The Resources Agency of California
Department of Fish and Game
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1960 KING SALMON SPAWNING POPULATION ESTIMATES FOR THE SACRAMENTO-SAN JOAQUIN RIVER SYSTEMS

Marine Resources Branch

INTRODUCTION

King salmon (Oncorhynchus tshawytscha) from California's Central Valley are the mainstay of valuable ocean and river fisheries. Management of salmon is related directly to their abundance as reflected by fishery landings and number of spawners.

Each year the number of Central Valley king salmon spawners is estimated. In addition, their spawning success, distribution on spawning areas, and stream conditions that affect both these important factors are determined and recorded. This information has been essential to evaluation of proposed water projects on salmon streams.

Fall-run stocks are most numerous, and an estimate of their number was the primary purpose of the work reported herein. Spring-run stocks were estimated but only as opportunity to do so occurred. No estimate of the spring-run stock has ever been made for the entire Central Valley. Due to overlap in spawning time of spring and fall-run salmon, a clear separation of the two was not possible except as indicated.

METHODS

Survey operations began September 26, 1960 and concluded on January 13, 1961.

Population estimates are primarily for fall-run fish. Spring-run salmon spawning in the Sacramento River and in the canyons of the Feather were not separated from fall-run fish because of overlap in spawning time. A separation between the two races of fish is normally made in the Feather River by a combination of aerial and ground counts; however, early fall-run spawning prevented observers from making separate estimates in 1960. Butte Creek estimates are for spring-run fish. Mill Creek counts are for both spring and fall-run fish. No estimates are made of the population size of winter-run salmon.

Size of the salmon run on upper Mill Creek was determined by counts made at Clough Dam. The Mokelumne River run was counted at Woodbridge Dam.

Salmon taken from Keswick Dam traps on the Sacramento River and from Battle Creek and spawned artificially at the U. S. Fish and Wildlife Service's Coleman Hatchery, as well as those taken from the American River and spawned at Nimbus Hatchery, are included in the totals.

Marine Resources Branch Administrative Report 62-1
John Mahoney - February 1, 1962

Population estimates were calculated primarily by counting dead salmon carcasses, estimating the percentage of the run that had been counted and then computing the spawning population for the stream or stream section. Factors affecting carcass recovery such as the physical characteristics of the stream, turbidity, volume of flow and number of survey trips, as well as information obtained from previous surveys, were considered in making the estimates. The population estimate for Butte Creek was made on the basis of tag and recovery data.

Two and three man crews conducted the salmon recovery work. All salmon carcasses found were cut in half with a machete to prevent recounting the same fish on subsequent trips, and to determine spawning success.

Aerial redd counts were used to estimate the spawning population in the Sacramento River downstream from Squaw Hill Bridge and in the Feather River canyons.

Live fish counts formed the basis for several of the estimates.

Figures 1, 2 and 3 indicate the streams which were surveyed during the season.

PERSONNEL

The survey was conducted by 15 men in two and three man crews. Marine Resources Branch provided 10, Region 2 three and Region 4 two.

SACRAMENTO RIVER

Spawning conditions on the Sacramento River during the 1960-61 season were good. Although reduction of flows from Keswick Dam resulted in the exposure of some redds the condition was not widespread or of long duration. Clear and relatively stable flows made conditions for carcass recovery excellent until mid-season when heavy rains resulted in tributary runoff which reduced stream clarity; however, since most of the spawning activities took place prior to this time carcass recovery was not severely affected.

A total of 16,339 fall-run king salmon was examined on the Sacramento River during the season. A total of 8,940 was trapped at Keswick Dam--8,904 of these were spawned at Coleman Hatchery and the remainder transferred to the U. S. Fish and Wildlife Service spawning channel on Mill Creek; 7,399 were carcass recoveries from the river between the A.C.I.D. Dam and Squaw Hill Bridge. The king salmon spawning population estimate for the Sacramento River is 232,940. This includes those fall-run salmon trapped at Keswick and spawned at Coleman Hatchery.

The population estimate for the area between Squaw Hill Bridge and the Highway 32 Bridge was based on aerial redd counts. Restricted water visibility prevented aerial redd counts downstream from the Highway 32 Bridge.

The 1960-61 estimate for the Sacramento River is smaller by 30,000 fish than the 1959-60 estimate. Since confidence limits are not available for these estimates the significance of the difference in estimates is not known.

TABLE 1

King Salmon Carcass Recovery and Population Estimates for the Sacramento River, 1960

River Section	No. of counting trips	No. of salmon counted*	Estimates spawning population
Keswick Dam Fish Trap	-	8,940	8,940
A.C.I.D. Dam to Highway 44 Bridge	13	2,962	60,000
Hwy. 44 Bridge to Upper Anderson Bridge	12	2,786	86,000
Upper Anderson Bridge to Ball's Ferry	12	1,179	36,000
Ball's Ferry to Jelly's Ferry	11	314	21,000
Jelly's Ferry to Iron Canyon	4	57	5,000
Iron Canyon to Red Bank Creek	4	10	2,000
Red Bank Creek to Tehama	6	84	10,000
Tehama to Squaw Hill Bridge	3	7	2,000
Squaw Hill Bridge to Highway 32 Bridge	-	-	2,000**
Highway 32 Bridge to Ord Ferry	-	-	No est.
Ord Ferry to Colusa	-	-	No est.
Totals		16,339	232,940

* Includes skeletons
** Estimates based on aerial redd counts

SACRAMENTO RIVER TRIBUTARIES NORTH OF BUTTE CREEK

Battle Creek

A total of 2,782 salmon carcasses was recovered during eight survey trips on Battle Creek between Coleman Station and the mouth. The king salmon spawning population estimate for the stream is 14,000.

A total of 9,605 king salmon entered Coleman Hatchery and were artificially spawned.

An estimated 200 salmon spawned in Gover Ditch.

Battle Creek king salmon spawning population for the season was estimated to be 23,795, somewhat lower than the 1959 season. There were virtually no late spawners in the stream compared to the two previous seasons.

Deer Creek

Low flows prevented entry of salmon in Deer Creek prior to mid-November, spawning occurred from that time until the end of December. Four counting trips were made on Deer Creek between Stanford-Vina Dam and the railroad bridge. A total of 57 carcasses was recovered during the survey. The king salmon spawning population estimate for Deer Creek is 800.

Mill Creek

Spring-run salmon counts over Clough Dam totaled 2,368, 800 more than the 1959 season. The fall-run count at Clough Dam was 67, only three more than the record low of the previous year. Rains again came too late to bring any number of fall salmon into Mill Creek.

Forty nine carcasses were recovered on four survey trips between Clough Dam and the mouth of Mill Creek. The salmon spawning population estimate for this area is 800.

Seventy three salmon spawned in the North Fork of Mill Creek in the experimental area operated by the U. S. Fish and Wildlife Service.

King salmon spawning population for Mill Creek during the year is estimated to be 3,308 fish.

Clear Creek

Six survey trips were made on Clear Creek, three between the sawmill, located a short distance below McCormick-Saeltzer Dam and the mouth, and three between the Highway 99 bridge and the mouth. One hundred sixteen carcasses were recovered in this section of the stream. The estimated king salmon spawning population is 900.

Several aerial surveys and one survey on the ground was made of the area upstream from McCormick-Saeltzer Dam; no salmon were observed nor was there any evidence that salmon had spawned in this area of the stream.

Other Tributaries North of Butte Creek

King salmon spawning populations of other tributaries north of Butte Creek for the 1960-61 season are: Cow Creek, 650; Cottonwood Creek, 350; Antelope Creek, 250; Bear Creek, 50 and Ash Creek, 10.

The canyon area of Chico Creek was surveyed once for spring-run spawning. Although several spring-run were observed, no population estimate was made. Reportedly some fall-run salmon spawners also entered Chico Creek.

Dye, Toomes and Thomes Creeks were surveyed but no salmon spawners were observed.

A summary of the survey data on streams north of Butte Creek is in Table 2.

TABLE 2

King Salmon Carcass Recovery and Population Estimates
for Sacramento River Tributaries North of Butte Creek, 1960

Stream	No. of counting trips	No. of salmon counted*	Estimated spawning population
Clear Creek	6	116	900
Cow Creek	3	26	650
Bear Creek	3	7	50
Ash Creek	2	1	10
Cottonwood Creek	3	34	350
Battle Creek (Coleman Station)	-	9,605	9,605
(below Coleman Stn.)	8	2,782	14,000
(Gover Ditch)	1	--	200
Stream total		(12,387)	(23,805)
Antelope Creek	4	17	250
Mill Creek (above Clough Dam, fall-run)	-	67	67
(above Clough Dam, spring-run)	-	2,368	2,368
(below Clough Dam, fall-run)	4	49	800
(North Fork, fall-run)	-	73	73
Stream total		(2,557)	(3,308)
Deer Creek	4	57	800
Totals		15,202	30,123

*Includes skeletons

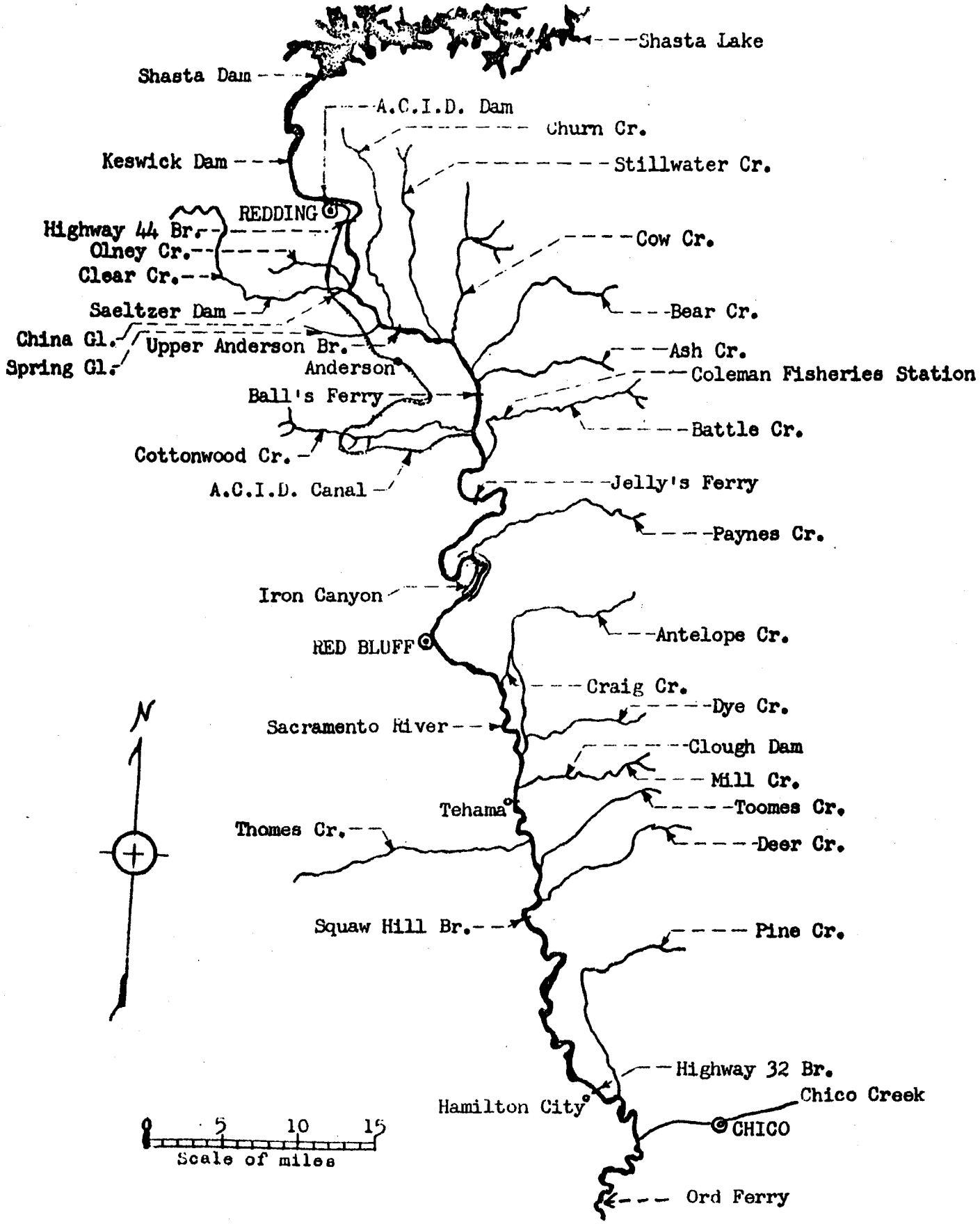

Figure 1. Upper Sacramento River and Tributaries Above Butte Creek Covered During the 1960 King Salmon Spawning Survey

SACRAMENTO RIVER TRIBUTARIES SOUTH OF CHICO CREEK

Butte Creek

The largest run of spring-run salmon ever recorded occurred on Butte Creek during 1960. Over 2,000 salmon entered the canyon area of the stream between DeSabla and Centerville Powerhouses during the spring period of high flows. By the end of July flows had receded and water temperatures increased to the danger level, within several weeks 2,000 salmon had died. Surveys by Departmental field crews were made periodically from this time through the spawning season. Live counts indicated that 100 salmon survived to spawn in this section of Butte Creek.

Below the Centerville Powerhouse stream conditions were much better. Releases of cool water in excess of 100 c.f.s. continued throughout the summer. This water is transported through a flume at high velocity from DeSabla, used for power generation at Centerville and released to the stream. Losses of spring-run salmon during the summer below Centerville were negligible.

In order to establish a firm basis for spawning population estimates in Butte Creek a tagging study was conducted prior to and during the spawning season. A separate report will be made describing this study. Based on tentative results of the tagging program the population of spring-run king salmon spawning between Centerville and the Paradise Skyway bridge is estimated to be 6,700. On the basis of this and subsequent tagging studies on Butte Creek it is probable that estimates for previous years will be adjusted.

Feather River

West Branch of the North Fork

One survey trip was made between the Yankee Hill Bridge and the mouth in search of spring-run salmon. No salmon or redds were observed, flows were extremely low.

South Fork to confluence with Middle Fork

No estimates; flows were again too low and temperatures too warm to maintain a spring salmon run.

North Fork and downstream to Oroville Dam site

The spawning population estimate based on aerial survey is 2,000 king salmon. The spawning population consists of both fall and spring-run salmon.

Middle Fork - Bald Rock Falls to confluence with North Fork

Based on aerial redd counts the spawning population of spring and fall-run salmon in the Middle Fork is 3,500, the bulk of these were spring-run fish. Flows were even lower than the previous year permitting easy access. Since much of the spawning in this stream is on deposits of gravel along the stream banks, the low flows restricted spawning and in some areas there was apparent overcrowding of fish.

Main stream - Oroville Dam site to Oroville

Spawning population estimate for this area is 500, based on aerial redd counts. This estimate includes fall and spring-run fish.

Main stream - Oroville to Honcut Creek

The bulk of the Feather River run, consisting of fall-run fish, spawns in this area. Flows were adequate for spawning although low flows during the early part of the season made some riffles unusable. Higher flows occurred after mid-season and reduced the effectiveness of carcass recovery; these flows also resulted in the shifting of sand bars above the mouth of Honcut Creek which resulted in the deposition of sand on completed redds. The damage is not believed to have been extensive.

Survey trips varied between seven and nine in the three sections of this portion of the stream. Most of the spawning as usual took place between Sutter Butte Dam and the Gridley Bridge in the area of most abundant gravel. Spawning between Oroville and Sutter Butte Dam and between Gridley and Honcut Creek dropped off some from the previous season. The angling pressure on the Oroville spawning beds was again extremely high; there were indications that angling pressure was also high in downstream areas prior to the closure of the season there.

The population estimate for king salmon in the Feather River between Oroville and the mouth of Honcut Creek is 77,300 based on a recovery of 5,726 carcasses.

The king salmon spawning population estimate for the entire Feather River system is 83,300, including both fall and spring-run fish.

Yuba River

For the first year since 1956 no major losses of unspawned salmon and no losses of redds occurred on the Yuba River. Large flows which attracted salmon into the stream and subsequent cutbacks which stranded them did occur but fish rescue work and timely additional flows averted all but a negligible loss.

Eight survey trips were made between the Blue Point Mine and the Highway 20 Bridge and seven trips were made between Highway 20 and the Baldwin gravel plant. A total of 3,327 carcasses was recovered. The spawning population is estimated to be 20,400. This is the largest run recorded on the Yuba River since the surveys were initiated.

American River

A total of 29,166 salmon entered Nimbus Hatchery and were artifidally spawned, which was a record in numbers of fish for Nimbus. A total of 3,368 salmon carcasses was recovered between Nimbus Dam and the hatchery racks and 3,268 between the racks and the Del Paso Gravel Plant. Spawning population estimate for the stream below the racks is 21,500, for the area between the dam and the racks, 3,700. The spawning population for the American River, including fish entering the hatchery, is 54,366 fish.

TABLE 3

King Salmon Carcass Recovery and Population Estimates
for Sacramento River Tributaries South of Chico Creek, 1960

Stream and/or stream section	No. of counting trips	No. of salmon counted*	Estimated spawning population
Butte Creek			
DeSabla Dam to Centerville Powerhouse	1	100	100**
Centerville Powerhouse to Paradise Rd.Br.	2	3,328	6,700***
Stream total		(3,428)	(6,800)
Feather River			
Middle Fork - Bald Rock to junction with North Fork	2	-	3,500****
North Fork and downstream to Oroville dam site	2	-	2,000****
West Branch of North Fork	1	-	No est.
Main Section			
Oroville Dam Site to Oroville	2	-	500****
Oroville to Sutter Butte Dam	9	553	6,900
Sutter Butte Dam to Gridley	8	4,405	62,500
Gridley to Honcut Creek	7	768	7,900
Stream total		(5,726)	(83,300)
Yuba River			
Blue Pt. Mine to Highway 20 Bridge	8	577	2,900
Highway 20 Bridge to Daguerre Pt. Dam	7	2,451	16,000
Daguerre Pt. Dam to Baldwin Gravel Pl.	7	299	1,500
Stream total		(3,327)	(20,400)
American River			
Nimbus Hatchery	-	29,166	29,166
Nimbus Dam to hatchery racks	-	3,368	3,700
Racks to Del Paso Gravel Plant	8	3,268	21,500
Stream total		(35,802)	(54,366)
Totals		48,283	164,866

* Includes skeletons
** Live count
*** Based on tag and recovery data
**** Based on aerial redd count

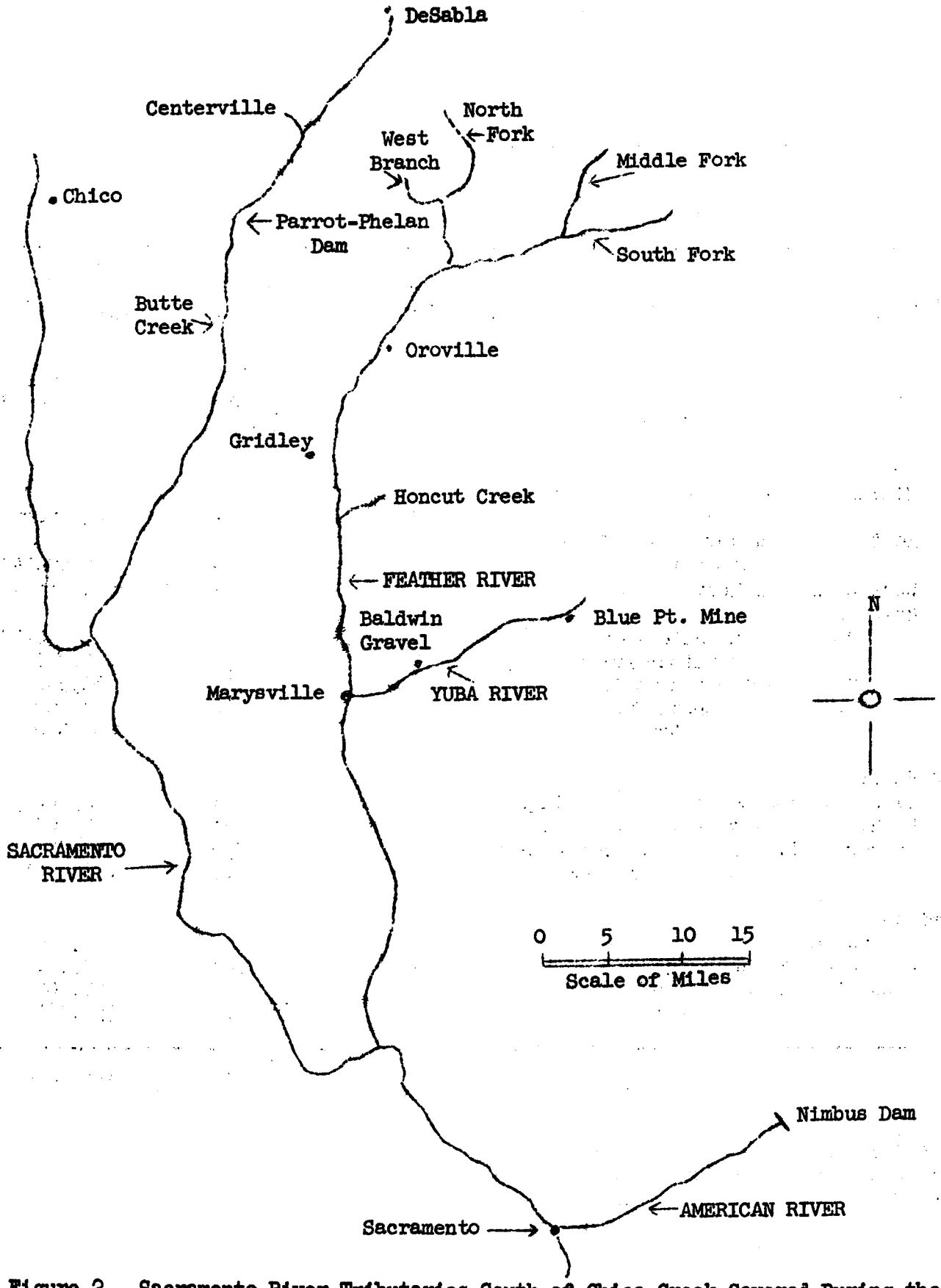

Figure 2. Sacramento River Tributaries South of Chico Creek Covered During the 1960 Spawning Area Survey

SAN JOAQUIN RIVER SYSTEM

Cosumnes River

November rains brought a rapid increase in Cosumnes River flow and as a result a number of salmon were able to enter the stream and spawn. Four survey trips were made between Michigan Bar and Sloughhouse. A total of 609 carcasses was recovered; the spawning population estimate is 1,400 king salmon.

Mokelumne River

The salmon run on the Mokelumne River is counted at the Woodbridge Counting Station at Woodbridge Dam. The station was opened on October 5 and closed on December 29. During that time 2,205 king salmon were counted through the ladder. The count of king salmon includes 152 which were transported to and spawned in the artificial spawning channel near Lancha Plana.

Fish kills of undetermined magnitude occurred in the Mokelumne again as a result of copper pollution from the Penn Mine area.

Tuolumne River

Six surveys were made of the stream between La Grange and the Reed Rock Plant at Waterford during the season. A total of 4,469 carcasses was recovered.

Encroachment of willows on the spawning areas increased considerably during the year and it was noted that in some areas salmon were having difficulty in spawning because of this growth. Flows for spawning were suitable throughout the season, although daily fluctuations occurred.

An estimated 45,000 king salmon spawned in the Tuolumne River in the 1960-61 season. However, during the period of egg incubation the flow at La Grange Dam was cut off which resulted in an estimated 50 to 70 percent loss of eggs and fry.

Stanislaus River

Flows in the Stanislaus River during the spawning season ranged from 75 to 100 c.f.s. which is more than twice the flow of the previous spawning season. As a result, spawning and migration conditions were much improved, although siltation from the sand and gravel operation in Oakdale again occurred this season.

A total of 1,937 carcasses was recovered by the survey crew during five trips. The spawning population of king salmon was estimated to number 8,300.

Merced River

Very low flows again occurred in the Merced River this season. Based on the recovery of 24 carcasses the spawning population was estimated to number 350 king salmon.

TABLE 4

King Salmon Carcass Recovery and Population Estimates
for San Joaquin River Tributaries, 1960

Stream and/or stream section	No. of counting trips	No. of salmon counted*	Estimated spawning population
Cosumnes River			
Michigan Bar to Bridgehouse	4	318	800
Bridgehouse to Sloughhouse	4	291	600
Stream total		(609)	(1,400)
Mokelumne River	-	2,205	2,205
Stanislaus River			
Goodwin Dam to Knights Ferry	5	377	1,261
Knights Ferry to Orange Blossom Br.	5	988	4,491
Orange Blossom Br. to Oakdale	5	312	1,248
Oakdale to Riverbank	5	260	1,300
Stream total		(1,937)	(8,300)
Tuolumne River			
La Grange to Rairden's Farm	6	3,358	33,580
Rairden's to Roberts Ferry Bridge	6	834	8,320
Roberts Ferry to Reed Rock Plant	6	277	3,100
Stream total		(4,469)	(45,000)
Merced River			
Shaffer Dam to Cressey Bridge	3	24	350
Totals		9,244	57,255

* Includes skeletons

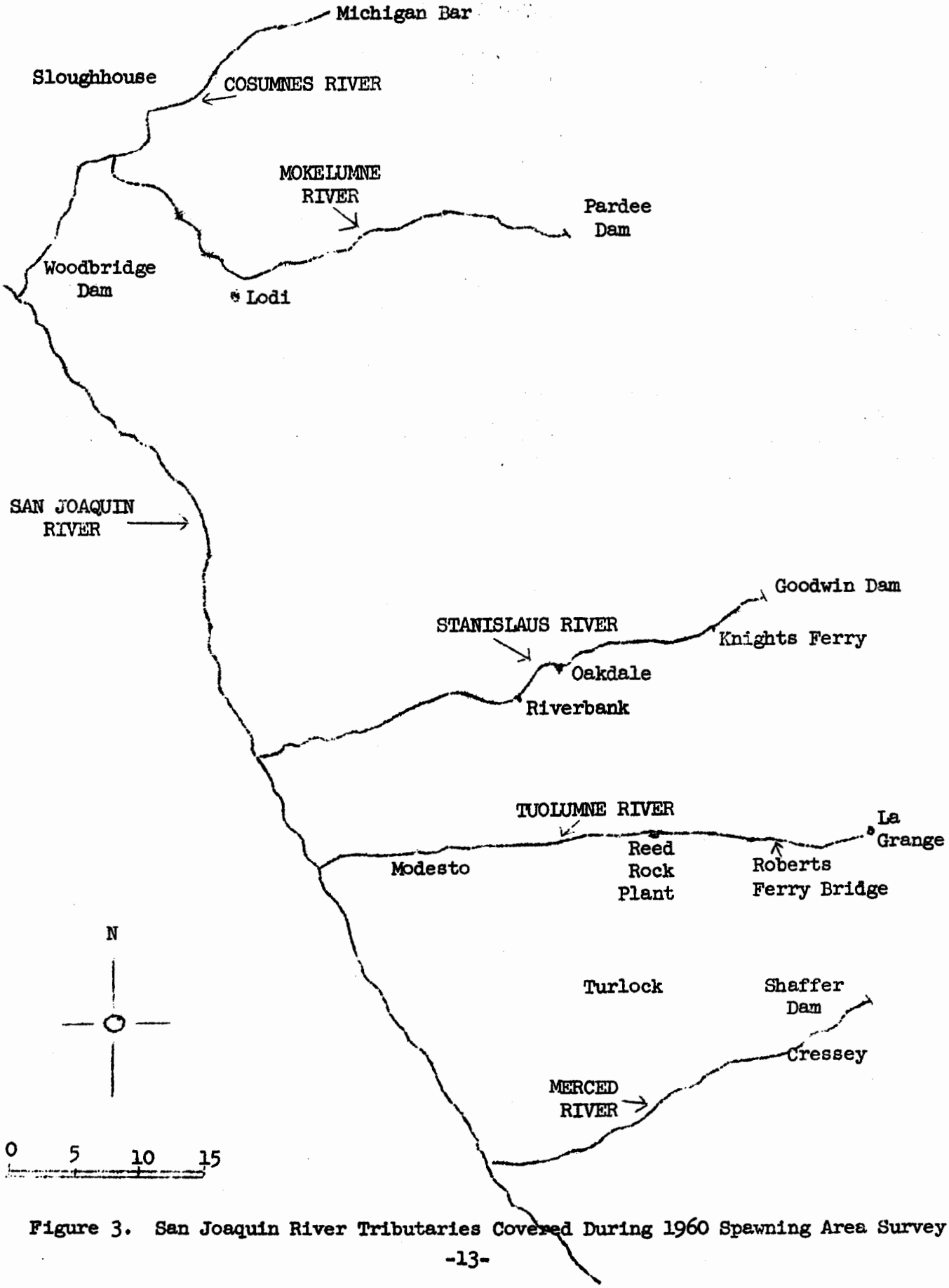

Figure 3. San Joaquin River Tributaries Covered During 1960 Spawning Area Survey

SILVER SALMON

Sixty three silver salmon entered Coleman Hatchery and were artificially spawned. Four silvers were counted through the Woodbridge Counting Station on the Mokelumne River.

SUMMARY

A survey of the king salmon spawning stocks in Central Valley streams was made in 1960.

Spawning population estimates were made primarily by counting salmon carcasses, estimating the percentage of the run counted and calculating the total population for each stream. Live fish counts and aerial redd counts, and in one stream tag and recovery data, were used.

A total of 89,068 king salmon, carcasses and live fish, were examined during the season. The 1960 king salmon spawning population of the Central Valleys was estimated to be 485,184, of which 427,929 spawned in the Sacramento River system and 57,255 in the San Joaquin River system.