall run)	Total winter and spring spawners (late fall + winter run)
March 15, 1970- March 13, 1971	79,299	71,266
March 14, 1971- March 11, 1972	69,748	69,658

CONCLUSION

In terms of the numbers of fish migrating past Red Bluff Diversion Dam the fall run was more important than any of the other three runs (spring, late-fall, or winter run). The spring run was the least significant.

Late fall- and winter-run fish have not been included in Central Valley spawning stock inventories prior to 1970. However, they occur above Red Bluff Diversion Dam in the same order of magnitude as fall- plus spring-run fish. During the two year period from March 15, 1970, to March 11, 1972, they accounted for 49% of the total king salmon spawners migrating past the dam.

A method is now available for estimating their numbers above Red Bluff. They should therefore be included in the annual estimate of the Central Valley spawning population.

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- Figure 2. Sacramento River tributaries from Chico Creek, south, covered during the 1971 king salmon spawning stock survey.
- Figure 3. San Joaquin River tributaries covered during the 1971 king salmon spawning stock survey.
- Figure 4. Red Bluff Diversion Dam weekly adjusted salmon counts, November 2, 1969 through April 15, 1972.

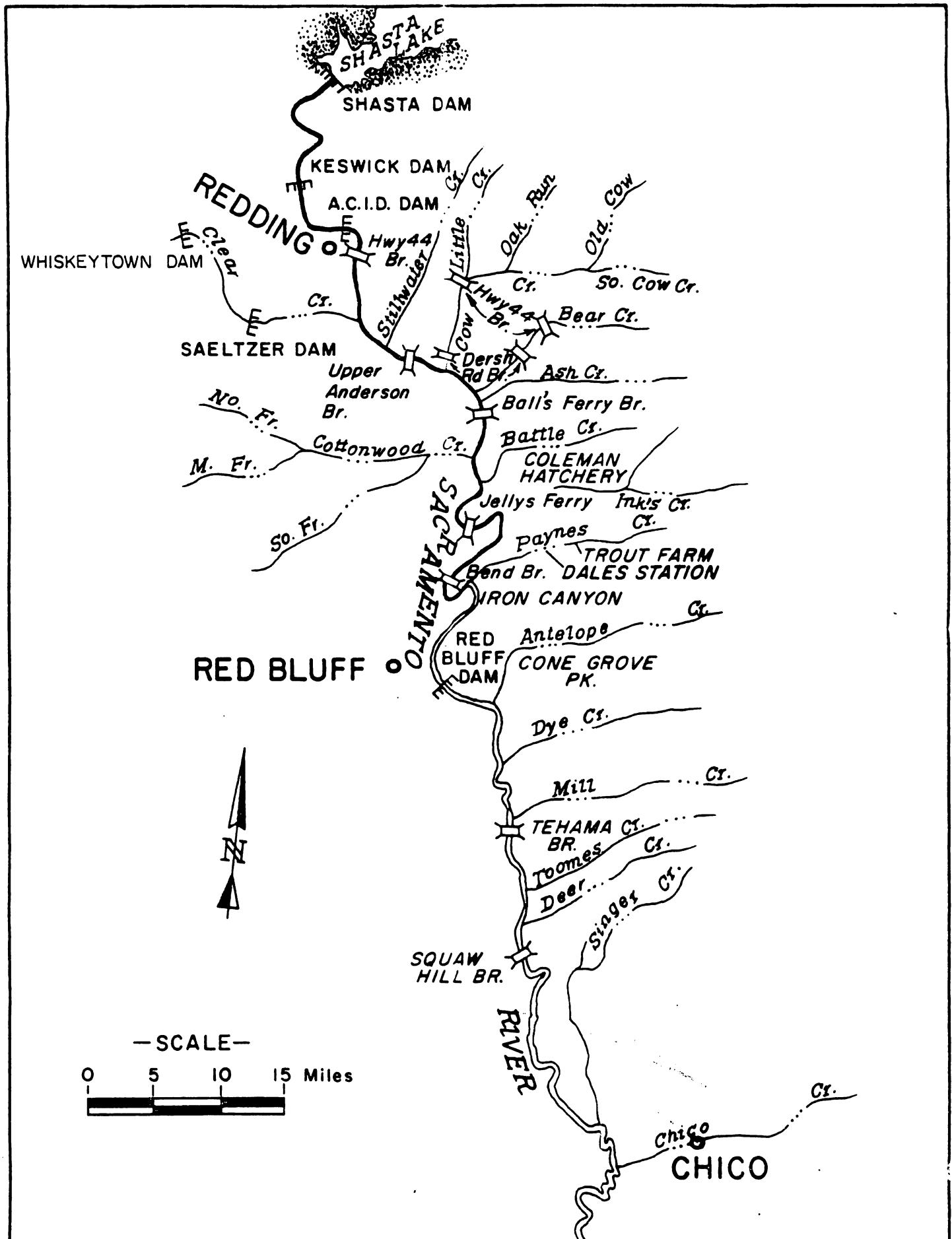


Figure 1. Upper Sacramento River and tributaries above Chico Creek covered during the 1971 king salmon spawning stock survey.

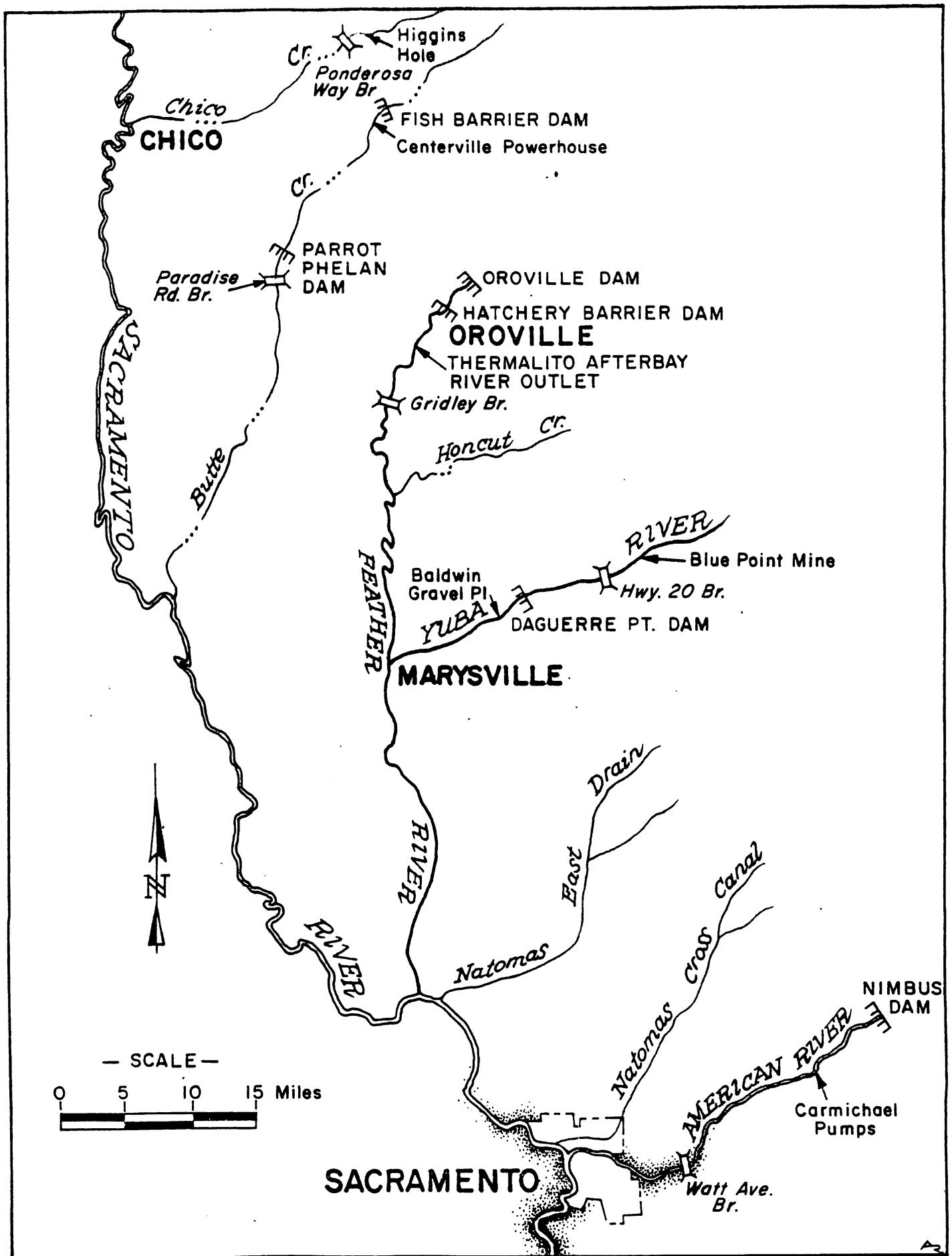


Figure 2. Sacramento River Tributaries from Chico Creek, south, covered during the 1971 king salmon spawning stock survey.

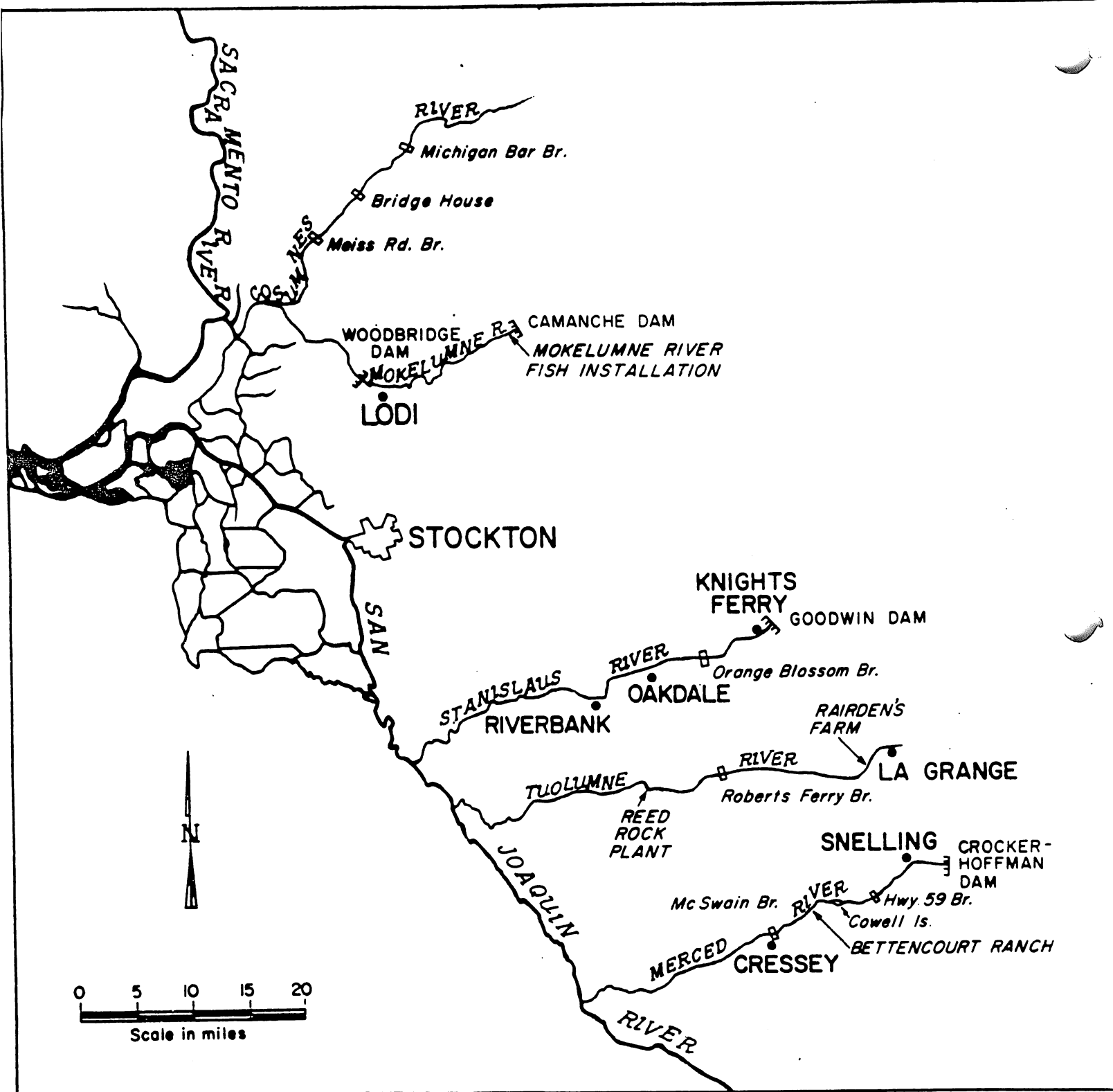


Figure 3. San Joaquin River Tributaries covered during the 1971 king salmon spawning stock survey.

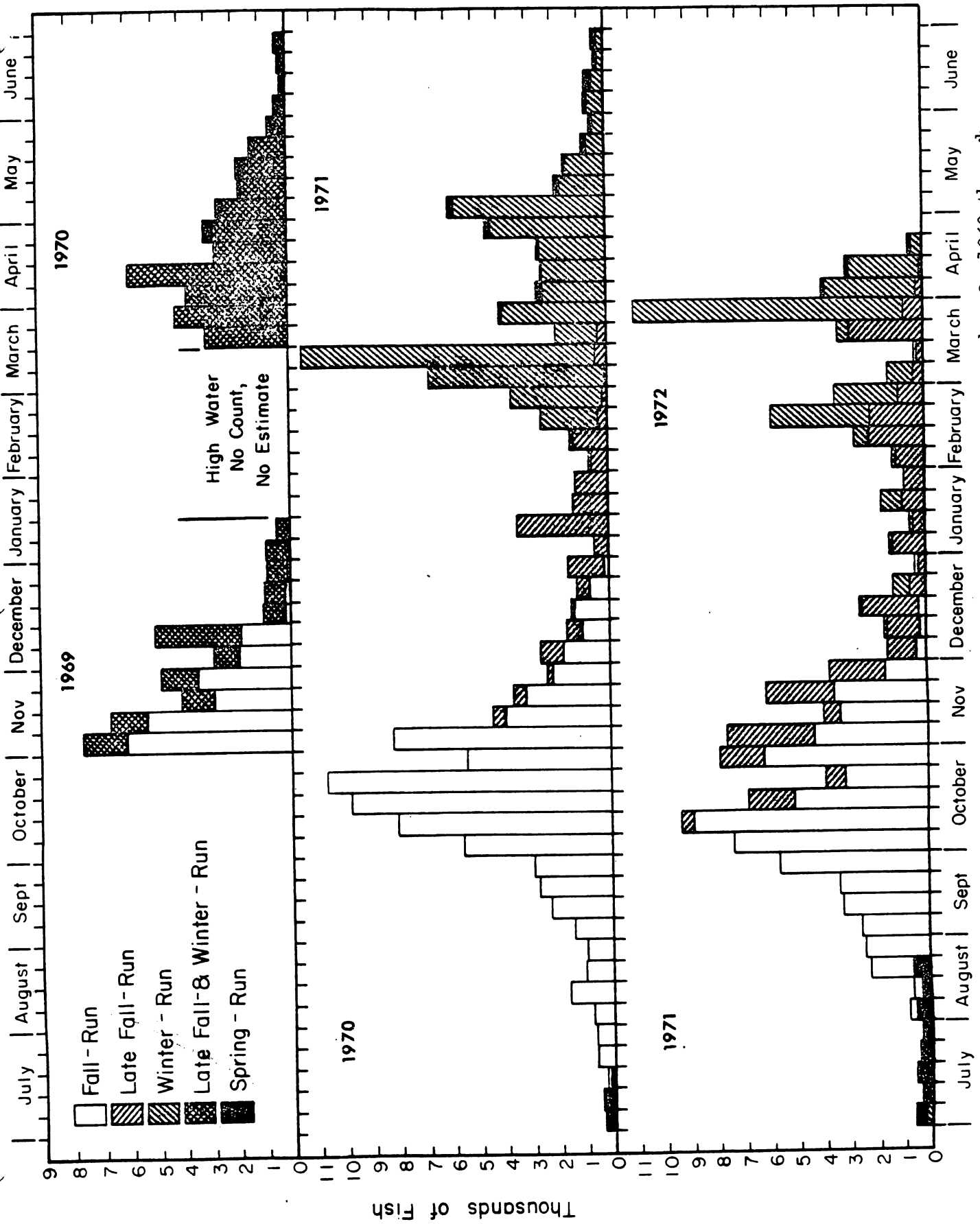


Figure 4. Red Bluff Diversion Dam weekly adjusted salmon counts, November 2, 1969 through April 15, 1972.

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Appendix Table 1

Sacramento-San Joaquin Valley Fall- and Spring-Run
King Salmon Spawning Stock Estimates, Major Streams,
1953-1971 (In Thousands of Fish)

Year	Main stem Sacramento River	Clear Creek	Cow Creek	Bear Creek	Cottonwood Creek	Battle Creek	Antelope Creek	Mill Creek	Deer Creek	Chico Creek
1953	408 a + 8 c	- b	- b	- b	- b	16 b + 2 c	- b	10 b + 3 c	4 b + 2 c	- c
1954	276 a + 9 c	- b	- b	- b	- b	12 b + 2 c	- b	7 b + 2 c	3 b + 2 c	- c
1955	231 a + 17 c	- b	- b	- b	- b	26 b + 2 c	- b	3 b + 3 c	* + 3 c	- c
1956	94 a + 7 c	- b	- b	- b	- b	21 b + 2 c	- b	0.9 b + 2 c	0.1 b + 3 c	- c
1957	68 a + - c	0.3 b	0.7 b	* b	0.4 b	5 b + - c	0.8 b	5 b + 1 c	2 b + - c	0.1 c
1958	128 a + - c	1.6 b	3 b	0.2 b	0.6 b	29 b + - c	0.4 b	4 b + 2 c	1.3 b + - c	1 c
1959	267 a - - c	0.8 b	0.7 b	* b	3 b	30 b + - c	- b	0.8 b + 1.6 c	* b + - c	0.2 c
1960	233 a - - c	0.9 b	0.6 b	0.1 b	0.4 b	24 b + - c	0.2 b	0.9 b + 2 c	0.6 b + - c	- c
1961	150 a + - c	- b	- b	- b	1.5 b	20 b + - c	- b	1.7 b + 1 c	- b + - c	- c
1962	139 a + - c	5 b	1.5 b	- b	6 b	13 b + - c	0.8 b	4 b + 2 c	2 b + - c	0.2 c
1963	146 a + - c	10 b	- b	- b	4 b	17 b + - c	0.3 b	1.3 b + 1.3 c	1.2 b + 1.7 c	0.5 c
1964	148 a + - c	2 b	1 b	0.1 b	3 b	16 b + - c	0.1 b	0.4 b + 1.6 c	0.1 b + 3 c	0.1 c
1965	103 a + - c	2 b	1 b	0.4 b	0.9 b	9 b + - c	0.1 b	0.2 b + - c	0.2 b + - c	0.1 c
1966	115 a + - c	0.9 b	8 b	0.4 b	3 b	3 b + - c	0.2 b	0.5 b + - c	0.1 b + - c	0.1 c
1967	92 a + - c	0.4 b	0.4 b	* b	0.6 b	5 b + - c	0.1 b	0.5 b + - c	0.1 b + - c	0.2 c
1968	110 a + - c	0.8 b	8 b	0.3 b	8 b	6 b + - c	0.1 b	0.8 b + - c	0.3 b + - c	0.2 c
1969	133 b + 20 c	1.2 b	6 b	0.6 b	5 b	6 b + - c	0.2 b	1.7 b + - c	0.8 b + - c	0.2 c
1970	71 b + 4 c	- b	- b	- b	- b	7 b + - c	0.4 b	0.7 b + 1.5 c	0.5 b + 2 c	0.0 c
1971	82 b + 6 c	- b	- b	- b	- b	5 b + - c	0.2 b + - c	1 b + 1 c	0.2 b + 1.5 c	0.0 c

Year	Butte Creek	Feather River	Yuba River	American River	Cosumnes River	Mokelumne River	Stanislaus River	Tuolumne River	Merced River	Others	Total
1953	- c	28 a + - c	6 b	28 b	2 b	2 b	35 b	45 b	- b	13	612
1954	- c	68 a + 3 c	5 b	29 b	5 b	4 b	22 b	40 b	4 b	12	505
1955	0.4 c	86 a + 1 c	2 b	17 b	2 b	2 b	7 b	20 b	- b	4	426
1956	3 c	18 a + 2 c	5 b	6 b	1 b	0.5 b	5 b	6 b	0.0 b	9	185
1957	2 c	10 a + 0.5 c	1 b	8 b	1 b	2 b	4 b	8 b	0.4 b	0.2	120
1958	1 c	31 a + 3 d	8 b	27 b	1 b	7 b	6 b	32 b	0.5 b	0.2	288
1959	0.5 c	76 a + 4 d	10 b	31 b	0.0 b	2 b	4 b	46 b	0.4 b	1	479
1960	7 c	80 a + 4 d	20 b	54 b	1 b	2 b	8 b	45 b	0.4 b	*	484
1961	3 c	44 a + - c	9 b	25 b	- b	0.1 b	2 b	0.5 b	0.05 b	1	259
1962	2 c	19 a + - c	34 b	27 b	1 b	0.2 b	0.3 b	0.2 b	0.06 b	-	257
1963	3 c	34 a + 0.6 c	37 b	41 b	1 b	0.5 b	0.2 b	0.1 b	0.02 b	1.5	303
1964	0.6 c	38 a + 3 c	35 b	59 b	2 b	2 b	4 b	2 b	0.04 b	1	322
1965	1 c	23 a + 0.7 c	10 b	39 b	0.8 b	1.3 b	2 b	3 b	0.09 b	0.2	198
1966	0.1 c	21 a + 0.3 c	8 b	27 b	0.6 b	0.7 b	3 b	5 b	0.04 b	0.3	197
1967	0.2 c	12 a + 0.1 c	24 b	23 b	0.5 b	3 b	12 b	7 b	0.6 b	-	182
1968	0.3 c	18 a + 0.2 c	7 b	31 b	1.5 b	1.7 b	6 b	9 b	0.5 b	0.1	210
1969	0.8 c	61 a + 0.3 c	5 b	47 b	4 b	3 b	12 b	32 b	0.6 b	1.1	341
1970	0.3 c	62 a + 0.2 c	14 b	37 b	0.6 b	5 b	9 b	18 b	5 b	5 **	243
1971	0.6 b + 0.5 c	47 a + 0.5 c	6 b	52 b	0.5 b	5 b	14 b	22 b	4 b	5 **	248
72		47	9	24							162

a Mostly fall-run; a few spring-run fish may have been included.

b Fall run only.

Spring run only.

Mostly spring-run but may include some fall-run fish.

- No estimate.

* Less than 50 fish.

** Combined estimate of Clear, Cow, Bear, Cottonwood, and Dye Creeks.

Appendix Table 2

King Salmon Runs, Main Stem Sacramento River, 1971

Area	Spring run	Fall run	Late-fall run	Winter run	Total
Keswick Dam to Red Bluff Dam	5,830	58,629 ^{1/}	28,976	54,348	147,783
Red Bluff Dam to Tehama	No est.	19,095 ^{2/}	No est.	No est.	19,095
Tehama to Woodson Bridge	"	4,120	"	"	4,120
Below Woodson Bridge	"	No est.	"	"	-
TOTAL MAIN STEM	5,830 ^{3/}	81,844 ^{3/}	28,976 ^{4/}	54,348 ^{4/}	170,998

^{1/} Includes fish which spawned in tributaries (other than Battle Creek) plus 1,641 trapped at Keswick Dam and hauled to Coleman Hatchery (11-11 through 12-31-71) and 4,741 trapped at Red Bluff Dam and moved to Tehama-Colusa Spawning Channel (10-5 through 11-7-71).

^{2/} Includes 295 which entered Tehama-Colusa Spawning Channel via Coyote Creek (10-5 through 11-12-71).

^{3/} Total annual run.

^{4/} Calendar year count at Red Bluff Diversion Dam.

Appendix Table 3

Distribution of Redds of Fall Spawning King Salmon in
Main Stem Above Red Bluff Diversion Dam

Area	Percent of redds in each area*
Keswick - A.C.I.D. Dam	4
A.C.I.D. Dam - Highway 44	20
Highway 44 - Upper Anderson Bridge	15
Upper Anderson Bridge - Balls Ferry	23
Balls Ferry - Jellys Ferry	19
Jellys Ferry - Bend Bridge	17
Bend Bridge - Red Bluff Dam	2

* Percent salmon redds observed between Red Bluff and Keswick Dam on three airplane flights, November 7, 17, and December 13, 1971. Includes fall- and spring-run redds.

Appendix Table 4

Fall Spawning King Salmon Counts and Population Estimates,
Sacramento River Tributaries North of Chico Creek, 1971

Streams or stream section	Number of counting trips	Estimated recovery rate (percent)	Number of carcasses recovered	Estimated spawning population		
				Spring run	Fall run	Total run
Battle Creek						
Coleman Hatchery	-	-	-	-	2,004 ^{1/}	
Below Hatchery	17	60	1,971	-	3,285	
TOTAL, Battle Creek				No. Est.	5,289	5,289
Other tributaries between Red Bluff and Keswick Dam				No. Est.	No. Est.	No. Est.
Antelope Creek	7	20	42	No. Est.	205	205
Mill Creek (lower)	9	25	245	0	980	980
" " (upper)	1	-	-	1,000	0	1,000
Deer Creek (lower)	7	25	62	0	248	248
" " (upper)	1	-	-	1,500	0	1,500
Dye Creek	3	10	1	-	100	100
TOTAL, tributaries - Red Bluff to Chico Creek				2,500	1,533	4,033
TOTAL, SACRAMENTO RIVER TRIBUTARIES NORTH OF CHICO CREEK			2,321	2,500	6,822	9,322

^{1/} Battle Creek trap total for operation October 15, 1971 through December 31, 1971.

Appendix Table 5

King Salmon Counts and Population Estimates Southern Sacramento
River Tributaries (Chico Creek and South) 1971-72

Stream or stream section	Number of counting trips	Carcasses and skeletons counted	Estimated Spawning Population		
			Spring run	Fall run	Total run
Chico Creek	3	0	No. Est.	No. Est.	
Butte Creek	3	114	470	615	1,085
Feather River (TOTAL)	11	13,593	481	47,041	47,522
Oroville Barrier					
Thermalito Outlet	(11)	(10,007)	No. Est.	(18,200)	
Thermalito Outlet to Gridley Bridge	(10)	(3,117)	No. Est.	(22,100)	
Gridley Bridge to Honcut Creek	(10)	(469)	No. Est.	(3,200)	
Oroville Hatchery	-	-	(481)	(3,541)	
Yuba River (TOTAL)	7	805	Extinct	5,650	5,650
Blue Pt. Mine to Hwy. 20 Bridge	(7)	(23)		(460)	
Hwy. 20 Bridge to Daguerre Pt. Dam	(7)	(144)		(1,440)	
Daguerre Pt. Dam to Hallwood Avenue	(7)	(526)		(2,630)	
To 1.3 mi. below Hallwood Avenue	(1)	(112)		(1,120)	
American River (TOTAL)	3	4,070	Extinct	51,790	51,790
Nimbus Racks to Carmichael Pumps	(3)	(2,777)		(36,800)	
Carmichael Pumps to Watt Avenue Bridge	(3)	(287)		(3,700)	
Above Nimbus Racks	-	(1,006)		(1,180)	
Nimbus Hatchery	-	-		(10,110)	
Natomas Drainage	-	-	None	No. Est.	
TOTAL, SOUTHERN SACRAMENTO RIVER TRIBUTARIES		18,582	951	105,096	106,047
TOTAL, SACRAMENTO TRIBUTARIES (TABLE 4 PLUS TABLE 5)		20,903	3,451	111,918	115,369

Appendix Table 6

Fall-Run King Salmon Counts and Population Estimates,
San Joaquin River Tributaries*, 1970-71

Stream or stream section	Number of counting trips	Number of carcasses and skeletons counted	Estimated spawning population
<u>Cosumnes River (TOTAL)</u>	3	101	500
Michigan Bar Bridge to Bridge House	3	44	220
Bridge House to Meiss Road Bridge	3	57	280
<u>Mokelumne River</u>	-	-	5,200
<u>Stanislaus River (TOTAL)</u>	4	726	<u>13,621**</u>
Goodwin Dam to Knight's Ferry	2	39	1,300
Knight's Ferry to Orange Blossom Bridge	4	492	7,029
Orange Blossom Bridge to Oakdale	4	164	4,100
Oakdale to Riverbank	4	31	1,033
<u>Tuolumne River (TOTAL)</u>	6	2,283	<u>21,885</u>
La Grange to Rairden's Farm	6	1,088	9,067
Rairden's Farm to Robert's Ferry Bridge	6	848	8,480
Robert's Ferry Bridge to Reed Rock Plant	6	347	4,338
<u>Merced River (TOTAL)</u>	5	924	<u>3,651</u>
Crocker-Huffman Dam to Highway 59 Bridge	5	537	1,790
Highway 59 Bridge to Bettencourt's Ranch	5	209	1,161
Bettencourt's Ranch to Cressey Bridge (McSwain)	5	30	500
Merced River Spawning Channel	-	148	200
TOTAL, SAN JOAQUIN RIVER TRIBUTARIES	-	4,034	44,857

* King salmon spawners other than fall-run were of insignificant numbers.

** Includes 159 salmon trapped near Orange Blossom Bridge and spawned at Moccasin Creek Hatchery.

Appendix Table 7a

Red Bluff Diversion Dam Weekly Adjusted King Salmon Counts.
November 2, 1969 to January 2, 1971

Week	Adjusted salmon count	Number sampled	Late fall run ^{1/} Percent	Number	Winter run ^{1/} Percent	Number	Spring run ^{1/} Percent	Number	Fall run ^{1/} Percent	Number
1969										
Nov. 2-8	7,933	325	1		21	1,566			79	6,267
9-15	6,891	368	"		21	1,447			79	5,444
11-22	4,140	328	"		29	1,201			71	2,939
23-29	4,236	211	"		29	1,431			71	3,505
Nov. 30-Dec. 6	3,951	236	"		35	1,068			65	1,983
Dec. 7-13	5,311	703	"		63	3,346			37	1,965
14-20	1,071	52	"		90	967			10	107
21-27	1,000 ^{2/}	02 ^{2/}	"		90	960			10	100
Dec. 28-Jan. 3	912	02 ^{2/}	"		90	821			10	91
TOTAL 1969	35,248	2,223				12,847 ^{1/}				22,401
1970										
Jan. 4-10	941	46			100	941				
11-17	591	69			100	591				
High water - No count, no estimate.										
Mar. 15-21	3,151	0*			100	3,151				
22-28	4,201	0*			100	4,201				
Mar. 29-Apr. 4	3,389	0*			100	3,389				
Apr. 5-11	6,011	360			100	6,011				
12-18	2,812	241			100	2,812				
19-25	3,141	129			90	2,827	10	314		
Apr. 26-May 2	2,817	99			92	2,592	8	225		
May 3-9	1,891	106			96	1,815	4	76		
10-16	2,022	116			87	1,759	13	263		
17-23	1,526	50			81	1,236	19	290		
24-30	760	71			44	334	56	426		
May 31-June 6	574	53			42	241	58	333		
June 7-13	251	13			46	115	54	136		
14-20	448	25			36	161	64	287		
21-27	482	33			3	14	97	468		
June 28-July 4	357	8			38	136	62	221		
July 5-11	473	31				45,673	100	473		
12-18	280	13					50	140	50	140
19-25	623	16						3,652	100	623
July 26-Aug. 1	627	23							100	627
Aug. 2-8	744	116							100	744
9-15	1,655	132							100	1,655
16-22	1,053	144							100	1,053
23-29	1,009	23							100	1,009
Aug. 30-Sept. 5	1,457	35							100	1,457
Sept. 6-12	2,397	47							100	2,397
13-19	2,712	122							100	2,712
20-26	2,956	69							100	2,956
Sept. 27-Oct. 3	5,518	70							100	5,518
Oct. 4-10	8,082	165							100	8,082
11-17	9,790	473							100	9,790
18-24	10,668	494							100	10,668
25-31	5,412	183							100	5,412
Nov. 1-7	8,108	540							100	8,108
8-14	4,458	64	12	535					88	3,923
15-21	3,736	96	16	598					84	3,138
22-28	2,409	148	10	241					90	2,168
Nov. 29-Dec. 5	2,739	0**	35	959					65	1,780
Dec. 6-12	1,692	0**	63	1,066					37	629
13-19	1,493	0**	90	1,344					10	149
20-26	1,296	70	42	544					58	752
Dec. 27, 1970- Jan. 2, 1971	1,601	58	90	1,441					10	160
										75,647
TOTAL 1970	118,853	4,551		6,728		32,826 ^{1/}		3,652		75,647

1/ The late fall-run fish of late 1969 and early 1970 were included with the winter-run.

2/ No sampling - Percentages are taken from previous week.

3/ No counting - Estimate is by interpolation.

* No sampling - Assumed to be all winter-run salmon and late fall-run salmon.

** No sampling - Percentages used are for corresponding weeks in 1969.

□ Total run passing Red Bluff Diversion Dam.

Appendix Table 7b

Red Bluff Diversion Dam Weekly Adjusted King Salmon Counts,
January 3, 1971 through April 15, 1972

Week	Adjusted	Number sampled	Late fall run		Winter run		Spring run		Fall run	
	salmon counts		Percent	Number	Percent	Number	Percent	Number	Percent	Number
1971										
Jan. 3- 9	556	3	100	556						
10-16	3,451	93	100	3,451						
17-23	1,382	0	100	1,382						
24-30	1,264	13	100	1,264						
Jan. 31-Feb. 6	752	15	56.7	652	13.3	100				
Feb. 7-13	1,408	33	93.9	1,322	6.1	86				
14-20	2,554	0*	13.0	532	57.0	2,222				
21-27	3,700	0*	3.6	133	96.4	3,567				
Feb. 28-Mar. 6	6,712	401	0.5	34	99.5	6,678				
Mar. 7-13	11,465	241	3.7	424	96.3	11,041				
14-20	1,979	11	18.2	360	81.8	1,619				
21-27	4,042	99	0	0	98.0	3,261	2.0	61		
Mar. 28-Apr. 3	2,561	188	2.1	54	91.0	2,330	6.9	177		
Apr. 4-10	2,373	234	0.9	21	97.4	2,312	1.7	40		
11-17	2,549	341	1.1	28	98.0	2,498	0.9	23		
18-24	4,610	445		16,741	95.0	4,380	5.0	230		
Apr. 25-May 1	6,018	329			96.0	5,777	4.0	241		
May 2- 8	1,928	321			92.2	1,778	7.8	150		
9-15	1,604	301			92.6	1,485	7.4	119		
16-22	951	64			73.4	693	26.6	253		
23-29	634	196			70.4	446	29.6	188		
May 30-June 5	888	65			78.4	696	21.6	192		
June 6-12	816	148			61.0	498	39.0	318		
13-19	401	128			70.3	282	29.7	119		
20-26	481	42			52.3	252	47.7	229		
June 27-July 3	729	78			38.4	280	61.6	449		
July 4-10	455	46			17.9	31	82.1	374		
11-17	450	144			4.9	22	95.1	428		
18-24	492	49				53,089	87.8	432	12.2	60
25-31	293	24					83.3	244	16.7	49
Aug. 1- 7	626						84.2	527	15.8	99
8-14	889	140					41.4	368	58.6	521
15-21	1,193	127					54.3	648	45.7	545
22-28	1,636	17							100	1,636
Aug. 29-Sept. 4	2,453	5							100	2,453
Sept. 5-11	2,594	131							100	2,594
12-18	3,292	447							100	3,292
19-25	3,357	430							100	3,357
Sept. 26-Oct. 2	5,693	0*							100	5,693
Oct. 3- 9	7,391	375							100	7,391
10-16	9,472	1,153	6.2	587					93.8	8,885
17-23	6,729	1,166	25.6	1,723					74.4	5,006
24-30	3,848	1,140	21.4	823					78.6	3,025
Oct. 31-Nov. 6	7,852	3,838	22.2	1,743					77.8	6,109
Nov. 7-13	7,613	1,087	44.3	3,373					55.7	4,240
14-20	3,870	205	16.1	623					83.9	3,247
21-27	6,071	428	44.0	2,671					56.0	3,400
Nov. 28-Dec. 4	3,791	403	58.0	2,199					42.0	1,592
Dec. 5-11	1,697	131	70.2	1,191	11.5	195			18.3	311
12-18	1,671	174	77.6	1,297	10.3	172			12.1	202
19-25	3,166	535	69.0	2,184	24.5	776			6.5	206
Dec. 26, 1971-										
Jan. 1, 1972	665	46	82.6	549	17.4	116				
TOTAL 1971	153,072	16,030		28,976		54,348		5,830		63,918
1972										
Jan. 2- 8	413	11	63.6	263	36.4	150				
9-15	1,389	138	88.4	1,228	11.6	161				
16-22	1,315	204	35.5	467	64.5	848				
23-29	833	1	100.0	833	0	0				
Jan. 30-Feb. 5	889	173	85.5	760	14.5	129				
Feb. 6-12	1,751	203	60.6	1,061	39.4	690				
13-19	5,878	676	35.5	2,087	64.5	3,791				
20-26	4,485	211	45.0	2,018	55.0	2,467				
Feb. 27-Mar. 4	2,061	44	47.7	983	52.3	1,078				
Mar. 5-11	564	22	59.1	333	40.9	231				
12-18	599	69	26.1	156	73.9	443				
19-25	12,737	534	21.2	2,700	78.8	10,037				
Mar. 26-Apr. 1	4,427	307	17.9	792	78.2	3,462	5.9	173		
Apr. 2- 8	3,230	76	9.2	297	85.5	2,762	5.3	171		
9-15	628	11	9.1	57	63.6	400	27.3	171		
				32,998						
TOTAL 1972	41,199			14,035		26,649		515		
GRAND TOTAL										
(Nov. 2, 1969 to										
Apr. 15, 1972)	348,372			46,739 ^{1/}		126,670 ^{1/}		9,997		161,966

^{1/} The late fall-run fish of late 1969 and early 1970 were included with the winter-run.

* No sampling - Percentages based on sampling during weeks before and after periods of no sampling.

□ Total run passing Red Bluff Diversion Dam.

Appendix Table 8

Summary of Adjusted Red Bluff Diversion Dam
King Salmon Counts by Run, November 2, 1969 through April 15, 1972

Name and year of run	Week first fish counted	Week last fish counted	Totals by run
Fall run, 1969	Nov. 2- 8, 1969	Dec. 28 1969- Jan. 3, 1970	22,401 ^{1/}
Combined ^{2/} late-fall and winter run	Nov. 2- 8, 1969	June 28- July 4, 1970	45,673 ^{1/}
Spring run, 1970	Apr. 19-25, 1970	July 12-18, 1970	3,652
Fall run, 1970	July 12-18, 1970	Dec. 27, 1970- Jan. 2, 1971	75,647
Late-fall run, 1970-71	Nov. 8-14, 1970	Apr. 11-17, 1971	16,741
Winter run, 1971	Jan. 31- Feb. 6, 1971	July 11-17, 1971	53,089
Spring run, 1971	Mar. 21-27, 1971	Aug. 15-21, 1971	5,830
Fall run, 1971	July 18-24, 1971	Dec. 19-25, 1971	63,918
Late-fall run, 1971-72	Oct. 10-16, 1971	Apr. 9-15, 1972	32,998
Winter run, 1971-72	Dec. 5-11, 1971	Apr. 9-15, 1972	27,908 ^{3/}
Spring run, 1972	Mar. 26- Apr. 1, 1972	Apr. 9-15, 1972	515 ^{3/}
GRAND TOTAL November 2, 1969- April 15, 1972			348,372

- ^{1/} Incomplete count. Part of the run occurred before November 2, 1969.
^{2/} Late-fall and winter runs not separated in late 1969 and early 1970.
^{3/} Incomplete count. Part of the run occurred after April 15, 1972.