KING (CHINOOK) SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1964 */

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Edited by
R. S. MENCHEN
Marine Resources Branch
California Department of Fish and Game

INTRODUCTION

This report covers the twelfth annual Central Valley king (chinook) salmon (Oncorhynchus tshawytscha) spawning stock inventory. Estimates and counts were made of principally fall-run stocks. For a few streams, separate spring-run salmon stock estimates were included. Some spring-run salmon were included in fall-run estimates for the Upper Sacramento and areas of the Feather River where an overlap in spawning period made it impractical to separate fall- and spring-run stocks. Early winter-run salmon enter the Upper Sacramento River just as this survey ends. Winter-run salmon are confined to the main stem of the Sacramento -- their spawning period extends from April into July. No estimate was made of their number, and few if any are included in these counts. In 1964, the total spawning stock estimate of fall-run king salmon in the Central Valley was 323,000 (323,248).

METHODS

Most population figures were obtained by counting dead salmon and estimating what percentage of the run was counted - the same method used in past inventories. Factors such as flow, turbidity, and number of counting trips, which would affect each estimate, were applied as dictated by past controlled tests.

Carcasses were examined for fin marks, tags, sex, and completeness of spawning, and were then cut in half to prevent recounting them on subsequent trips. Aerial counts of redds were a basis for population estimates in some stream sections. Additional counts were made at fishways, hatcheries, and egg-collection stations.

Regions 1, 2, and 4 conducted all surveys. Marine Resources Branch served as liaison between Regions to assure uniformity of methods, and compiled all pertinent results into this annual report. Spawning stock surveys were conducted by twelve Department of Fish and Game personnel, as follows: Region 1, four; Region 2, six; and Region 4, two. This does not include personnel at counting stations.

MAIN STEM OF SACRAMENTO RIVER
(Figure 1 and Table 1)
by
Millard Coots and Curt Hiser - Region 1

The survey began October 1, 1964 and ended abruptly December 18, 1964, due to heavy precipitation and turbid, high flows.

Fall-Run

During October, water releases from Keswick Dam were reduced from 7,450 to 5,000 cfs. In November, flows were reduced gradually to 3,900 cfs. The minimum flow reached 2,600 cfs. on December 4 and was maintained at that level until December 21. After this, flow was increased gradually to a peak of 45,000 cfs. on December 26. The water was fairly clear during the survey period, and carcass recovery conditions were good.

Although the level of Shasta Reservoir reached a record low, water temperatures in the river below Keswick Dam remained suitable for salmon spawning. Cold water releases from Whiskeytown Reservoir into Keswick Reservoir likely helped maintain river temperatures between 50 and 55 degrees F.

The method used to estimate the population in various sections of the main Sacramento River was based on carcass recoveries in an 86.5-mile section of river between Keswick Dam and Squaw Hill Bridge near Corning. Supplemental information was obtained from aerial flights on October 1 and December 17.

The ACID Dam's fishway at Redding was opened November 27, and the dam's flashboards were removed December 1. The river between ACID and Keswick Dams was surveyed once.

During early 1964, new information regarding salmon spawning habits was obtained in this area. On February 4, "Scuba" divers observed salmon spawning activity at depths down to 13 feet between Diestelhorst Bridge and Middle Creek

There were 2,984 salmon carcasses examined on the Main Stem Sacramento River between Keswick Dam and Squaw Hill Bridge. The estimated number of spawners was 148,000 (148,084); this includes 2,084 fish trapped at Keswick Dam and spawned at Coleman Hatchery.

Spring Run

No separate estimate of the spring run was made. An unknown but small number of spring-run fish may have been included in the fall-run count.

SACRAMENTO RIVER TRIBUTARIES NORTH OF CHICO CREEK
(Figure 1 and Table 2)
by
Millard Coots, Curt Hiser, and Terry Healey - Region 1

The survey period was from October 9 to December 18, 1964.

Salmon were observed spawning during February in most of these major tributary streams, including Chico Creek. Occurrence of February spawning, also observed in past seasons, appears to be increasing. Population estimates have not been made.

Clear Creek

Fall Run
This was the first year in which there were scheduled flow releases below Whiskeytown Dam. The release was 50 cfs. during October, then increased to 100 cfs. on November 1 and remained at this level throughout November and December.

Spawning fish were observed first on October 20. Spawning activity peaked during the last two weeks of November. A trap at the upper end of the tunnel-type fishway at McCormick-Saeltzer Dam collected nine salmon, all males, between October 30 and November 4. Gravel removal operations in the lower three miles of stream constitute a definite threat to salmon spawning habitat.

Three survey trips were made and 718 carcasses examined. An estimated 2,500 king salmon spawned in the lower seven miles of stream below the McCormick-Saeltzer Dam.

Spring Run
None.

Cow Creek

Fall Run
Unusually late fall rains delayed the fall run until about the first week of November. Fish spawned mainly in South Cow Creek up to the P. G. & E. power-house and a few miles up Little Cow Creek. Aerial observations on December 17 indicated spawning activity had passed its peak.

One survey trip was made and 190 carcasses recovered. The total run was estimated at 1,000 fish.

Spring Run
None.

Bear Creek

Fall Run
No carcasses were seen on November 25 when the creek was roily. A local resident reported a few fish were in this small stream. An estimated 50 fish spawned in Bear Creek.

Spring Run
None.

Cottonwood Creek

Fall Run
Salmon entered Cottonwood Creek following fall rains during the early part of November and appeared well distributed throughout all accessible portions of the drainage. Aerial observations on December 17 indicated very little spawning activity had occurred at that time.

Two survey trips were made on Cottonwood Creek and 285 carcasses examined from an estimated run of 3,450 fish.

Spring Run - No estimate made.

Battle Creek

Fall Run
Recovery conditions were good all season, with constant flows and clear water. The run was about the same as 1963 with considerable spawning in the lower four miles of this creek. Eight marked carcasses, all D-LV, were recovered.

Seven survey trips were made on Battle Creek, and 1,639 carcasses recovered. The Battle Creek run was estimated to be 16,000 (15,875) salmon including 3,875 fish taken at Coleman Hatchery.

Spring Run - No estimate made.

Antelope Creek

Fall-Run
Diversions and bifurcations in this creek limited access of spawners to the spawning areas.

No carcasses and only a few redds were noted during one ground survey. The total run was estimated to be 50 fish.

Spring Run - No estimate made.

Mill Creek

Fall Run
Low water and unseasonably late fall rains limited the fall-run migration into Mill Creek.

There were 19 carcasses recovered during one survey trip. An estimated 450 spawners entered, including 171 fish trapped and transported to the North Fork by the Fish and Wildlife Service.

Spring Run
There were 1,539 fish counted over the Clough Dam between February 25 and June 28. This was higher than in 1963.

Deer Creek

Fall Run
Lack of early fall rains and low flows limited the fall run. A few live fish were seen on November 24.

One survey trip was made on the lower five miles of Deer Creek on December 1, and 12 carcasses were examined from an estimated run of 100 fish.

Spring Run
A counting station was installed at Stanford-Vina Dam in time to count the spring run. There were 2,874 fish counted between February 19, 1964 and May 19, 1964. This was higher than in 1963. The upstream migration had ended by May 19.

Deer Creek (continued)

Spring Run (continued)

Two-hundred-ten (210) adult fish were rescued from lower Deer Creek in May when intolerably high water temperatures prevailed. Sixty of these were placed back into Deer Creek at Squaw Hill, and the remainder were released into the Sacramento River. Four survey trips were made in May below Stanford-Vina Dam, and 291 carcasses counted. A few of these were known to be winter-run fish. On June 22, an estimated 100 fish were still alive in the first pool below Stanford-Vina Dam.

Other Tributaries North of Chico Creek

Fall Run
No salmon were seen in Thomes Creek during a ground survey on November 30 and an aerial survey on December 17. Low water flows in the Sacramento River prevented spawners from entering Paynes Creek. Dye and Elder creeks were too low or intermittent for salmon to enter.

SACRAMENTO RIVER TRIBUTARIES - CHICO CREEK AND SOUTHWARD
(Figure 2, Table 3)
by
William White, Region 2

The spawning stock survey was carried out on the Sacramento River tributary streams from Chico Creek, south, from September 28, 1964 to December 18, 1964.

Chico Creek

Fall Run
No estimate was made.

A few late fall-run salmon were noted spawning near the town of Chico on February 15, 1965.

Spring Run
Survey conditions were very good. The water was clear and low. Most of the fish were seen in the upper spawning area near Higgins Hole (near Ponderosa Way)..

One survey trip was made but no carcasses recovered. The population of spring-run salmon in Chico Creek was estimated to be 100 fish. This estimate was base on counts of live fish.

Butte Creek

Fall Run - No estimate made.

Spring Run
Spawning took place between Centerville Powerhouse and the Paradise Highway Bridge. The flow from Centerville Powerhouse remained constant at about 130 cfs.

Butte Creek (continued)

Spring Run (continued)
during the spawning season. Recovery conditions were fair. Peak of spawning occurred about the beginning of the fourth week in September.

Two survey trips were made and 197 carcasses recovered. The population of spring-run salmon in Butte Creek was estimated to be 600 fish - a very poor run for this creek. This estimate was based on both aerial survey and carcass recovery.

Feather River

In 1964, the Feather River Hatchery Barrier Dam was a complete block to fish for the first time. All salmon trapped at this Dam were transported above Oroville Dam.

Fall Run
There were 5,952 fall-run salmon transported above Oroville Dam from the Feather River Hatchery Barrier Dam. Seven survey trips were made and 1,104 carcasses recovered. An estimated 32,400 salmon used the spawning area from the Barrier Dam downstream to Honcut Creek. The fall-run was estimated to be 38,400 (38,352) fish.

Spring Run
The spring-run consisted of 2,908 fish trapped at the Feather River Hatchery Barrier Dam and transported above Oroville Dam.

The total of the Feather River spring and fall runs was estimated to be 41,300 (41,260).

Yuba River

Fall Run
Recovery conditions were fair during most of the survey period.

Six survey trips were made and 2,554 carcasses examined from an estimated spawning population of 34,900 fish.

Spring Run - No estimate made.

American River

Fall Run
The number of carcasses recovered from the river during seven survey trips between Del Paso Gravel Plant upstream to the Nimbus Hatchery Racks was 8,582. The run in this section was estimated to be 34,300. Between the Nimbus Racks and Nimbus Dam, 3,534 carcasses were examined. Estimate of this run was 4,200 fish. Adding the 20,671 fish that entered Nimbus Hatchery to the above estimates, the total American River run was estimated to be 59,200 (59,171) salmon.

Spring Run - No estimate made.

Other Tributaries - Chico Creek, South

Tributaries to Natomas East
Drain and Natomas Cross Canal

Fall Run
Water Projects personnel made a survey of Secret Ravine, Miners Ravine, Antelope Creek, Auburn Ravine, Doty Ravine, and Coon Creek. The run in Secret Ravine and Auburn Ravine was greater than in 1963; the other streams were about the same.

One survey trip was made on these streams, and 71 carcasses examined from an estimated run of 1,000 salmon.

Spring Run
None.

LOWER SAN JOAQUIN RIVER TRIBUTARIES
(Figure 3 and Table 4)
by
William White, Region 2

The survey period was from November 30 to December 15, 1964.

Cosumnes River

Fall Run
Due to flood flows after the middle of December, only three runs were made, whereas seven were made in 1963. During the three survey trips on the Cosumnes River, 218 carcasses were examined from an estimated run of 2,200 salmon.

Spring Run
None.

Mokelumne River

Fall Run
At Woodbridge Dam 2,210 salmon were counted this season compared to only 481 in 1963.

Spring Run
None.

UPPER SAN JOAQUIN RIVER TRIBUTARIES
(Figure 3, Table 4)
by
Jerry Goertzen, Region 4

The survey period was from November 9 to December 22, 1964.

Stanislaus River

Fall Run
The run this season was the best since 1960. Due to late December floods, this survey was necessarily completed earlier than in past seasons. During most of the survey, flows ranged between 150 and 200 cfs. Good visibility prevailed most of the time except below the Standard gravel plant near Oakdale where the river was muddy due to gravel operations.

Aquatic weeds were a problem again this season, but the flood flows of 40,000 cfs. on December 24 may have washed much of the weed growth from riffles.

Three survey trips were made on the Stanislaus River and 294 carcasses recovered from an estimated run of 3,700 fish.

Spring Run: None

Tuolumne River

Fall Run
Flows were generally high during most of the season. They ranged from 550 to 2,500 cfs. before the Christmas flood, but daily fluctuations were not too great. Water visibility was fair most of the time. Spawning took place in deep riffles again this season. No redds were observed in shallow water, which is unusual in this type spawning stream. The survey was completed at the end of four runs when the flow reached 7,000 cfs. This occurred late in December, but peak of the run was over by this time.

Four survey trips were made on the Tuolumne River and 117 carcasses examined from an estimated run of 2,100 fish.

Spring Run: None

Merced River

Fall Run
Flows were high at the start of the season, dropped to a very low level at mid-season, and increased again after heavy rainfall in late December. Water visibility was poor due to construction work at Exchequer Dam. Only two survey trips were made, but spawning seemed to be completed by the end of the second trip.

Approximately 1,250,000 eyed king salmon eggs from Nimbus Hatchery were planted in the Merced River on December 1, 1964. Sac fry were observed emerging from the gravel at all planting sites on December 14 and 15.

Two survey trips were made on the Merced River and three carcasses examined. Based on live fish, carcass and redd counts, the run was estimated to be 35 fish.

Spring Run: None.

TABLE 1

FALL-RUN* KING SALMON COUNTS AND POPULATION ESTIMATES FOR THE MAIN STEM OF THE SACRAMENTO RIVER, 1964

River Section	Stream Miles	Number Counting Trips	Number Carcasses and Skeletons Counted	Estimated Spawning Population
Keswick Dam Fish Trap		-	-	2,084 **
Keswick Dam to A.C.I.D. Dam	4.5	1	10	500
A.C.I.D. Dam to Hwy. 44 Bridge	4.0	7	1,044	34,000
Hwy. 44 Bridge to Upper Anderson Bridge	10.5	7	985	55,000
Upper Anderson Bridge to Ball's Ferry	8.0	7	585	18,000
Ball's Ferry to Jelly's Ferry	9.5	7	238	22,000
Jelly's Ferry to Iron Canyon (Bend Br.)	8.5	6	47	5,000
Iron Canyon (Bend Br.) to Red Bluff	12.0	3	33	6,000
Red Bluff to Tehama Br.	15.0	2	22	4,000
Tehama Br. to Squaw Hill Bridge	14.5	2	20	1,500
TOTAL, SACRAMENTO MAIN STEM	86.5		2,984	148,084

* A few spring-run fish probably were included in the estimates.

** Trap counts. This count includes fish taken from November 27, 1964 to February 24, 1965.

TABLE 2

KING SALMON COUNTS AND POPULATION ESTIMATES
NORTHERN SACRAMENTO RIVER TRIBUTARIES (NORTH OF CHICO CREEK)
1964

Stream and/or Stream Section	Number of counting trips	Carcasses and Skeletons Counted	ESTIMATED SPAWNING POPULATION		
			Spring Run	Fall Run	Total Run
CLEAR CREEK	3	718	None	2,500	2,500
COW CREEK	1	190	None	1,000	1,000
BEAR CREEK	1	0	None	50	50
COTTONWOOD CREEK (TOTAL)		285	No Est.	3,450	3,450
North Fork	(2)	(7)	No Est.	(250)	
Middle Fork	(2)	(274)	No Est.	(2,700)	
South Fork	(2)	(4)	No Est.	(500)	
BATTLE CREEK (TOTAL)		1,639	No Est.	15,875	15,875
Coleman Hatchery		-	None	(3,875) (a)	
Below Hatchery	(7)	(1,639)	No Est.	(12,000)	
ANTELOPE CREEK	1	0	No Est.	50	50
MILL CREEK (TOTAL)		19	1,539	450	1,989
Main Stem	(1)	(19)	(1,539) (b)	(279)	
North Fork		-	-	(171) (c)	
DEER CREEK	1	12	2,874 (d)	100	2,974
TOTAL NORTHERN SACRAMENTO RIVER TRIBUTARIES		2,863	4,413	23,475	27,888

(a) Trap counts from October 8, 1964 to January 10, 1965.

(b) Ladder counts; spring run began on Feb. 25, 1964 and ended on June 28, 1964.

(c) Transferred from a trap in Mill Creek.

(d) Ladder counts; spring run began on February 19, 1964 and ended on May 19, 1964.

TABLE 3

KING SALMON COUNTS AND POPULATION ESTIMATES
SOUTHERN SACRAMENTO RIVER TRIBUTARIES (CHICO CREEK AND SOUTH)
1964

Stream and/or Stream Section	Number of counting trips	Carcasses and Skeletons Counted	ESTIMATED SPAWNING POPULATION		
			Spring Run	Fall Run	Total Run
CHICO CREEK	1	None	100	No Est.	100
BUTTE CREEK	2	197	600	No Est.	600
FEATHER RIVER (TOTAL)		1,104	2,908	38,352	41,260
Oroville Fish Trap		-	(2,908)	(5,952)	
Oroville Br. to Sutter Butte Dam	(7)	(226)	-	(7,500)	
Sutter Butte Dam to Gridley	(7)	(760)	-	(19,000)	
Gridley to Honcut Creek	(7)	(118)	-	(5,900)	
YUBA RIVER (TOTAL)		2,554	No Est.	34,900	34,900
Blue Pt.Mine to Hwy. 20 Br.	(6)	(315)	-	(4,000)	
Hwy. 20 Br. to Daguerre Pt.Dam	(6)	(1,535)	-	(19,200)	
Daguerre Pt. Dam to Baldwin Gr. Pl.	(6)	(704)	-	(11,700)	
AMERICAN RIVER (TOTAL)		12,116	No Est.	59,171	59,171
Nimbus Hatchery		-	-	(20,671)	
Nimbus Dam to Hatchery Racks		(3,534)	-	(4,200)	
Hatchery Racks to Del Paso Gr. Pl.	(7)	(8,582)	-	(34,300)	
NATOMAS DRAINAGE	1	71	None	1,000	1,000
TOTAL SOUTHERN SACRAMENTO R.TRIBUTARIES		16,042	3,608	133,423	137,031

TABLE 4

FALL-RUN* KING SALMON COUNTS AND POPULATION ESTIMATES
FOR SAN JOAQUIN RIVER TRIBUTARIES, 1964

Stream and/or Stream Section	Number counting trips	Number carcasses & skeletons counted	Estimated spawning populatio
COSUMNES RIVER Michigan Bar to Sloughhouse	3	218	2,200
MOKELUMNE RIVER	-	-	2,210 **
STANISLAUS RIVER Goodwin Dam to Riverbank	3	294	3,700
TUOLUMNE RIVER La Grange to Reed Rock Plant	4	117	2,100
MERCED RIVER Shaffer Dam to McSwain Br.	2	3	35
TOTAL, SAN JOAQUIN TRIBUTARIES		632	10,245

* No spring-run fish entered any of these streams this year.

** Ladder count. Count began October 7 and ended December 22, 1964. A few fish went over the dam before count began.

TABLE 5

SACRAMENTO-SAN JOAQUIN KING SALMON SPAWNING STOCKS
1953 - 1964

(in thousands of fish)

Year	Sacramento Valley	San Joaquin Valley	GRAND TOTAL Central Valley	STATUS * (% of Base No.)
1953	513	84	597	119
1954	412	75	487	97
1955	369	31	400	80
1956	153	12	165	33
1957	102	15	117	23
1958	237	46	283	57
1959	421	52	473	95
1960	415	56	471	94
1961	247	2	249	50
1962	252	2	254	51
1963	301	2	303	61
1964	313	10	323	66
12-year Avg.	311	32	344	69

Source: MRB, Salmon/Steelhead Program, Sacramento.

* Base number is 500,000 fall-run salmon. This quantity will fully utilize available spawning areas. Other runs spawn at different times.

TABLE 6

SACRAMENTO-SAN JOAQUIN VALLEY KING SALMON
SPAWNING STOCK ESTIMATES, MAJOR STREAMS 1953-1964
(in thousands of fish)

Year	Main Stem Sacramento River (a)	Battle Creek(b)	Butte Creek(c)	Feather River(a)	Yuba River(b)	American River(b)	Cosumnes River(b)	Mokelumne River(b)	Stanislaus River (b)	Tuolumne River(b)
1953	408	16	-	28	6	28	2	2	35	45
1954	276	12	-	71	5	29	5	4	22	40
1955	231	26	1	87	2	17	2	2	7	20
1956	94	21	3	20	5	6	1	0.5	5	6
1957	68	5	2	11	1	8	1	2	4	8
1958	128	29	1	35	8	27	1	7	6	32
1959	267	30	0.5	80	10	31	0	2	4	46
1960	233	24	7	83	20	54	1	2	8	45
1961	149	20	3	41	9	25	-	0.1	2	0.5
1962	139	13	2	19	34	27	1	0.2	0.3	0.2
1963	146	17	5	35	37	41	1	0.5	0.2	0.1
1964	148	16	0.6	41	35	59	2	2	4	2
AVERAGE	191	19	2	46	14	29	2	2	8	20

(a) mostly fall-run
(b) fall-run only
(c) spring-run only

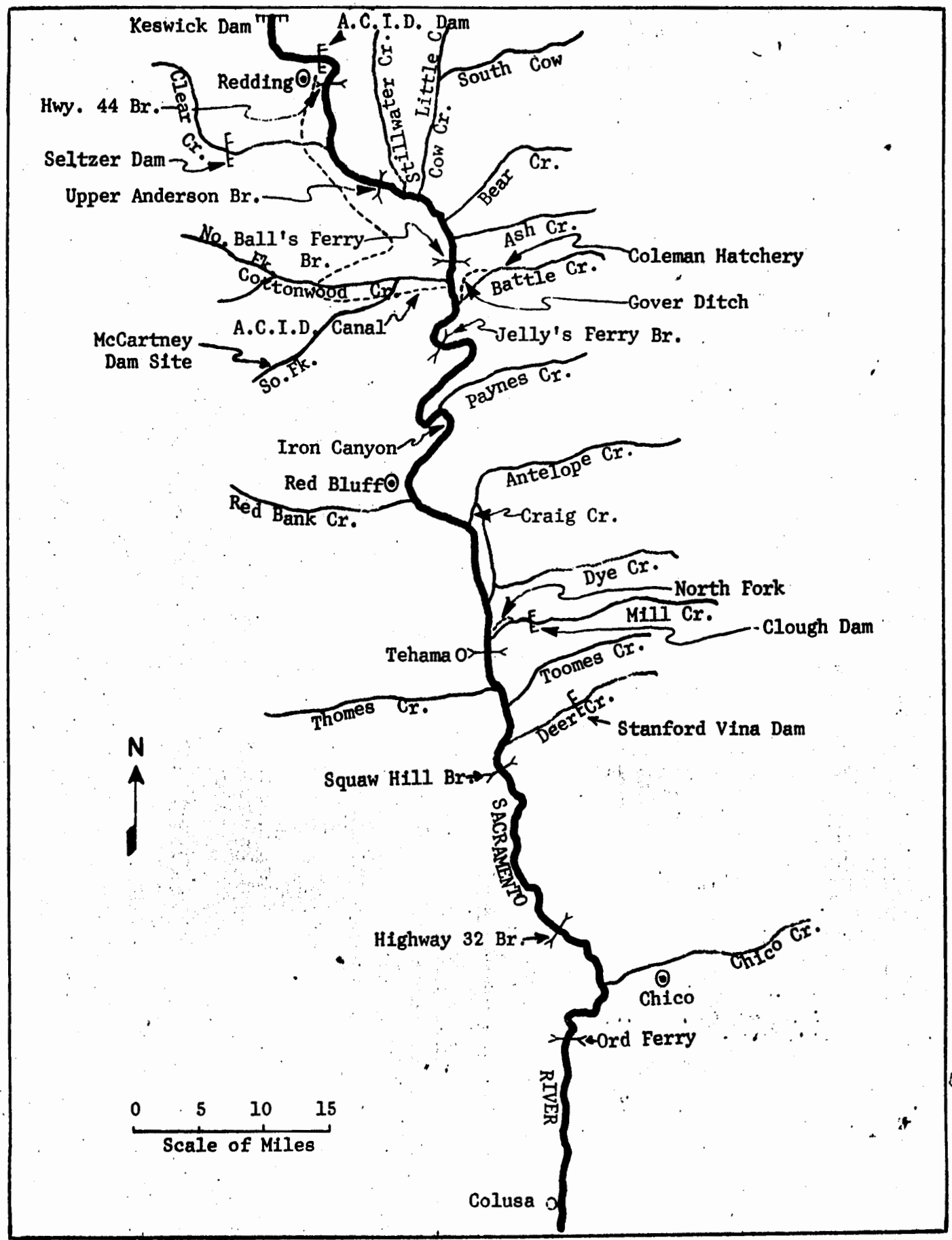

Figure 1. Upper Sacramento River and Tributaries above Chico Creek covered during the 1964 King Salmon Spawning Survey.

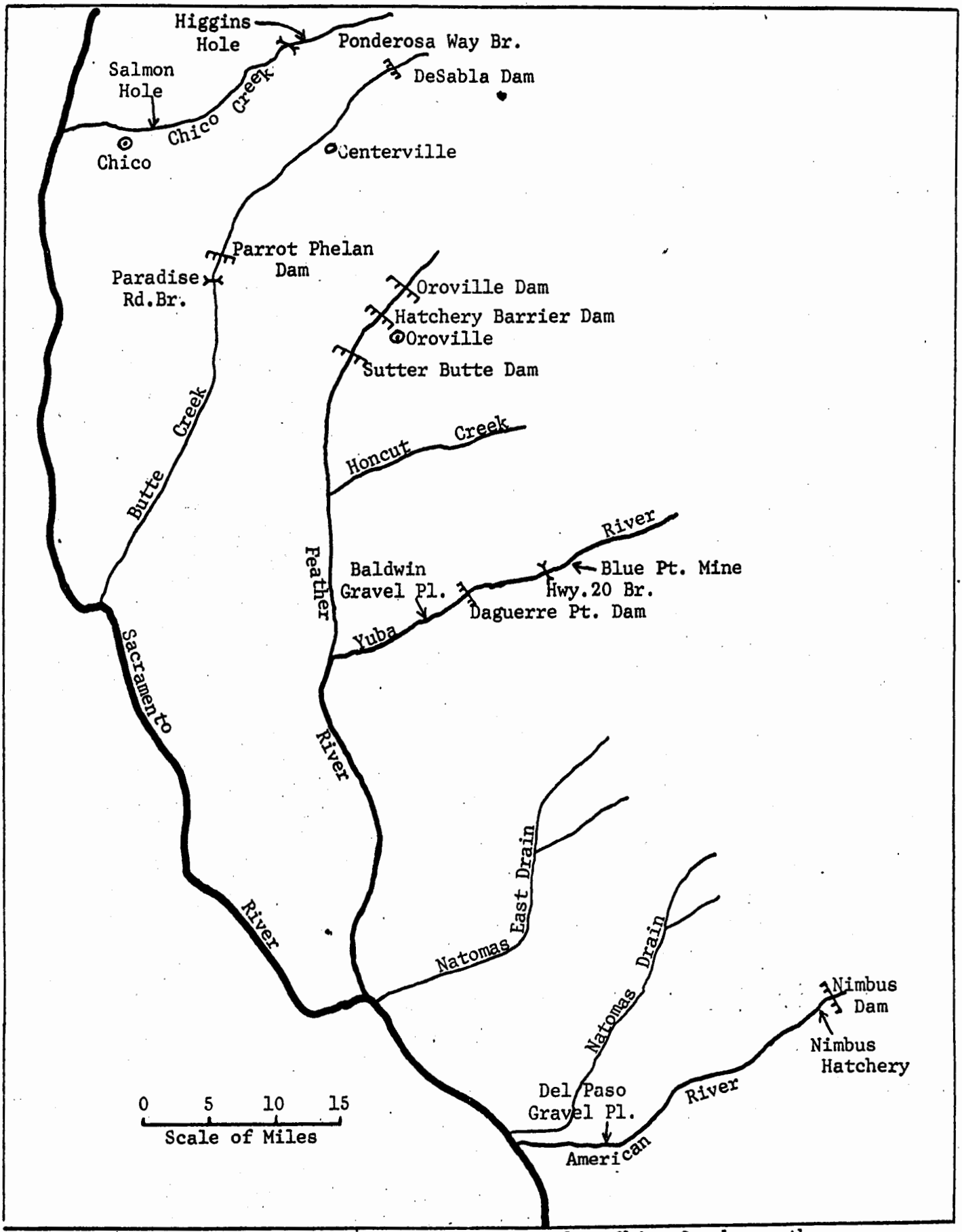

Figure 2. Sacramento River Tributaries from Chico Creek, south, covered during the 1964 Spawning Area Survey.

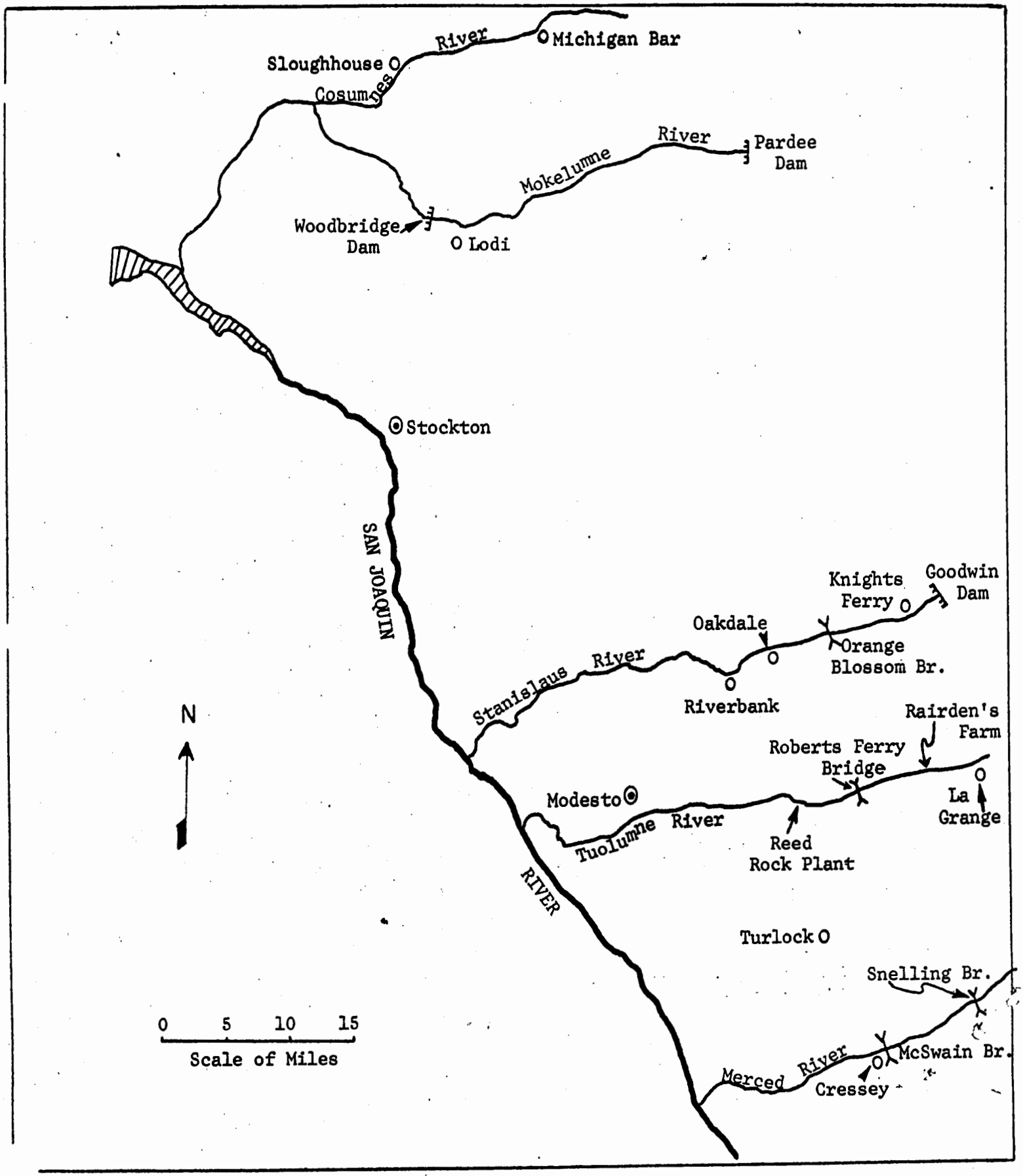

Figure 3. San Joaquin River Tributaries covered during 1964 Spawning Area Survey.