State of California
The Resources Agency
Department of Fish and Game

MERCED RIVER KING (CHINOOK) SALMON SPAWNING CHANNEL AND YEARLING REARING POND, ANNUAL REPORT FOR 1971-72 SEASON[1/]

by

Robert S. Menchen
Anadromous Fisheries Branch

SUMMARY

This is the second annual report of the Merced River king salmon spawning channel and yearling rearing pond operation. It covers the period from July 1, 1971, through June 30, 1972.

The facility was first operated in the fall of 1970. The purpose is to enhance the fall-run king salmon (Oncorhynchus tshawytscha) resource in the Merced River.

In the fall of 1971, 94 king salmon females entered the channel and deposited an estimated 476,623 eggs. No estimate of total outmigration was made. Periodic trapping accounted for 15,005 migrants. Toward the end of the downstream migrant season, an estimated 30,000 fish that had not migrated were held in the channel, and will be released as yearlings in the fall of 1972.

In October, 1971, 86,000 yearling salmon of Stanislaus River strain were released into the Merced River from the single rearing pond. A second rearing pond was added in February of 1972, increasing the rearing capacity to 200,000 yearlings (100,000 in each pond). A new crop of 289,000 Stanislaus River strain fry, hatched at Moccasin Creek Hatchery, was transferred to the ponds in March, 1972.

Thirty-four percent of this years spawners were from previous yearling releases, based on age analysis of 29 spawners.

[1/] Anadromous Fisheries Branch Administrative Report 73-3. Submitted February, 1973.

INTRODUCTION

The Merced River spawning channel facility was built by the Merced Irrigation District (MID) with part of the Davis-Grunsky Act funds received by the District for recreation and fish enhancement. The Davis-Grunsky Act contract is between the California Department of Water Resources and MID. The facility is operated by the California Department of Fish and Game with operating assistance and maintenance costs provided by MID. As of August, 1972, a fish culturist was assigned permanently with housing at the facility; relief assistance is provided through appropriate seasonal aid time. Prior to August, operations at the channel were handled with MID personnel plus Fish and Game seasonal aid time.

This is the second annual report for this facility, and covers the period of operation from July 1, 1971, through June 31, 1972. A summary of results of each year's salmon spawning channel and rearing pond operation is given in Table 1.

The channel is provided as a natural spawning area for fall-run king salmon. It had been completed in time for use by the 1970 fall spawning run. Two rearing ponds are in use, one first operated in April, 1971, and the other in March, 1972, for raising salmon to yearling age.

Table 1

King Salmon, Annual Summary--Merced River
Spawning Channel Facility 1970-71 and 1971-72 Seasons

Season	Estimated spawning females	Female prespawning mortality	Estimated egg deposition	Number outmigrants	Number yearlings planted	Fingerlings on hand June 30, 1972
1970-71	40	2	152,722	59,127	0	100,000*
1971-72	94	0	476,623	No. Est.	86,000*	319,000**

* Stanislaus River strain fish.
** Stanislaus River strain fish, except it includes 30,000 Merced River strain held in spawning channel.

LOCATION

The spawning channel is immediately downstream from Crocker-Huffman Dam on the Merced River, a tributary to the San Joaquin River, about 15 miles northeast of Merced (Figure 1). The channel is at the upper end of salmon migration in the Merced River.

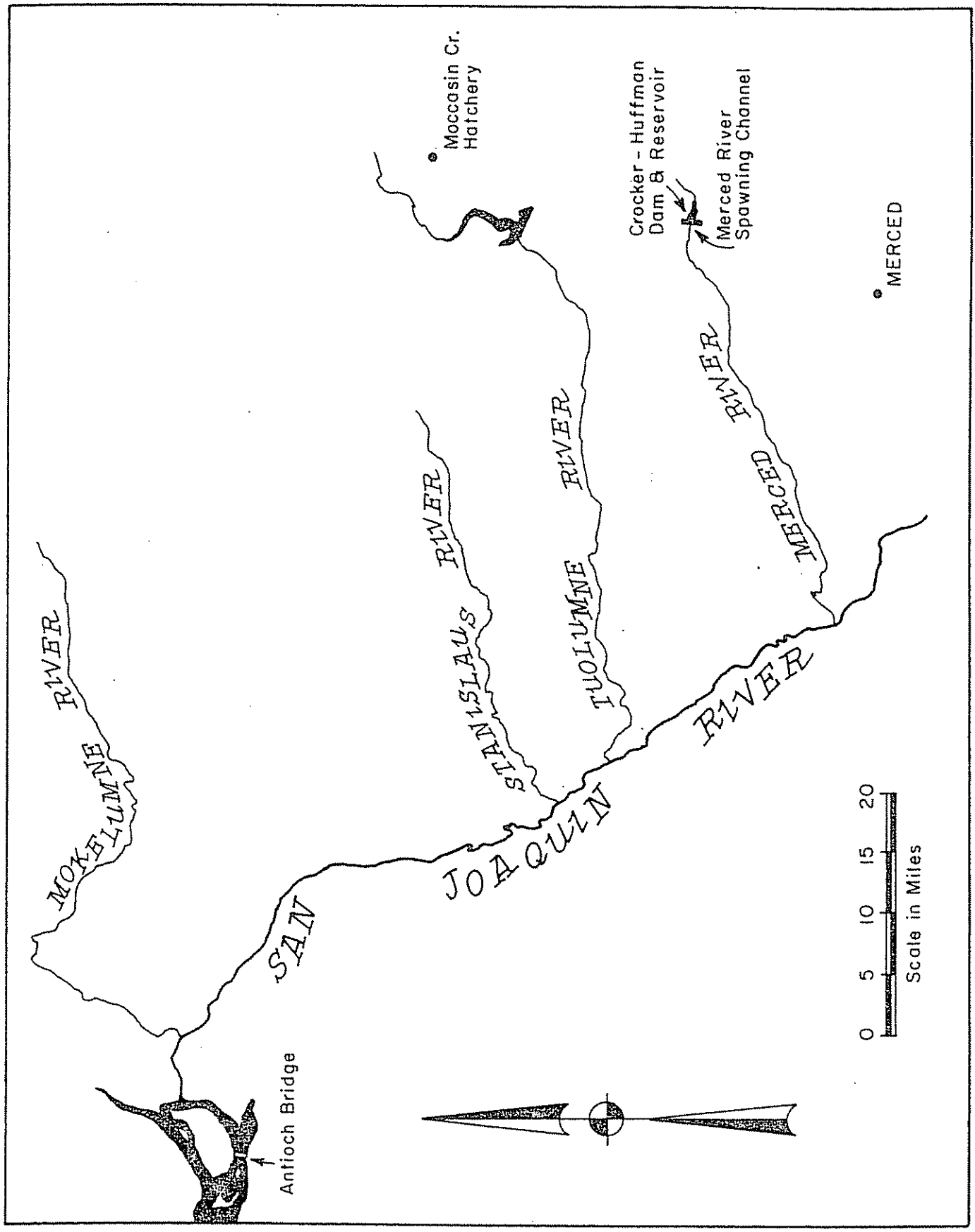

Figure 1. Map showing location of Merced River Spawning Channel.

PURPOSE

The purpose of the Merced River facilities is to rebuild the king salmon resource in the Merced River. Salmon had all but vanished from the river in the mid-1960's, chiefly because of low flows in the fall. In most years prior to 1968, fall flows were too low for successful spawning, and in some years flows were too low even to allow spawners to ascend the river. Under the Davis-Grunsky Grant Agreement, MID guarantees to release between 180 and 220 cfs in the river from November to April. Another factor contributing to salmon decline was the limited amount of spawning gravel. The spawning channel provides needed spawning area. The rearing ponds allow rearing of salmon to yearling size, increasing fingerling survival several fold.

DESCRIPTION OF THE SPAWNING CHANNEL

A detailed description of the spawning channel and rearing pond was given in the first annual report (1970-71 season). A summary of the operation is as follows:

The spawning channel is made up of one loop containing seven spawning sections and six resting pools (Figure 2). Fish enter the channel through a three-step fishway leading from the river about 100 yards downstream from Crocker-Huffman Dam.

Water is supplied directly from the reservoir backed up by Crocker-Huffman Dam. When the flow in the channel is about 200 cfs, spawning conditions are optimum i.e., average depth of 1.5 ft and average velocity of 2 ft per second. Sloping perforated plate screens are installed at the lower and upper ends of the channel after the spawning season is over. The lower screen is used when we want to trap or count downstream migrants; the upper screen prevents young salmon from leaving the channel at the upper end.

Two gravel rearing ponds are provided at the lower end of the channel (Figure 2). One pond was completed in the 1970-71 season and the other in the 1971-72 season. Each one has a capacity to rear 100,000 salmon to yearling size.

KING SALMON PROGRAM

Spawning Season--1971 Brood Year

On October 10, 1971, the flow for the spawning period was increased to 150 cfs from the summer flow of 70 cfs. The flow varied between about 130 and 160 cfs throughout the spawning period. On January 15, 1972, the flow was reduced to about 40 cfs where it was held until the outmigration was completed.

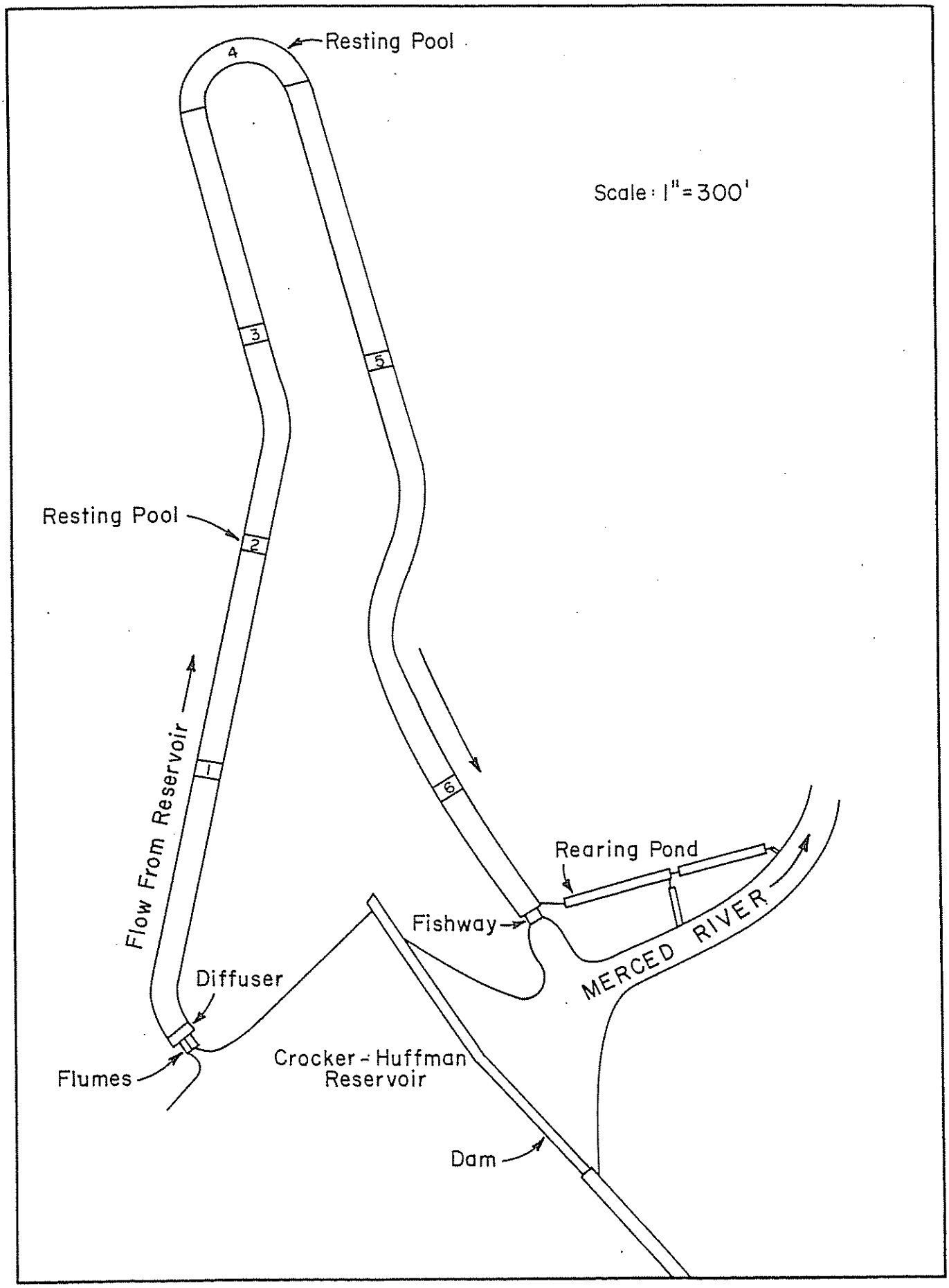

Figure 2. Merced River Spawning Channel

All adult salmon received in the channel came in of their own accord. No attempt was made to trap and count the fish as they entered. The number of spawners using the channel was estimated by recovering carcasses and counting redds. This was the same procedure used last season. A higher percentage of fish die prior to spawning if the fish are handled and sorted, and that is the reason for following the above procedure. Only two female salmon died without spawning in two seasons of operation.

The first salmon was seen entering the channel on October 11, and the first redd was started on October 12. As expected, most of the salmon entered the channel in November. The spawning peak was reached in early November and the last fish had completed spawning by January 5, 1972.

In the spawning period a daily record was kept of redd construction in the channel. The markers used last season were used again to locate each redd as it was being made. This information is being used to determine how successful gravel manipulation has been in places where salmon did not spawn in the past. For example, after the channel was completed in 1970, some of the spawning gravel was left with grooves running longitudinally to the channel. I believe this reduces the percolation of water through the gravel and discourages spawners from using these areas. Just before the 1971 spawning season started, the gravel was raked perpendicular to the length of the channel from pool #3 upstream to the headworks. The manipulation appeared to be successful, as several females spawned in parts of the improved section where none had spawned the previous season. In another section, just below resting pool #4, three small gravel berms were made one-half way across the channel, but these were not used. A large channel section below this pool was not used again this year, probably because the current is too slow. MID has plans for changing this section, but it probably will not be done until the spawning population has increased to a point that spawning area becomes critical.

As a result of the gravel work, spawning was spread out more than last season. Most spawning took place in the following areas:

1) between 200 and 260 ft down channel from the diffuser,
2) between 300 and 330 ft down channel from the diffuser,
3) between 290 and 320 ft down channel from resting pool #1,
4) between 355 and 390 ft down channel from resting pool #1,
5) between 120 and 140 ft down channel from resting pool #3,
6) between 365 and 405 ft down channel from resting pool #3,
7) downstream edge of resting pool #6, and
8) between 85 and 100 ft down channel from resting pool #6.

Carcass Recovery and Redd Count--1971 Brood Year

The channel was inspected for carcasses each day on a 5-day week basis. As many carcasses as possible were recovered by walking the full length of the channel. Then a small boat was used to float the channel to recover carcasses which had settled to the bottom of the resting pools. All carcasses were measured and cut open for examination. Condition of the gonads was noted, and the number of eggs retained was counted.

One hundred and forty-eight carcasses were recovered from the channel, of which 94 were females and 54 were males. Of the females recovered, none had died before spawning. The total number of eggs remaining in the body cavities of all the females was 709. The range per fish was from 0 to 300 with a mean of eight eggs per female, which is a very successful spawning.

I believe that 100% of the female carcasses were recovered because the females usually stay close to their redds until death. This makes them easy to recover when the channel is worked on a daily basis. The males on the other hand, tend to wander from redd to redd and a good number of them wander or float out of the channel without being recovered.

In the spawning period I could account for only 76 individual redds. There had to have been at least 94 because this number of spawned-out female carcasses was recovered. Some fish probably spawned on weekends when no observations were being made. New redds may have gone unobserved if they had been dug in the same areas where other fish had spawned earlier.

Estimated Egg Deposition--1971 Brood Year

We have no information on the fecundity of Merced River salmon. The Mokelumne River is the closest salmon stream where this information is available. Therefore, I applied length-fecundity data from 18 females from the Mokelumne in 1966, to the 94 females which used the Merced channel in 1971. All 94 females recovered were measured and the average size was found to be 28.73 inches fl.

The Mokelumne River data had been fitted to the linear model $y = a + bx$ by the least squares method where y = number of eggs, x = fork length in inches, and a and b are constants. The regression line which represented this sample was $y = -4,983.99 + 350.24$. This equation was applied to the mean size (28.73 inches fl) of the 94 females that spawned in the Merced channel and resulted in an estimated average of 5,078 eggs per female. When multiplied by 94, this average gives an estimated potential deposition of 477,332 eggs. Subtracting the unspawned eggs (709) gives an adjusted estimate of 476,623 eggs deposited.

Downstream Migrant Projection--1971 Brood Year

The method developed to capture downstream migrants from the spawning channel was only partly successful in the early part of the season. It was not until mid-season, after several changes were made, that the problems were finally solved.

On February 16, 1972, a sloping screen, for capturing downstream migrants, was installed across the fishway of the channel. Four, 4-inch diameter ports in the screen were used as fish bypasses. Hoses were attached to

the ports, which in turn terminated into two live boxes behind the screen, two hoses for each live box. From February 16, to March 20, two of the bypasses and one live box were operated to test efficiency of the method. The test was successful so on March 21, the other two bypasses and live box were activated.

After March 21, I thought 100% of the flow would be screened, However, about this time the weather became warm and algae became so abundant that the screen became plugged faster than it could be cleaned. As a result, most of the flow passed over the screen and an unknown number of fish along with it. A fyke net was placed below the screen for short periods to determine relative numbers of fish going over the screen (Table 2).

The algae problem was solved on May 11, by MID personnel. About 30 ft upstream from the end of the channel they buried two large perforated pipes in the gravel and laid two smaller open pipes on top of the gravel. All of these were covered with gravel high enough to make a dam across the channel. The perforated pipes passed the water, the open pipes passed the fish, and the dam held the algae back. From then on 100% of the water was screened and the screens needed to be cleaned only once a day.

By May 11, low flows and high water temperatures were such that young salmon in the lower river could no longer make a safe journey to the sea. I decided to hold the remaining fish in the channel until next fall. This was accomplished by plugging the entrance of the two open pipes in the gravel dam. I estimated 30,000 salmon remained in the channel at that time.

The number of juvenile salmon captured from February 16, through May 11 (Table 2), is a minimum count and does not reflect a percentage or a total outmigration. It is, at best, a crude index of important migration periods. No actual estimate of outmigration was attempted.

From February 16, through March 21, all of the 1,508 live fish captured in the channel were released in the river. After March 21, all fish captured (13,184) were transferred to the rearing pond.

Table 2

Disposition of Outmigrants Trapped in the Merced River Spawning Channel 1971-72 Season

Week	Outmigrants captured				Released to river	Transferred from channel to pond
	At screen alive	In fyke net alive	Dead	Total		
Feb. 16-22	232		2	234	232	
23-29	124		6	130	124	
Mar. 1- 7	530		6	536	530	
8-14	351		0	351	351	
15-21	271		1	272	271	
22-28	817		17	834		817
Mar. 29-Apr. 4	2,285	570	144	2,999		2,855
Apr. 5-11	714	-	7	721		714
12-18	1,562	-	14	1,576		1,562
19-25	804	40	6	850		844
Apr. 26-May 2	2,561	341	107	3,009		2,902
May 3- 9	2,739	-	3	2,742		2,739
10-11	751		1	752		751
TOTAL	13,741	951	314	15,006	1,508	13,184

REARING POND PROGRAM

1970 Brood Fish

This was the first brood of salmon to be reared to yearling size at the spawning channel, and it was highly successful. On October 12, 1971, 86,000 "yearlings" were released from the pond to the river. These were the result of an original transfer of more than 100,000 fry in April, 1971.

1971 Brood Fish

Because the rearing pond here was so successful the first year, another pond was added in early 1972. The second pond was ready in time to receive the 1971 brood fry. This pond was built below the first one, making a two pond series (Figure 2). On March 16, 1972, 289,000 fry were placed in the lower pond.

As the lower pond became crowded, fish were gradually transferred to the upper pond. Also, all fingerlings captured in the lower end of the spawning channel were placed in the upper pond.

Fish from both the 1970 and 1971 broods were the progeny of adults trapped and spawned in the Stanislaus River; they were hatched at Moccasin Creek Hatchery.

AGE ANALYSIS

In the 1971 spawning period, scale samples were taken from carcasses recovered in good condition to determine the percentage of fish with yearling nuclei to help evaluate the yearling program. Of twenty-nine samples collected, 34% showed a freshwater yearling growth period. A summary of age classes is as follows:

	Age				
	2	3	4		Total
Number by age	6	18	5	=	29
Percent by age	20.69	62.07	17.24	=	100
Number with yearling growth	1	6	3	=	10
Percentage with yearling growth				=	34.48

WATER TEMPERATURE

Water temperature in the channel was recorded with a 30-day recording thermometer located at the head of the channel. It was checked frequently with a hand thermometer to be certain the recorder was accurate.

Water temperatures were about optimum for salmon production again this year. For the months of July through June, temperatures ranged from 48 to 60 F. Monthly water temperature ranges were as follows:

Date	Range	Date	Range
July 1971	59-52	January 1971	50-48
August 1971	60-54	February 1972	54-48
September 1971	60-54	March 1972	55-49
October 1971	59-53	April 1972	57-51
November 1971	55-52	May 1972	58-52
December 1971	51-48	June 1972	58-52