RSF 90012

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, 19701/

Edited by R. S. Menchen Anadromous Fisheries Branch

SUMMARY

During 1970, the California Department of Fish and Game conducted its 18th annual king (chinook) salmon (<u>Oncorhynchus tshawytscha</u>) spawning stock inventory of the Sacramento-San Joaquin River System. Included in this inventory are fish that spawn primarily from September through December. Fish that spawn in the upper Sacramento River from January through July are not included.

Counts of carcasses, live fish, and redds were the base for spawning estimates in most Central Valley streams. Runs in the Sacramento River above Red Bluff were counted at Red Bluff Diversion Dam. Here salmon are sampled periodically the year round to classify them as to period of spawning.

During 1970, an estimated 243,000 (243,165) king salmon spawned in the Sacramento-San Joaquin River System as compared with an estimated 342,000 fish in 1969. Of these, 205,068 (84%) spawned in the Sacramento River and its tributaries from the American River north.

King salmon counts and population estimates were as follows:

	Fall Run	Spring Run	Combined
Sacramento, Main Stem	71,002	3,652	74,654
Northern Sacramento River Tributaries (North of Chico Creek)	13,730	3,500	17,230
Southern Sacramento River Tributaries (Chico Creek and South)	112,664	520	113,184
San Joaquin River Tributaries (Including the Mokelumne and Cosumnes rivers)	38,097	None	38,097
TOTALS	235,493	7,672	243,165

<u>1</u>/ Anadromous Fisheries Administrative Report No. 72-2. Submitted July, 1971. Fall-run estimates were made on all major streams and on most minor streams which have a fall run in most years. Some spring-run fish could not be separated from the fall-run fish and were included in the fall-run estimates.

Spring-run estimates are incomplete; they were made on only five streams.

Winter-run salmon spawn almost exclusively in the Main Stem Sacramento River above Red Bluff. None of these fish are included in the estimate; however, they are presented in Table 2 with the number of fall- and spring-run fish counted at the Red Bluff Diversion Dam.

INTRODUCTION

This report covers the 18th annual Central Valley king (chinook) salmon spawning-stock inventory. Estimates and counts were principally of fallrun fish; for a few streams, separate spring-run salmon stock estimates were included. Spring-run salmon were included in fall-run estimates for areas of the Feather River where an overlap in time of spawning made it impractical to separate fall- and spring-run stocks. Winter-run salmon began entering the upper Sacramento River just as the survey ended: these fish are almost entirely confined to the Main Stem of the Sacramento River. The winter-run spawning period extends from April into July; therefore few, if any, winter-run fish were included in the carcass counts. In 1970, the total spawning stock estimate of fall-run king salmon in the Central Valley was 243,000 which was a significant decrease over last year's (1969) estimate of 342,000 fish.

A summary of estimates of all streams for years 1953 through 1970 is presented in Table 1.

METHODS

Most population figures were obtained by counting dead salmon and estimating what percentage of the run was counted. Although this method may not give as accurate an estimate of salmon populations as the use of a counting station, it is at present the most economical method for large-scale statewide programs. Dependability and accuracy of this method is based primarily on two factors: (1) The relationship to tag-and-recovery studies on selected streams. In a tag-and-recovery study, fish are caught, tagged, and released near the downstream end of a spawning area. After the fish have spawned and died, as many carcasses as possible are recovered and the ratio of tagged-to-untagged fish is determined. (2) The availability of a well-trained observer who is familiar with methods of evaluation. The tag-and-recovery method has proven quite valuable as a method of training personnel to estimate the size of the run in a stream. After a man has learned from a tagging experiment the proportion of fish he can expect to see under certain conditions such as quantity of flow, amount of turbidity, and weather conditions, he is much better able to estimate the size of the run in a stream where no tagging has been done.

Carcasses were examined for fin marks and tags. They were cut in half to determine sex and completeness of spawning and to prevent recounting on subsequent trips. Aerial counts of redds and live fish were used in conjunction with carcass recovery for population estimates in some stream sections. Additional counts were made at fishways, hatcheries, and egg-collecting stations.

During the fall of 1970 the estimated numbers of fall- and spring-run salmon that spawned in the Sacramento River System above the mouth of Chico Creek are based on a combination of counts at the Red Bluff Diversion Dam, plus spawning-bed surveys and carcass counts.

The sole 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 fishways at the dam. These counts were adjusted for the day and night hours when no counts were made but when the fishway remained open. The adjusted counts were then separated into numbers of fall-, winter-, and spring-run salmon. This was accomplished by regularly sampling a portion of the salmon in the trapping facility adjacent to the east bank fishway. A salmon was assigned to a particular run by taking into account the time of year it passed the dam, plus estimating by its external appearance when the fish would have spawned. Gonads of some fish were also examined.

Spawning-bed surveys and carcass counts were used to estimate the number of salmon that utilized the Sacramento River System between Chico Creek and Red Bluff.

Regions 2 and 4 surveyed streams in their respective areas and prepared individual reports. The Anadromous Fisheries Branch (AFB) surveyed streams in Region 1, served as liason between the regions to assure uniformity of methods, and compiled the regional reports into this annual report. Spawning-stock surveys were conducted by 14 Department of Fish and Game personnel as follows: AFB, four; Region 2, eight; and Region 4, two. These figures do not include personnel at counting stations.

MAIN STEM OF SACRAMENTO RIVER (Figure 1)

by

Richard J. Hallock and John H. Rowell, Jr. Anadromous Fisheries Branch

Fall and Spring Run

Estimate Above Red Bluff

At the Red Bluff Diversion Dam, 107,166 salmon were counted from January 4, 1970 through January 2, 1971. When compensating, by interpolation, for periods under a week when counts were not made but when the fishway was open for fish to pass, the figure becomes 114,062. No adjustment was made for the period January 18-March 14, 1970 when high water prevented all counting. An additional compensation of 4.2% is made for nighttime hours when no counts were made (10 PM-5 AM) but the fishway was open. The adjusted count for the year 1970 is 118,853 (Table 2).

During 1970, 4,551 salmon were examined at the trapping facility in the east bank fishway at the Red Bluff Diversion Dam. Sampling revealed that the adjusted salmon count (118,853) consisted of 37,919 winter-, 3,652 spring-, and 77,282 fall-run salmon (Table 2). The spring- and fall-run counts are the total runs for 1970; the winter-run counts represent the tail end of the 1969-70, and early part of the 1970-71 runs.

Based on the five-year average, 1965-59, 85% of the salmon that spawn in the fall above Red Bluff do so in the Main Stem of the Sacramento River, and 15% in tributaries. Therefore, an estimated 68,794 salmon (65,142 fall- and 3,652 spring-run fish) are credited to the Main Stem above the dam in the fall of 1970. This includes 2,844 fall-run fish trapped at Kewsick Dam and spawned artificially at Coleman Hatchery. All spring-run salmon were arbitrarily assigned to the Main Stem Sacramento River even though small numbers are known to regularly enter several tributaries above Red Bluff. We lack data which would permit us to allot numbers of spring-run salmon to any one tributary.

The number of salmon estimated to have spawned in the Main Stem Sacramento River above Red Bluff in the fall of 1970 was broken down into numbers spawning in each of several river sections according to percentages of redds observed in these sections (Table 3). We made two aerial flights to obtain this information (October 26 and November 12, 1970).

Estimate Between Chico Creek and Red Bluff

Spawning stock surveys in the Sacramento River downstream from Red Bluff Diversion Dam began on October 23 and ended on November 19, 1970. The area surveyed was from Red Bluff Diversion Dam to Squaw Hill Bridge near Corning. Although some salmon normally spawn as far downstream as Hamilton City and below, the numbers that utilize gravels downstream from Squaw Hill Bridge have been small in recent years.

Near Red Bluff, flows in the Sacramento River during the fall of 1970 were far from optimum both for salmon spawning and carcass recovery. The river fluctuated between 7,000 and 8,000 cfs during October. However, in early November the flow increased to over 17,000 cfs and remained above 15,000 cfs between November 19 and the end of the month. The flow was over 56,000 cfs on November 28. The mean monthly flow of the Sacramento River near Red Bluff during December was over 32,000 cfs. The water was murky during a good portion of the spawning period, particularly in November and December. We counted 41 salmon carcasses between Red Bluff Diversion Dam and Squaw Hill Bridge during four survey These were made at key times (October 23, 28, and November 3 trips. and 19) during the early part of the spawning season. During aerial flights on October 26 and November 12, we counted 183 redds. Of these, 176 (96%) were between Red Bluff and Tehama Bridge and 7 (4%) were between Tehama and Squaw Hill bridges.

A total estimated 74,654 salmon spawned in the Main Stem Sacramento River between Chico Creek and Keswick Dam during the fall of 1970. This figure includes 71,002 fall-run salmon, of which 65,142 spawned above and 5,860 spawned below the Red Bluff Diversion Dam; and 3,652 springrun salmon, all of which spawned above the dam (Table 3). No estimate was made of the number of spring-run salmon that spawned below the dam, but some spring-run fish might have been included in this figure.

SACRAMENTO RIVER TRIBUTARIES NORTH OF CHICO CREEK (Figure 1)

Counts at the Red Bluff Diversion Dam were used to estimate the number of salmon that utilized the tributaries above the dam. Fifteen percent of the number counted, that spawn in the fall, was assigned to these tributaries (Table 4). For a more detailed description of methods refer to page 4. Battle Creek was the only stream surveyed above the dam; we combined the estimate from carcass recovery with the count at Coleman Hatchery to estimate the number of spawners in this stream.

Spawning-bed surveys and carcass counts were used to estimate the number of salmon that utilized tributary streams in the fall between Chico Creek and Red Bluff (Table 4). Estimates of salmon spawners in tributaries below Red Bluff include both spring- and fall-run fish where applicable.

Battle Creek and Other Tributaries Above Red Bluff Diversion Dam

Fall Run

Four survey trips were made on Battle Creek, November 5 through December 22, from Coleman National Fish Hatchery to the mouth. Carcass recovery conditions were good in the first three trips, but poor in the last trip.

A total of 332 carcasses was recovered. The run below the hatchery was estimated to be 3,320. Another 3,512 salmon entered Coleman Hatchery bringing the estimated run in Battle Creek to 6,832 fish (Table 4). An estimated 12,140 salmon spawned in the tributaries above Red Bluff Diversion Dam; hence an estimated 5,308 salmon spawned in the tributaries not including Battle Creek.

Spring Run

No estimate was made. Spring-run salmon normally spawn in Battle Creek, and some were observed in North Battle Creek near the mouth of Digger Creek during the spring and summer of 1970 by Region 1 personnel. Tagging experiments and observations have demonstrated that some springrun salmon spend the entire summer in the Sacramento River, then move into lower Battle Creek below Coleman Hatchery and spawn in late September. Any spring-run salmon that spawned in lower Battle Creek would have been included in the fall-run salmon estimate.

Antelope Creek

Fall Run

Three trips were made on Antelope Creek, November 6, 20, and December 14. We covered about 2-3/4 miles of stream from the USGS gaging station, at the canyon mouth, to 1 mile below Cone Grove Park. On November 6, we did not recover any carcasses or see any redds or live salmon. However, it was raining and the creek was quite murky on that date making observations very difficult. Clear weather and low, clear water in the creek on the last two trips made carcass recovery conditions much better, and as a result we recovered 24 carcasses and saw 103 live salmon. The fall run was estimated to be 400 fish (Table 4).

Spring Run

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

Dye Creek

Fall Run

One survey trip was made on Dye Creek. On November 18, 1970, the creek was covered from Highway 99-E upstream to 1-1/2 miles above the Shasta Boulevard crossing. No redds, carcasses or live salmon were observed. The water was low and clear, making carcass recovery conditions good.

A few young salmon were observed in Dye Creek in the spring of 1971. These may have been diverted through a ditch from Mill Creek or they could have resulted from spawners that entered Dye Creek after November 18. However, based on the available data, we have no estimate of salmon spawning in Dye Creek in 1970.

Spring Run

None.

Mill Creek

Fall Run

Eight survey trips were made on Mill Creek between October 31 and December 28, 1970. The area covered was from the Los Molinos Mutual Water Company's upper dam to the mouth of Mill Creek. Rain and high, muddy water resulted in poor salmon carcass recovery conditions during the second survey trip on November 10. On the remaining survey trips (October 31, November 14, 25, and December 10, 22, 28) the water was stable and clear.

We counted 83 carcasses and 399 live salmon. The run was estimated to be 690 fish (Table 4).

Spring Run

Three survey trips were made on upper Mill Creek (October 4, 11, and 17, 1970). The area covered was from 4-1/2 miles above the Ponderosa Way Road Bridge at Blackrock to the mouth of Little Mill Creek. Salmon carcass recovery conditions were good with clear skies and low, clear stream flows. However, the area was not readily accessible, and there were many deep pools which make the percentage of recovery very low. We recovered 66 carcasses and observed an additional 162 live salmon. It is estimated that the run totaled 1,500 salmon (Table 4).

Toomes Creek

Fall Run

One survey trip was made on Toomes Creek (Dry Creek) in 1970. On November 18 this stream was covered from 1-1/2 miles below to 2-1/2 miles above the Vina-Tehama Road crossing. Carcass recovery conditions were excellent as the water was low and clear.

No adult salmon were observed. However, in the spring of 1971, 72,000 young-of-the-year were sampled from the creek, so apparently some fish spawned in this creek after November 18. Based on the data available, we could not make an estimate of the number of salmon that spawned in Toomes Creek in 1970.

Spring Run

None.

Deer Creek

Fall Run

Three survey trips were made on Deer Creek, November 16 and December 9 and 16. The area covered was from the mouth to the County Road Bridge, which is about 2 miles above the Stanford-Vina Dam. Although the skies were clear when the surveys were made, the stream was muddy and higher than normal resulting in poor carcass recovery conditions.

We counted 30 carcasses and 38 live salmon. An estimated 500 salmon spawned in Deer Creek (Table 4).

Spring Run

During the latter part of September, 1970, two trips were made to upper Deer Creek in the vicinity of Lower Deer Creek Falls. One trip was made by Region 1 personnel and the other by Anadromous Fisheries Branch personnel.

A total of over 200 live fish and 30 carcasses were observed, and it is estimated that the run was 2,000 salmon (Table 4).

Singer Creek

Fall Run

No survey trips were made on Singer Creek in the fall of 1970; however, in the spring of 1971 a few salmon-of-the-year were rescued from this stream. Although no estimate of adult spawners was made, some spawning obviously did take place in the fall of 1970.

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

by

Jerry Staley and Richard Painter Region 2

Chico Creek

Fall Run

No estimate. (In some years a few fall spawners have been observed in the Chico area.)

Spring Run

An inventory was taken on October 1 and 14 to determine the number of spring-run salmon in Chico Creek. As in the past, observations were made by walking from Higgins Hole downstream to the Ponderosa Way Bridge. From the bridge downstream to where the road leaves the creek, we spotchecked the main pools and riffles. No salmon or signs of spawning activity was seen.

A few salmon were observed in Bidwell Park within the city of Chico in the spring of 1970. If these fish survived the summer they might have spawned in the lower reaches of the creek where no surveys were made.

Several of the upper pools of the Iron Canyon Fishway were completely filled with gravel during the late winter and early spring runoff, which may have prevented fish from migrating upstream beyond this point. It is felt however, that during the migration period the normal spring flows enable fish to move up Chico Creek without the aid of the fishway.

Some fingerling salmon were seen in lower Chico Creek in the spring of 1971, so either some spring-run or late fall-run salmon spawned in 1970.

Butte Creek

Fall Run

No estimate. (In some years a few fall spawners have been observed below the Highway 99 Bridge.)

Spring Run

Two survey trips were made on Butte Creek between the Centerville Powerhouse and the Paradise Highway Bridge. The first trip was made September 29-30 and the second October 15-16, 1970. Recovery conditions were good as the creek was low and clear.

We recovered 57 carcasses on 2 survey trips and observed 84 single and 11 multiple redds. Based on this information, it is estimated that 285 spring-run king salmon spawned in Butte Creek in 1970 (Table 5).

Feather River

Fall Run

Weekly survey trips were conducted from October 13 to December 21, 1970. During this period the recovery conditions were judged to be good. Flows were relatively constant.

We recovered 165 fin-marked fish during the spawning-stock survey period as follows:

Mark	Origin	Area released	Age	Males	Females	Grilse*	Total
Ad-RP	Feather R. Hatchery	hatchery	3 yrs	60	76	21	157
Ad-An	TT	Rio Vista	3 yrs	2	5	0	7
Ad-LV	Coleman Hatchery	hatchery	2 yrs	0	0	1	1

* Less than about 26 inches total length. These fish were not sexed.

Most of these marked fish were recovered in the area between Oroville and the Thermalito outfall; only 9 were recovered downstream from the outfall. The Ad-RP and the Ad-An marks each were from a group of 100,000 fish of the 1967 broodyear released as yearlings. The Ad-RP fish were released at the hatchery and the Ad-An marks at Rio Vista. The Ad-LV mark was from a group of 100,000 fish from the 1968 broodyear released at the size of 90/lb at Coleman Hatchery.

The estimated population of fall-run adult king salmon utilizing the Feather River from Oroville to Honcut Creek was 58,170 fish. Combining this figure with the 3,355 fish taken at Feather River Hatchery gives a total run of 61,525 fall-run salmon (Table 5).

Spring Run

No holding loss was observed in the river from June through October. No attempt was made to separate spring-run from fall-run fish during the survey trips. The number of spring-run king salmon taken at the Feather River Hatchery totaled 235.

The estimated total run of fall- and spring-run salmon in the Feather River was 61,760 fish (Table 5).

Yuba River

Fall Run

Flow conditions in the Yuba River were ideal for salmon spawning, but not for good carcass recovery during the fall of 1970. The recently completed New Bullard Bar Project by the Yuba County Water Agency began operation in 1970. Power generation at the New Narrows Powerhouse maintained flows in the Yuba River at from 3,000 to 3,800 cfs with only minor water level fluctuations throughout the salmon spawning period.

Because of higher than normal fall flows and turbid water, carcass recovery was difficult. The section of river between the Highway 20 Bridge and Daguerre Point Dam was particularly difficult to survey because willow thickets, fast currents, and multiple channels impaired access to areas where carcasses accumulate.

An estimated 56% of the 1970 run spawned upstream from the Marysville Dam site at Daguerre Point. Fish ladder operation problems at the Daguerre Point Dam may have been responsible for the higher than average percentage of salmon spawning below this point.

An aerial survey was made on November 10, and an estimated 945 redds were seen. Six survey trips were made above Daguerre Point Dam and seven below it. There were 1,377 carcasses recovered. It is estimated that 13,830 salmon spawned in the Yuba River (Table 5).

Not included in the above count were 78 carcasses with clipped dorsal fins which resulted from a plant of 100 marked ripe salmon imported from Nimbus Hatchery on the American River. The majority of these salmon died without spawning, a short time after planting. Apparently, the stress from handling and transporting of these fish was too great for them.

Spring Run

Extinct.

American River

Fall Run

A new survey method was started in the fall of 1970. Salmon carcasses were not cut in two as was done in previous years. Instead, we counted them as they were observed. The intention of the new program was to reduce the survey effort. We counted carcasses every two weeks, and it was assumed that only a small percentage of carcasses were recounted. Three trips were made this season. More trips were planned, but weather conditions prevented any surveys being made after December 15. Since the water was high for a good portion of the season, the percentage of carcasses seen was less than during a normal year.

We counted 1,234 carcasses from Nimbus racks to Watt Avenue Bridge. The estimated population in this section was 25,000 fish. An additional 3,131 carcasses were recovered upstream from the Nimbus racks. Based on an 85% recovery, we estimated that 3,680 salmon spawned between the racks and Nimbus Dam.

There were 8,629 fish that entered Nimbus Hatchery, bringing the total population estimate in the American River to 37,309 fish (Table 5).

Spring Run

Extinct.

Other Sacramento River Tributaries South of Chico Creek

Tributaries to Natomas East Drain and Natomas Cross Canal

Fall Run

No estimate.

No surveys were made of these streams this season because we lacked manpower to do so. There were adequate water flows for salmon in this area and it is entirely possible that some salmon spawned there.

Spring Run

None.

-13-

LOWER SAN JOAQUIN RIVER TRIBUTARIES (Figure 3)

by

Jerry Staley Region 2

Cosumnes River

Fall Run

Very heavy rains made survey conditions poor for most of the season. High flows during December washed many carcasses downstream, thereby lowering the number that could be recovered. At one time, during the period of high flows, the Michigan Bar guage recorded a flow of 5,000 cfs.

Three survey trips were made between Michigan Bar Bridge and Meiss Road. Altogether, 82 carcasses were counted and the run was estimated to be 600 fish (Table 6).

Spring Run

None.

Mokelumne River

An adult salmon trapping facility was installed in the Woodbridge fish ladder on October 21, and trapping was terminated on December 30, 1970.

Ninety-four salmon were trapped on the first day of operation. December 23 was the last day a fish was taken in the trap. For one month prior to October 21, the flow was 625 cfs. During the period of trapping it varied from 310 cfs on October 29 to 1,500 cfs on December 15. Thus there was always a good attraction flow for fish into the river system. When the trap was in operation all salmon ascending the ladder were counted and sexed. A total of 3,516 salmon were counted in this way, including 1,262 males, 766 females, 919 grilse, and 569 sex unknown. We trucked 548 salmon from Woodbridge to the Mokelumne River Spawning Channel.

I estimate that about 1,500 salmon used the ladder before the trap was installed or passed over the dam during flashboard removal. This figure is based on observations of fish going up the ladder before the trap was installed and number counted on the first day of trap operation. We counted 375 salmon redds in the river above Woodbridge during an aerial count on November 10. When the count at the trap is added to the estimate of fish which passed the dam but were not counted, an estimate of 5,000 salmon is obtained (Table 6).

Spring Run

Extinct.

UPPER SAN JOAQUIN RIVER TRIBUTARIES (Figure 3)

Ъy

Jerry Goertzen Region 4

The salmon spawning stock inventory for the Stanislaus, Tuolumne, and Merced rivers was conducted from November 9, 1970 to January 22, 1971.

Stanislaus River

Fall Run

An adult salmon trap on the Stanislaus River was installed and operated again this season by Region 4 personnel from Moccasin Creek Hatchery. The trap was located about 1/2 mile above Orange Blossom Bridge and operated from October 28 to November 19, 1970. In this period they trapped 1,079 fish of which 174 were females; of these, 109 were spawned and 515,372 eggs taken.

Salmon spawning activity in the Stanislaus River was observed as early as October 19, 1970. The heaviest spawning occurred in mid-November. On the first completed survey of the river (November 12-14), we counted 1,974 live salmon, 500 redds, and 184 carcasses. Most of these were below the salmon trap site. A few salmon entered the spawning area above the trap site before the trap was installed, but this area was not used much for spawning until the trapping was completed. Before the trap was removed, hundreds of salmon were seen milling around in pools below the trap. After it was removed, many of them moved into the upper area. Carcass recovery here was poor because, by the time the trap was removed and fish had completed spawning, the water was high, and heavy rains made dirt roads in this area impassable.

We found 30 unspawned female carcasses in the Stanislaus River during the survey period. All of these were in the near vicinity of the trap. Causes of this mortality were not known, but the delay at the trapping site seems to be a possibility. Pre-season flows were about 200 cfs at Orange Blossom Bridge. On October 26, 1970 the flow was lowered to 90 cfs to install the salmon trap. On October 31, the flow was raised to 150 cfs for the trap operation. When the trap was removed on November 20, the flow was increased to 500 cfs. By December 5, the flow was increased to 2,000 cfs because of heavy rains, and remained high until the end of February. No major loss of eggs or fry was experienced this season from water fluctuations.

Poaching was heavy again this season prior to November 19 when the water was low and clear. After the trap was removed the flow increased and poaching decreased. Warden activity during the critical period reduced the amount of poaching considerably.

Five fin-marked salmon, three RV, one LV, and one adipose, were recovered in the Stanislaus River this season--all at the trap site. The origin of these marks in unknown.

Five survey trips were made on the Stanislaus River, and 388 carcasses were recovered. The spawning population was estimated to be 9,297 fish, including 247 retained at the trap (Table 6). The spawning population, based on carcass recovery, was composed of 31% females of all sizes, 41% males, and 28% grilse (under 23-7/8 inches FL).

Spring Run

Extinct.

Planting of Yearlings

On November 23 and 24, 1970, 40,500 king salmon yearlings were planted at Knights Ferry Bridge. These were from Stanislaus River strain, 1969 brood, raised at Moccasin Creek Hatchery.

Tuolumne River

Fall Run

The salmon run in the Tuolumne River was later than usual this season because the flow from Don Pedro Dam was shut off during the early part of the migration. Lack of flow was due to a change in operation from Old Don Pedro Dam to New Don Pedro Dam. A 200 cfs release was begun on November 10, 1970, from the new dam. This flow was barely enough to allow the fish to ascend Dennet Dam at Modesto. Fish passage was improved somewhat by placing sand bags at both ends of the dam.

Because of construction problems in Don Pedro Reservoir, the water had to be kept at a low level. When heavy rains occurred in late November, the flow from New Don Pedro had to be increased to 3,000 cfs. The flow fluctuated for the rest of the season according to the amount of rainfall. By late December, flows dropped to 900-1,000 cfs which left carcasses scattered over adjacent gravel tailings and recovery of carcasses was good. "Market" poachers worked the river from the start of the run until after the peak of spawning. Fish and Game wardens, county sheriff's officers, and city police officers worked together to reduce the poaching problem.

Six survey trips were made on the Tuolumne River and 1,536 carcasses were recovered for an estimated population of 18,400 fish (Table 6). The spawning population, based on carcass recovery, was composed of 43% females, 40% males, and 17% grilse (males under 23-7/8 inches FL).

Spring Run

Extinct.

Merced River

Fall Run

During the months of October and November 1970, the flow in the Merced River was about 200 cfs. The flow was gradually increased to 300 cfs by December 9. The next day the flow was increased to 850 cfs where it remained until the spawning season was completed. Recovery conditions were good above Highway 59 Bridge, only fair from there downstream to Cowell Island, and poor below the Island because of gravel operations.

An artificial spawning channel, constructed by the Merced Irrigation District, went into operation for the first time this fall. It is located at the base of Crocker-Huffman Dam. A grill at the upper end of the channel was pushed out after the salmon had entered the channel. This allowed about 100 salmon to occupy the river above the dam. In addition to these, about another 100 fish spawned in the channel.

The estimated run for the Merced River this season was 4,800 fish--the largest since we started annual salmon inventories in 1953. I believe the causes for this increase were as follows: (i) planting in excess of 100,000 "yearlings" annually starting in 1967 (1965 brood fish), (ii) a significant increase in flows for salmon since 1967; and (iii) very low flow in the Tuolumne River during the early adult migration season which, when combined with the good flows in the Merced River, enticed fish from the Tuolumne to the Merced. I believe this third factor was responsible for the major part of the increase in the run this season. In the early part of the migration only a small number of salmon went into the Tuolumne River, presumably because of very low flows, yet there was a good run in the Merced at this time.

Bear Creek, a tributary to the Merced River, had a noticeable run of salmon this season. No survey was made, but there were many reports of salmon observed and caught in this stream. It is a small stream which flows through the city of Merced. Heavy rains increased the flow enough to encourage fish to enter it. Five survey trips were made on the Merced River and 788 carcasses were recovered. The estimated population was 4,800 fish, including the estimated 100 salmon that used the new spawning channel (Table 6) but not the 100 salmon that escaped into the Crocker-Huffman pool. Some of these fish were taken by fishermen and some apparently spawned, but outmigrant survival was believed to be near zero. The Merced River spawning population, based on carcass recovery, was composed of 24% females, 46% males, and 30% grilse (males under 23-7/8 inches FL).

Spring Run

Extinct.

Planting of Yearlings

Between November 10 and 20, 1970, 184,860 "yearling" salmon (1969 brood Stanislaus River strain) were planted in the Merced River at the Bettencourt Ranch near the Shaffer Bridge. Many of these fish were seen throughout the survey season from Crocker-Huffman Dam to Cressey. Most of them were believed to have migrated towards the sea by early February.



Figure 1. Upper Sacramento River and tributaries above Chico Creek covered during the 1970 king salmon spawning stock survey.



Figure 2. Sacramento River Tributaries from Chico Creek, south, covered during the 1970 King Salmon Spawning Stock Survey.



:

-20-

LIST OF TABLES

- TABLE 1 Sacramento-San Joaquin Valley King Salmon Spawning Stock Estimates, Major Streams, 1953-1970 (in thousands of fish).
- TABLE 2 1970 Red Bluff Dam Salmon Counts, Adjusted for Day and Night Hours When No Counts Were Made, and Separated Into Winter-, Spring-, and Fall-Run Fish.
- TABLE 3 Fall Spawning King Salmon Counts and Population Estimates, Main Stem of Sacramento River, 1970.
- TABLE 4 Fall Spawning King Salmon Counts and Population Estimates, Sacramento River Tributaries North of Chico Creek, 1970.
- TABLE 5 King Salmon Counts and Population Estimates, Southern Sacramento River Tributaries (Chico Creek and South) 1970-71.
- TABLE 6 Fall-Run King Salmon Counts and Population Estimates, San Joaquin River Tributaries, 1970-71.

.

Sacramento-San Joaquin Valley King Salmon Spawning Stock Estimates, Major Streams, 1953 - 1970 (In thousands of fish)

_	T	r	T		T					
Year	Main Stem Sacramento River	Clear Creck	Cow Creek	Bear Creck	Cottonwood Creek	Battle Crcek	Antclopu Creek	Nill Creek	Beer Creek	Okieo Creek
1953	408а 48с	- b	- b	- b	- b	16 b + 2 c	- b	10 b + 3 c	4 b i 2 c	- e
1954	276э 49с	- b	- b	- b	- b	12 b + 2 c	- b	7 b + 2 c	3 b i 2 c	- e
1955	231 л + 17 с	– b	- b	- b	- b	26 b + 2 c	- b	3 h + 3 c	* + 3 c	- r
1956	94 н • 7 с	– h	- b	- b	- b	21 b + 2 c	- b	0.9 b + 2 c	0.1 b + 3 c	- r
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 e
1958	128 a ∙ - c	1.6 b	3 b	0.2 b	0.6 h	29 b + - c	0.4 b	4 b+2 c	1.3 b + - c	1 e
1959	267 n + - c	0.8 b	0.7 b	* b	3 b	30 b + - c	- b	0.8 b + 1.6 c	* b + - c	0.2 e
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	0.8 b + - c	- P
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 ii
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 e
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 e
1965	103 м + - с	2 b	1 b	0.4 b	0.9b	9 b + - c	0.1 b	0.2 b + - c	0.2 b · - c	0.1 c
1966	115 а + - с	0.9 b	8 b	0.4 b	3b	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	193 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 4 - c	0.2 e
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 e /
Year	Butte Fe Greek R	ather iver	Yuba Am River	erican C River	osumnes Ho River	okelumne St River	anislaus Tu River	olumne Hero River Rive	ed T Others	Total
1953	-c 28 a	+ - c	6 b	28 b	2 b	2 b 3	15 b 4	5 b	- b 13	612
1954	-c 68 n	+ J c	5 b	29 b	5 b	4 b 2	12 b 4	0 b 4	b 12	505
1955	0.4 c 86 n	• 1 c	2 b	17 b	2 b	2 b	7.b 2	оь	-b 4	426
1956	3 c 18 a	• 2 c	5 b	6 b	1 b	0.5 b	5 b 2	6 b о.0	b 9	185
1957	2 с 10 в	• 0.5 c	1 b	8 b	1 b	2 b	4 b	8 b 0.4	b 0.2	120
1968	1 с 31 в	• 3 d	8 b	27 b	1 b	7 b	6 b 3	2 b 0.5	b 0.2	288
1959	0.5 c 76 s	• 4 d	10 b	31 b	0.0 b	2 b	4 b 4	6 b 0.4	b 1	474
1960	7 c 80 s	• 4 d	20 b	54 b	1 b	2 b	8 b 4	5 b 0.4	b *	484
1961	3 с 44 в	+ - c	9 b	25 b	- b	0.1 b	2 b	0.5 b 0.0	5 b 1	259
1962	2 с 19 в	+ - c	34 b	27 b	1 b	0.2 b	0.3 b	0.2 b 0.0	6 b -	257
1963	8 c 84 a	+ 0.6 c	37 b	41 b	1 b	0.5 b	0.2 b	0.1 b 0.0	2 b 0.5	303
1964	0.6 c 38 a	+ 3 c	35 b	59 b	2 b	2 b	4 b	2 b 0.0	4 b 1	322
1965	1 c 23 a	• 0.7 c	10 b	39 Ъ	0.8 b	1.3 b	2 b	3 b 0.0	9 b 0.2	198
1966	0.1 c 21 a	• 0.3 c	8 b	27 Б	0.6 b	0.7 b	3 b	5 b 0.0	4 b 0.3	197
1967	0.2 с 12 а	• 0.1 c	24 b	23 b	0.5 b	3 b 1	2 b	7 b 0.6	b -	182
1968	0.3 с 16 а	• 0.2 c	7 b	31 b	1.5 b	1.7 b 1	6 b	9 b 0.5	b 0.1	210
(1 1								. []	

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

b Fall-run only,

.

c Spring-run only.

d Hostly spring-run but may include some fall-run fish.

- No estimate.

* Less than 50 fish.

** Combined estimate of tributaries to Sacramento River above the Red Bluff Diversion Dam, except Battle Creek.

والمراكبين المعرور المجم ووالمح

1970 Red Bluff Dam Salmon Counts, Adjusted for Day and Night Hours When No Counts Were Made, and Separated Into Winter-, Spring-, and Fall-Run Fish

Węek	Adjusted salmon count	Number sampled	Winter percent	Run number	Spring percent	Run number	Fall : percent	Run number
(3,000)						·· ·· ··		
(1970)			100					
J.m. 4-10	941	40	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	3,889	0 *	100	3,889				
Apr. 5-11	6,011	360	100	6,011				
L2-18	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	1,010	12	243		
10-10	1 576	50	07 01	1,737	10	203		
17-23	740	71	01	1,230	19	290		
24-30		/1	44	334	06	426		
May 31-June 6	574	53	42	241	58	333		
1000 7-13	251	13	46	115	54	136		
14-20	448	25	76	141	6A	100		
1-1-20	497	12		101	04	207		
23-27	402	50	3	14	91	400		
June 28-July 4	357	8	38	136	62	221		
July 5-11	473	31			100	473		
12_18	780	13			100	140	50	140
1025	623	16			50	140	30	140
T T.I.	020	10					100	02.0
July 26-Aug.]	627	23					100	627
Aux. 2-8	744	116					100	744
9-15	1.655	132					100	1 455
16-22	1 053	144					100	1,000
20	1 000	22					100	1,053
2.3-29	1,009	2.1					100	1,00.7
Aug. 30-Sept. 5	1,457	35					100	1.457
Sept. 6-12	2,397	47					100	2.397
13-17	2.712	122					100	2 712
20-26	2,956	69					100	2,122
	-,						100	z , <i>yy</i>
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
B-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			<u>0</u> ن	2,168
Nov. 29-Dec. 5	2,739	0**	35	QEU			23	3 780
Dec. 6-12	1.692	0**	37	894			60 6 A	1 044
14_19	1.403	0**	10	140			03	2 944
20-26	1 206	70	10	147 147			90	1,344
line, $2 - 1 - 1 - 2$	±,270	70	72	744			58	152
(1071)	1 601	58	an	1 441			10	140
()	TTA 855	1 31	70	37 841 37 817		5 228	10	100 100
	***,000	TODE		979919		3,032		11,282

×

No sampling - Assumed to be all winter-run salmon. No sampling - Percentages used are for corresponding weeks in 1969. **

•

Fall Spawning King Salmon Counts and Population Estimates, Main Stem of Sacramento River, 1970

	Estimated recovery rate (percent)	Number of counting trips	Number of carcasses recovered	Percent redds in each area*	Estimated spawning population
Above Red Bluff Diversion Dam	-	<u>0</u>	<u>0</u>	100	68,794**
Keswick Dam Fish Trap	-	-	-	-	2,844***
Keswick Dam to A.C.I.D. Dam	-	-	-	2.7	1,781
A.C.I.D. Dam to Highway #44	-	-	-	15.4	10,156
Highway #44 to Upper Anderson Bridge	-	-	-	26.0	17,147
Upper Anderson Bridge to Balls Ferry	-	-	-	34.0	22,423
Balls Ferry to Jellys Ferry	-	-	-	12.6	8,310
Jellys Ferry to Bend Bridge	-	-	-	8.6	5,672
Bend Bridge to Red Bluff	-	-	–	0.7	461
Red Bluff Diversion Dam to Squar Hill Bridge	<u>א</u>	4	41	100	5,860
Red Bluff to Tehama Bridge	0.7	4	39	96	5,625
Tehama Bridge to Squaw Hill Bridge	0.7	4	2	4	235

Sacramento River Main Stem (Total)

74,654**

* Percent salmon redds observed between Red Bluff and Keswick Dam and Red Bluff and Squaw Hill Bridge on two airplane flights (10-26-70 and 11-12-70).

** Includes 3,652 spring-run salmon that spawned either in tributaries or main stem above Red Bluff.

*** Keswick Dam trap total for operation from 10-29-70 through 12-31-70.

Fall Spawning King Salmon Counts and Population Estimates, Sacramento River Tributaries North of Chico Creek, 1970

Streams or	Estimated recovery rate	Number of counting	Number of carcasses	Estimated	spawning p	opulation
stream section	(percent)	trips	recovered	Spring run	Fall run	Total run
Battle Creek						
Coleman Hatchery		-	-	none	3,512*	
Below Hatchery	10	4	332	no est.	3,320	
Total, Battle	Creek -	-	-	no est.		(6,832)
Other tributaries between Red Bluf	f					
and Keswick Dam	-	0	-	no est.	5,308	(5,308)
Total, tributa	ries - Red Bl	luff to Keswi	ick Dam (15%) [;]	**		12,140
Antelope Creek	6	3	24	no est.	400	(400)
)ye Creek	-	1	0	0	no est.	no est.
Mill Creek (lower)	12	8	83	0	690	(690)
" " (upper)	4	3	66	1,500	0	(1,500)
Toomes Creek	-	l	0	0	no est.	no est.
Deer Creek (lower)	6	3	30	0	500	(500)
" " (upper)	-	1	200***	2,000	0	(2,000)
Singer Creek	-	1	0	0	no est.	no est.
Total, tributa	ries - Chico	Creek to Red	l Bluff			5,090
TOTAL, NORTHER	N SACRAMENTO	RIVER TRIBUT	TARIES	3,500	13,730	17,230

* Battle Creek trap total for operation from 9-25-70 through 12-31-70.

** 5-yr. average (1965-69) of salmon spawning in tributaries other than Battle Creek above Red Bluff in the fall.

*** Live fish, vicinity of lower Deer Creek Falls (late September, 1970).

هنا

King Salmon Counts and Population Estimates Southern Sacramento River Tributaries (Chico Creek and South) 1970-71

24	Number of	Carcasses and			
stream or stream section	counting trips	skeletons counted	Spring run	spawning p Fall run	opulation Total run
Chico Creek	<u>2</u>	<u>0</u>	none	no est.	no est.
Butte Creek	2	<u>57</u>	285	<u>no est.</u>	285
Feather River (Total)	<u>11</u>	15,277	235	<u>61,525</u>	61,760
Thermalito Outlet	(끄)	(9,075)	no est.	(16,500)	
to Gridley Bridge	(10)	(5,554)	no est.	(37,400)	
Honcut Creek	(10)	(648)	no est.	(4,270)	
Oroville Hatchery	-	-	(235)	(3,355)	
Yuba River (Total)	<u>7</u>	1,377	Extinct	13,830	<u>13,830</u>
Hwy. 20 Bridge	(6)	(143)	Extinct	(1,430)	
Daguerre Pt. Dam Daguerre Pt. Dam to	(6)	(311)	Extinct	(6,220)	
Baldwin Gravel Pl.	(7)	(923)	Extinct	(6,180)	
American River (Total) Nimbus Backs to	<u>3</u>	4,365	Extinct	37,309	37,309
Carmichael Pumps	(3)	(1,103)	Extinct	(20,000)	
Watt Avenue Bridge	(3)	(131)	Extinct	(5,000)	
Above Nimbus Racks	(3)	(3,131)	Extinct	(3,680)	
Nimbus Hatchery	-	-	Extinct	(8,629)	
Natomas Drainage	=	<u>-</u>	none	<u>no est.</u>	no est.
TOTAL SOUTH SACRAMENTO RIVE	R TRIBUTARIES	21,076	520	112,664	113,184

Í

Stream or stream section	Number of counting trips	Number of carcasses and skeletons counted	Estimated spawning population
Cosumnes River (Total)	_3	92	600
Michigan Bar Bridge to Bridge House Bridge House to Meiss	(3)	(34)	(250)
Road Bridge	(3)	(58)	(350)
Mokelumne River			5,000**
Stanislaus River (TOTAL)	_5	388	9,297
Knights Ferry	(3)	(20)	(800)
Blossom Bridge	(5)	(184)	(4,600)
Blossom Bridge	(-)	-	(247)***
to Oakdale	(5)	(167)	(2,800)
Oakdale to Riverbank	(5)	(17)	(850)
Tuolumne River (Total)	_6	1,536	18,400
Rairden's Farm	(6)	(1,076)	(10,800)
Ferry Bridge	(6)	(292)	(4,200)
Reed Rock Plant	(6)	(168)	(3,400)
Merced River (Total)	_5	788	4,800
Highway 59 Bridge	(5)	(555)	(2,500)****
Highway 59 Bridge to Bettencourt's Ranch	(5)	(204)	(1,700)
Bettencourt's Ranch to Cressey Bridge (McSwain)	(5)	(29)	(600)
TOTAL, SAN TOAOUTN RIVER TRIBUT	ARIES	2.804	38,097

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

* No spring-run fish entered these streams.

** This figure is the count made at Woodbridge Dam plus an estimate for fish not counted.

*** These fish were trapped near Orange Blossom Bridge, and the fish were spawned and their progeny are being reared to yearling size at Moccasin Creek Hatchery.
**** About 100 of these fish utilized the Merced Irrigation District's spawning channel.