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ANNUAL REPORT CHINOOK SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, 1982

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Edited by

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Anadromous Fisheries Branch

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CHINOOK SALMON SPAWNING STOCKS IN CALIFORNIA'S CENTRAL VALLEY, $1982^{1/2}$

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ABSTRACT

This report covers the 30th annual inventory of chinook salmon, <u>Oncorhynchus</u> tshawytscha, spawning populations in the Sacramento-San Joaquin River system. It is a compilation of estimates of fall- and spring-run chinook salmon spawning populations for every stream in the Sacramento-San Joaquin system which supports a significant spawning run and partial counts of late-falland winter-run chinook salmon.

Estimates are made from counts of fish entering hatcheries and spawning channels, fish migrating past dams, carcasses and live fish on spawning areas, and aerial redd counts.

The esimtated 1982 total escapement of chinook salmon in the Central Valley was 267,844 This total includes 231,822 fall-, 27,890 spring-, 1,233 winterand 6,899 late-fall-run spawners. Of the total, 248,083 spawned in the Sacramento River system and 19,761 in the San Joaquin River system. All of the spring, winter, and late-fall salmon, as well as 212,061 of the fall-run salmon spawned in the Sacramento River system. All salmon that spawned in the San Joaquin River system were fall-run fish.

The estimated 1982 escapement of fall spawning (fall- plus spring-run) chinook salmon in the Central Valley was 259,712; this figure is slightly less than the historic average (1953-1981) of 279,700 and also less than the 1981 estimate of 282,903.

Total fall run in the Central Valley exceeded the previous 10-year average by about 12%. The spring run was about double for the same period, while the late-fall and winter runs were only a fraction of the previous averages.

Salmon counts of all four races at Red Bluff Diversion Dam and their sport catches above the dam were recorded. Spawning populations for all Central Valley streams were summarized. Fin mark and coded wire-tag recoveries were also recorded.

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INTRODUCTION

This report covers the 30th annual chinook salmon spawning stock inventory for the California Central Valley (Figure 1). The Sacramento-San Joaquin River system, which flows through the valley, is the principal producer of chinook salmon caught in California's ocean fisheries and also contributes significantly to the ocean fisheries of Oregon and Washington. Spring and fall runs have been monitored since 1953 and late-fall and winter runs have been monitored since 1971. The four runs are described as follows:

- 1) Late-fall run. These fish are mainly confined to the upper Sacramento River, which they enter from early November through February and spawn from January through early April. They are usually larger than the fall- and winter-run fish spawning in the same area.
- <u>Winter run</u>. Most are confined to the upper Sacramento River, which they enter from early January through mid-June and then spawn from April to early August.
- 3) <u>Spring run</u>. Once widespread in the Central Valley, these fish have disappeared from many of the streams as a result of dam construction. Spring run enter the Sacramento River from March to July and spawn from late August to early October.
- 4) <u>Fall run</u>. These are presently the most numerous and widely distributed salmon in the Central Valley. They enter the river from July through November and spawn from mid-October through early January.

Monitoring of salmon spawning escapement in the Central Valley is an important component of the Department of Fish and Game's fishery management effort. The primary objectives of this work are to determine size and sex composition of spawning populations and to recover tagged or marked salmon to determine their contribution to river spawning escapement. Other objectives are to observe any changes in spawning distribution and habitat conditions that may adversely affect salmon and determine if corrective action is necessary.

GENERAL METHODS

During 1982, spawning stock data were collected on all Central Valley streams known to support sizeable chinook salmon runs by observing potential spawners passing through fishways, conducting stream surveys where numbers of live fish, carcasses, and redds were enumerated, and making aerial redd counts. In some streams, carcasses were tagged and released, and subsequent recovery rates of tagged carcasses were used in estimating spawning populations. Unless otherwise stated, all counted carcasses were cut in half or tagged to prevent recounting on subsequent trips. Specific methods and results are presented under the individual stream headings.



FIGURE 1. Salmon streams in the California Central Valley.

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CHINOOK SALMON SPAWNING POPULATIONS FOR THE SACRAMENTO RIVER SYSTEM

Keswick Dam to Red Bluff Diversion Dam

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Richard J. Hallock Anadromous Fisheries Branch

Estimates were made of all four spawning populations in the upper Sacramento River main stem using fish counts at Red Bluff Diversion Dam (Figure 2). In addition, fall-run population estimates were made for Battle, Clear, and Cottonwood creeks using carcass counts and returns to Coleman Hatchery. Aerial redd counts were conducted to determine spawning distribution in the Sacramento River main stem.

A total of 76,650 salmon spawned in the Sacramento River system between Keswick Dam and Red Bluff in 1982 including 47,362 fall-, 4,899 late-fall-, 1,233 winter-, and 23,156 spring-run fish. The fall run consisted of 17,731 salmon that spawned in the main stem, 28,310 that spawned in tributaries, and 1,321 trapped at Keswick and Red Bluff Diversion dams (Table 1 and Appendix Table 3).

Sacramento River Main Stem

Estimates of the total numbers of salmon utilizing the Sacramento River and its tributaries upstream from Red Bluff Diversion Dam during 1982 were based on daily counts made by the U.S. Fish and Wildlife Service and the Department of Fish and Game at Red Bluff Diversion Dam. The counts were obtained by closed circuit television observations of salmon passing through the fishways (Appendix Table 1).

Weekly counts were adjusted for periods when the fishways remained open but no counts were made: during periods when the river was turbid, when flood conditions made it necessary to open the gates of the dam, and during night hours when no counts were made. Count adjustments for the daytime lapses were made by interpolation. Adjustment for the nighttime hours consisted of multiplying the 14-h day counts by a "night factor" developed from weekly night counts.

The adjusted weekly totals were separated into numbers of late-fall-, winter-, spring-, and fall-run salmon by examining fish entering the trapping facility adjacent to the east bank fishway and estimating, by their degree of ripeness, when they would spawn. To convert the adjusted numbers of salmon in each of the four runs passing the dam into the numbers that actually spawned, the estimated number of salmon landed by sportsmen in the Sacramento River between Keswick Dam and Red Bluff was subtracted from each corresponding run (Appendix Table 2). No attempt was made to measure any other forms of mortality in the upper river prior to spawning.

The estimated salmon sport catch at resorts was obtained by visiting all fishing resorts once every other week to obtain the number of salmon landed during the previous 2 weeks. To estimate the total catch, the resort catch was multiplied



FIGURE 2. Upper Sacramento River above Princeton Ferry.

Run	Fish p in cal 1981	ass .end	sing dam lar year 1982		Potential 1982 spawners (runs)		Estimated 1981-82 sport catch above dam		Estimated 1982 spawning populations
Late fall 1981-82	4,113	+	800	=	4,913	-	14	=	4,899
Winter 1981-82	29	+	1,213	=	1,242	-	9	=	1,233
Spring 1982	0	+	23,438	=	23,438	-	282	=	23,156
Fall 1982	0	+	48,431	=	48,431	-	1,069	Ξ	47,362
TOTALS	4,142		73,882*		78,024		1,374		76,650

TABLE 1. Calculation of Chinook Salmon Runs and Spawning Populations, Sacramento River System Above Red Bluff Diversion Dam, 1982

*An additional 5,926 late-fall run and 37 winter run, destined to spawn in 1983, started passing the dam in late 1982. These fish will be included in the 1983 run and sport catch.

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by 1.5944, a factor derived from sampling resorts and public boat launching ramps in the area during the 8-year period from 1967-74. Practically all salmon caught in this section of the river are landed at either the resorts or public boat launching ramps. To break down the total catch into the numbers landed from each of the four runs, it was assumed that salmon from the various runs are caught in proportion to their abundance, as indicated by counts at Red Bluff Diversion Dam (Table 1 and Appendix Table 2).

While a calendar year count includes total annual runs passing the dam for spring- and fall-run salmon, it represents only part of the total annual run of late-fall salmon and often only part of the winter-run salmon, since both of these runs usually begin passing Red Bluff in one calendar year and finish in the next. Generally, a calendar year count of the late-fall run will include approximately the latter half of one run during the first part of the year, and the first half of the next late-fall run at the end of the year. The same calendar year will usually include most of a winter run early in the year, and the first small portion of the subsequent winter run at the end of the year. About 84% of the 1981-82 late-fall-run salmon (all destined to spawn in 1982) passed Red Bluff in 1982. Only 3% of the 1981-82 winter run occurred during To arrive at the total numbers of 1982 spawners in these two runs, it 1981. is necessary to add the appropriate portion of the 1981 calendar year count that would spawn in 1982 and delete that portion of the 1982 calendar year count that will spawn in 1983.

To obtain the Sacramento River main stem spawning population above Red Bluff, estimates for Battle, Clear, Cottonwood, and Paynes creeks were subtracted from runs passing Red Bluff Diversion Dam. Salmon that spawned in all unsurveyed tributaries are included in the main stem estimate.

Late-fall Run. An estimated 4,913 late-fall-run salmon migrated over Red Bluff Diversion Dam. Of these, about 14 were caught by anglers, leaving 4,899 to spawn (Table 1). Included in this total are 247 trapped at Keswick Dam in the winter of 1981-82 and hauled to Coleman Hatchery to be spawned, 43 that entered Coleman Hatchery, and 875 that spawned in Clear Creek (Figure 2). Although some late-fall-run salmon probably spawned in other tributaries to the Sacramento River, no spawning stock surveys were made in these streams at the time they spawn; therefore, the remaining 3,734 fish are considered to have spawned in the main stem. The 4,899 spawners is 32% of the 1972-81 average (excluding 1974 when flooding resulted in inaccurate counts).

Winter Run. An estimated 1,242 winter-run salmon migrated over Red Bluff Diversion Dam. Of these, about 9 were caught by anglers, leaving 1,233 to spawn (Table 1). This total is only 6% of the 1972-81 average (excluding 1974). Although some winter-run salmon have been known to spawn in tributaries such as Battle Creek, this race spawns primarily in the main stem of the Sacramento River.

Spring Run. An estimated 23,438 spring-run salmon migrated above Red Bluff Diversion Dam during 1982. Of these, 282 were caught by anglers, leaving 23,156 to spawn naturally (Table 1). This total is 207% of the 1972-81 average (excluding 1974). Although some spring run spawn in tributaries to the Sacramento River, especially Battle and Cottonwood creeks, no spawning stock surveys were made in these streams at the time they spawn, and all spring-run salmon above Red Bluff were assigned in this report to the main stem. Fall Run. An estimated 48,431 fall-run salmon migrated above Red Bluff Diversion Dam during 1982 and an estimated 1,069 fall run were caught by anglers, leaving 47,362 to spawn (Table 1). Of this total, 26,795 entered Battle Creek (including 19,525 handled at Coleman Hatchery and 7,270 that spawned naturally), 235 were hauled from Keswick Dam to Coleman Hatchery, 1,086 were hauled from Red Bluff Diversion Dam to Tehama-Colusa Spawning Channel, and 1,515 spawned in Clear, Cottonwood, and Paynes creeks. The remaining 17,731 were assigned to the main stem, although a small portion did spawn in other tributaries. The 47,362 total exceeds the 1972-1981 average by 2%.

Spawning Distribution

Data collected during three airplane flights (14 October, 6 November, and 10 December 1982) over the main stem of the Sacramento River showed the general salmon redd distribution of all spawning salmon, and indicated the relative number of salmon that spawned on riffles above Princeton Ferry (Table 2). Redd counts showed 67.5% of the main stem fall spawning activity occurred upstream from Red Bluff Diversion Dam; this exceeds the 1974 through 1981 average of 56% (1974 was the first year aerial surveys were made). The most heavily used area was between Balls Ferry and Jellys Ferry (Figure 2 and Table 2).

Battle Creek

Late-fall Run. A few (43) late-fall-run salmon entered Coleman Hatchery from Battle Creek in January 1982, but no estimate of natural escapement was made. A total of 247 salmon was hauled from Keswick Dam to Coleman Hatchery.

Winter and Spring Runs. In past years, small numbers of these races have been observed in Battle Creek. No surveys or population estimates were made in 1982.

Fall Run. An estimated 26,795 fall-run salmon spawned in Battle Creek during 1982, which is 319% of the previous 10-year average. This total includes 19,525 salmon handled at Coleman Hatchery, and 7,270 that spawned in Battle Creek between Coleman Hatchery and the Sacramento River. An additional 235 were trapped at Keswick Dam and hauled to Coleman Hatchery.

Carcass recovery data were used to estimate the numbers of salmon that spawned in Battle Creek below Coleman Hatchery. Fourteen survey trips were made on lower Battle Creek, from 20 September 1982 through 3 January 1983. Carcass recovery conditions were good during the early part of the survey period, but poor in late November and early December 1982. A total of 2,908 carcasses was recovered at an estimated overall efficiency rate of 40%.

Seven coded-wire tag groups were recovered (H5-03-01, H5-03-02, H5-03-03, H5-03-05, H5-03-06, 6-58-17, and 6-60-16). The estimated recovery rate for these tags was 40%, the same as for other carcasses (Appendix Table 6).

Clear Creek

A salmon mark and recovery procedure (Schaefer Method for stratified populations) was used on Clear Creek to estimate the size of the late-fall- and fall-run salmon spawning populations. The estimates were made by Department of Fish and Game personnel under contract with the California Department of Water Resources. The area covered was from McCormick-Saeltzer Dam to the mouth of Cottonwood Creek.

TABLE 2.	Estimated Redd Distribution of Fall Spawning Chinook Salmon,
	Main Stem of Sacramento River, Keswick Dam to Princeton Ferry, Based on Aerial Redd Counts, 1982.

		Redds	counted		Average	e redds
Area	Oct. 14	Nov. 9	Dec. 10	Total	Number	Percent
Keswick to A.C.I.D. Dam	0	77	78	155	52	5.0
A.C.I.D. Dam to Highway 44	45	29	7	81	27	2.6
Highway 44 to Upper Anderson Bridge	78	204	102	384	128	12.5
Upper Anderson Bridge to Balls Ferry	120	284	142	546	182	17.7
Balls Ferry to Jellys Ferry	200	280	101	581	194	18.9
Jellys Ferry to Bend Bridge	101	185	22	308	103	10.0
Bend Bridge to Red Bluff Diversion Dam	15	9	1	25	8	0.8
Red Bluff Diversion Dam to Tehama	279	308	150	737	246	23.9
Tehama to Woodson Bridge	93	50	5	148	49	4.8
Woodson Bridge to Hamilton City	29	56	0	85	28	2.7
Hamilton City to Ord Ferry	4	14	1	19	6	0.6
Ord Ferry to Princeton Ferry	9	7	0	16	5	0.5
TOTALS	973	1,503	609	3,085	1,028	100.0

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Late-fall Run. Fifteen survey trips were made between 9 January and 17 April 1982. A total of 159 salmon carcasses was recovered at an estimated average efficiency of about 18.2%. The spawning population was estimated to be 875.

Fall Run. Eleven survey trips were made between 6 November 1982 and 18 January 1983. A total of 491 salmon carcasses was recovered at an estimated average efficiency of 62.5%. The spawning population was estimated to be 785.

Cottonwood Creek

Fall Run. Two aerial surveys were made on Cottonwood Creek (14 October and 9 November 1982). A total of 212 redds was counted (105 in the North Fork, 17 in the South Fork, and 90 between the mouth of the South Fork and the Sacramento River). The spawning population was estimated to be 700.

Paynes Creek

<u>Fall Run</u>. Two survey trips were made along the lower 5 miles of Paynes Creek. Ten redds and seven live salmon were observed. The spawning population was estimated to be 30.

Red Bluff Diversion Dam to Princeton Ferry

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Spawning populations in the Sacramento River main stem were estimated by carcass count surveys and aerial redd counts. Carcass counts were conducted and spawning escapement was estimated for the following seven tributary streams: Antelope, Craig, Mill, Deer, Salt, Toomes, and Dye creeks (Figure 2). No estimates were made on Singer or Thomes creeks.

A total of 25,915 salmon spawned in the Sacramento River system between Red Bluff and Princeton Ferry (Chico Creek) in 1982, including 22,608 in the main stem, 1,225 that entered the Tehama-Colusa Fish Facility via Coyote Creek, and 2,082 that spawned in tributaries; all were fall-run fish. No estimates were made of any spring-, late-fall-, or winter-run salmon that might have spawned in this area.

Flow in the upper Sacramento River at Red Bluff was high in September and October 1982, averaging about 227 m^3/s (8,000 cfs) and 164 m^3/s (5,800 cfs), respectively. By mid-November, flows reached over 396 m^3/s (14,000 cfs). From mid-November through December, flows averaged about 538 m^3/s (19,000 cfs), not counting 3 days in December, when the flow was greater than 1,416 m^3/s (50,000 cfs).

Precipitation and runoff in the upper Sacramento Valley were moderate during the early part of the 1982 fall spawning season. Low flows existed in most tributaries to the upper Sacramento River until mid-November. However, from mid-November through mid-December, there was considerable fluctuation and high stream flows, which made spawning stock surveys difficult.

Sacramento River Main Stem

Late-fall, Winter, and Spring Run. While it is likely that some fish from each of these groups spawned in the main stem, no spawning population estimates were made. Any spring-run spawners are included in the fall-run totals.

<u>Fall Run</u>. An estimated 23,833 fall-run salmon spawned in the Sacramento River between Red Bluff Diversion Dam and Princeton Ferry; this was only 58% of the 1972-81 average. Of these, 1,225 entered the Tehama-Colusa Spawning Channel via Coyote Creek. Estimates of spawning activity in this section of river were principally based on aerial redd counts and on river conditions. Carcass counts were also made in the upper portion of this section between Red Bluff Diversion Dam and Woodson Bridge (Figure 2).

Based on these survey efforts, an estimated 16,730 fall-run spawned between Red Bluff Diversion Dam and Tehama. Another 3,391 spawned from Tehama downstream to Woodson Bridge.

Spawning activity between Woodson Bridge and Princeton Ferry has been minimal in the past. The 1982 estimate for this section was 2,487 (Woodson Bridge to Hamilton City--1,809; Hamilton City to Ord Ferry--452; and Ord Ferry to Princeton Ferry--226).

Spawning Distribution

Data collected during three airplane flights (14 October, 6 November, 10 December 1982) over the main stem of the Sacramento River showed the general salmon redd distribution of all spawning salmon, and indicated the relative number of salmon that spawned on riffles above Princeton Ferry (Table 2). Redd counts showed 32.5% of the main stem fall spawning activity occurred downstream from Red Bluff Diversion Dam; this compares to the 1974 through 1981 average of 44%. The most heavily-used area was between Red Bluff Diversion Dam and Tehama (Figure 2 and Table 2).

Salt Creek

<u>Fall Run</u>. Two survey trips were made in the Tuscan Springs Bridge area; one on 16 December 1982 and the other on 6 January 1983. Only two live salmon and two salmon carcasses were observed. The spawning population was estimated to be 20.

Antelope Creek

Spring Run. Spring-run salmon regularly enter Antelope Creek but the population size is unknown. No population estimate was made in 1982.

<u>Fall Run</u>. Four survey trips were made on Antelope Creek between Cone Grove Park and the 99-E Highway Bridge. Thirteen salmon carcasses were recovered and 52 redds were observed. Based on an estimated recovery rate of 8%, the salmon population totaled 162 fish in the area covered.

Craig Creek

<u>Fall Run</u>. Craig Creek is an overflow channel from lower Antelope Creek. Four survey trips were made on Craig Creek between its beginning (below Cone Grove Park) and its confluence with the Sacramento River. Nine salmon carcasses were recovered and 30 redds were counted. Based on an estimated carcass recovery rate of 10%, the spawning population totaled 90 fish.

Dye Creek

Fall Run. Three survey trips were made on Dye Creek between Highway 99-E and the county road crossing--2 miles above (6 and 12 December 1982 and 6 January 1983). One live salmon and one redd were observed. The population was estimated to be 25.

Mill Creek

Late-fall and Winter Runs. Some fish of these races have been known to spawn in Mill Creek during past years. No surveys or estimates were made for 1982.

Spring Run. Seven survey trips were made for spring-run salmon on upper Mill Creek. The area partially covered was from Highway 36 to 2 miles below Blackrock. Thirty-seven redds and 33 live salmon were observed. The spawning population was estimated to be 700.

<u>Fall Run</u>. Ten trips were made on lower Mill Creek, from the Los Molinos Mutual Water Company's upper diversion dam to its confluence with the Sacramento River, between 27 October 1982 and 4 January 1983. A total of 129 carcasses was recovered. Based on a 10% recovery rate, the fall run was estimated to be 1,290.

Toomes Creek

Fall Run. Two survey trips were made on lower Toomes Creek near the Tehama-Vina Road crossing (30 November 1982 and 9 December 1982). Only one carcass was recovered; the population was estimated to be 15.

Deer Creek

Spring Run. Eight survey trips were made for spring-run salmon on upper Deer Creek. The area partially covered was from upper Deer Creek Falls to the Ponderosa Way Road crossing. Eighty-six redds and 129 live salmon were observed. The spawning population was estimated to be 1,500.

<u>Fall Run</u>. Eight survey trips were made on lower Deer Creek between 3 November 1982 and 7 January 1983. The area covered was from the mouth upstream to the county bridge, located about 3.2 km (2 miles) upstream from the Stanford-Vina Dam. A total of 48 salmon carcasses was recovered. Based on a 10% recovery rate, the estimated fall run totaled 480 spawners.

Butte Creek to American River

Tributaries surveyed were Butte Creek, Feather River, Yuba River, and American River (Figure 3). The Schaefer Method (Schaefer 1951, Taylor 1974b) is typically used to estimate fall runs in the Feather, Yuba, and American rivers. In 1982 high flow during the spawning survey season resulted in estimates for the Feather and Yuba rivers being extrapolated from previous years pattern of return and the Schaefer Method. The estimate for the American River was based on 3 weeks of survey data and return patterns from previous years.

Butte Creek - by Richard Flint, Region 2

Late-fall and Winter Runs. Small numbers of late-fall and winter runs are known to have spawned in this stream during past years, but no surveys or estimates were made for 1982.

Spring Run. An estimated 534 spring-run salmon spawned in Butte Creek. Flows were conducive to adult migration through May and part of June. No boards were placed in Parrott-Phelan Dam until after the upstream migration period. This, along with the newly installed Denil fishway on this dam, greatly improved fish passage over past years and prevented any backup of salmon below the dam. As a result, salmon migrated up into the canyon above Helltown Bridge.

Estimates were based on redd and live fish counts. Butte Creek was surveyed by canoe on 30 September and 1 October 1982 from Centerville Powerhouse downstream to the Skyway Bridge. Water was murky in portions of the stream making recovery conditions poor to fair. A total of 124 multiple redds, 7 single redds, 141 live fish, and 20 carcasses was seen.

<u>Fall Run.</u> Due to high flow, no surveys for fall run were made. Observations of salmon at Parrott-Phelan Dam and other locations indicated a large run. No estimate of run size was made.

Feather River - by Lawrence G. Preston, Region 2

Late-fall Run. A total of 402 adult chinook salmon (no grilse) entered Feather River Hatchery from 11 January to 11 April 1982. These fish were termed late-fall run per Hallock's definitions. After the fish ladder was reopened on 1 December 1981 to receive steelhead, no salmon entered the hatchery for 42 days. Salmon were observed spawning in the river in January through March, and anglers took an estimated 140 salmon during this time. An estimated total of 2,000 late-fall-run salmon entered the Feather River.

Spring Run. A total of 1,910 spring run entered Feather River Hatchery-1,700 adults (>60.7 cm FL or 23.9 inches) and 210 grilse (<60.7 cm FL or 23.9 inches). Spring run in the Feather River are defined as those fish that enter the hatchery between 1 September, when the ladder is first opened, and 1 October. A total of 1,088 entered Feather River Hatchery on 2 and 3 September, and then no fish entered for 2 weeks. Coded-wire tags taken from "spring run" showed that some had fall-run parents, which indicates difficulty in separating the two races. The carcasses of spring-run salmon spawning in the fall cannot be distinguished from fall-run salmon spawning at the same time; this likely results in some spring run being misidentified as fall run. An estimated 90 spring-run salmon spawned in the river.



FIGURE 3. Sacramento River tributaries from Chico Creek south.

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Fall Run. Total fall run was estimated at 55,519 (45,357 adults and 10,162 grilse); this is 112% of the previous 10-year average run. A total of 7,563 (6,320 adults and 1,243 grilse) entered Feather River Hatchery. An estimated total of 47,956 (39,037 adults and 8,919 grilse) spawned naturally between Oroville Fish Barrier Dam and Honcutt Creek.

Surveys were started on 18 October and completed on 14 December 1982. During the survey, the section between Oroville Fish Barrier Dam and Thermalito Outlet had a flow of 11.3 m³/s (400 cfs), and water clarity ranged between 1.5 and 3.0 m (5 and 10 ft). The section between Thermalito Outlet and Honcut Creek had a flow of 79.3 m³/s (2,800 cfs) and water clarity of 1.5 m (5 ft) until 16 November, when flows greatly increased and surveys in this section had to be terminated.

The Schaefer Method (Schaefer 1951) as described by Taylor (1974b) was used to calculate the estimated number of salmon spawning in the Feather River, but during this season only adults were tagged and recaptured. Grilse were examined for marks and chopped; they were also recorded to later determine ratio of adults to grilse and estimate overall population. The pattern of previous years return was used to determine the fraction of the run which had spawned prior to high flows that prevented additional surveys. To compensate for the reduced survey efforts, the population estimate for the section downstream from Thermalito Outlet derived from the Schaefer Method, was doubled. In Moe's Ditch (a spawning channel constructed in the flood plain near the hatchery) salmon spawners were counted after a fence was placed at the lower end of the spawning channel to prevent any carcasses from being washed downstream.

Based on the above, 18,116 adults (≥60.7 cm FL or 23.9 inches) and 3,451 grilse (<60.7 cm FL or 23.9 inches) spawned between Oroville Fish Barrier Dam and Thermalito Outlet (Table 3). From Thermalito Outlet to Honcut Creek, 19,662 adults and 5,353 grilse spawned (Table 4). There were 1,259 adults and 115 grilse counted in Moe's Ditch.

The sex and age composition for the 1982 fall-run salmon as determined from the 3,212 fresh carcasses examined was 31.0% male adults, 8.4% male grilse, 53.3% female adults, and 7.3% female grilse. In the hatchery, sex and age composition was 38.5% male adults, 46.8% female adults, and 14.7% grilse of both sexes.

Eighty-two adipose-clipped, coded-wire-tagged salmon were observed during the surveys; 45 in Moe's Ditch, 36 between Oroville Fish Barrier Dam and Thermalito Outlet, and 1 between Thermalito Outlet and Gridley Bridge.

The total number of tags in each stream section was estimated by multiplying the ratio of total number of spawners to number of fresh carcasses by the number of tags observed (Table 5).

Recovery				Tagging	period	Number tagged	Total number	Population			
period	Oct.	Oct.	Nov.	Nov.	Nov.	Nov.	Nov.	Dec.	observed	carcasses	estimate
(j)	18	25	1	8	15	22	29	7	(Rj)	(Cj)*	(N)
Oct. 25	28								28	715	1,582
Nov. 1	4	63							67	1,465	2,933
Nov. 8	1	25	96						122	1,849	3,157
Nov. 15		4	34	84					122	1,934	3,678
Nov. 22			10	27	113				150	1,851	3,068
Nov. 29				5	27	49			81	963	2,285
Dec. 7				3	19	16	13		51	647	1,599
Dec. 13					4	5	10	16	35	424	1,028
Total tagged f:	ish				·						19,330+
recovered (Ri)	33	92	140	119	163	70	23	16			
Total fish									-		
tagged (Mi)	73	183	228	239	255	200	79	30			
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TABLE 3. Population Estimates of Adult Chinook Salmon Based on Tag and Recovery Data for the Feather River Fish Barrier Dam to Thermalito River Outlet, Using Schaefer's Method, 1982.

+ Includes tagged fish recovered.

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Total tagged fish from second week on must be subtracted 19,330 - 1,214 = 18,116.

Population estimate (N) = $\xi(\text{Rij} \cdot \frac{\text{Mi}}{\text{Ri}} \cdot \frac{\text{Cj}}{\text{Rj}}) - \xi_2^i$ mi

Grilse made up 16% of the total population or 3,451 fish. Total escapement for this section of stream was, therefore 21,567.

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TABLE 4. Population Estimates of Adult Chinook Salmon Based on Tag and Recovery Data for Feather River from Thermalito Outlet to Gridley Bridge Using Schaefer's Method, 1982.

Recovery		Tagging	period (i)		Number tagged observed (Rj)	Total number	Population
period (j)	Oct. 19	Oct. 26	Nov. 2	Nov. 11		carcasses (Cj)*	estimate (N)
Oct. 26	5				5	257	90 0
Nov. 2		11			11	559	2,663
Nov. 10	1	4	23		28	810	3,153
Nov. 16		2	6	29	37	691	3,458
Total tagged							10,174+
fish recovered (Ri)	6	17	29	29			
Total fish							
tagged (Mi)	21	81	109	153			

* Includes tagged fish recovered.

The number of fish tagged from the second week on must be subtracted 10,174 - 343 = 9,831.

Population (N) = ξ (Rij $\cdot \frac{\text{Mi}}{\text{Ri}} \cdot \frac{\text{Cj}}{\text{Rj}}$) - ξ_2^i Mi

The survey had to be terminated after 16 November due to high flows. It was assumed the run was 50% complete; therefore, adult escapement was estimated at 19,662. Grilse made up 21.4% of the total population or 5,353 fish. Total escapement was 25,015.

١.,

			Orovi	lle Fish Ba	arrier	Thermalito Outlet to			
	Moe's	Ditch	Dam to	o Thermali	to Outlet	Gridley Bridge			
		Estimate in			Estimate in			Estimate in	
	Number	spawning		Number	spawning		Number	spawning	
CWT	recovered	population	CWT	recovered	population	CWT	recovered	population	
6 50 16	C	J	6-58-17	7	08	6-62-10	1	39	
0-30-10	2	2	6-56-17	1	90	0-02-10	Ŧ	57	
6-58-1/	11	11	6-58-18	1	14				
6-58-19	4	4	6-58-19	1	14			/	
6-58-22	1	1	6-58-21	3	42				
6-58-23	1	1	6-58-22	1	14				
6-62-6	1	1	6-62-7	1	14				
6-62-7	5	5	6-62-8	5	70				
6-62-8	6	6	6-62-9	8	112				
6-62-9	6	6	6-62-11	3	42				
6-62-10	1	1	6-62-12	6	84				
6-62-11	2	2							
6-62-12	5	5							
TOTALS	45	45	<u></u>	36	504		1	39	

TABLE 5. 1982 Coded-Wire-Tag Recoveries and Expansions for the Feather River by River Section.

Yuba River - by Lawrence G. Preston, Region 2

<u>Spring Run</u>. Spring-run chinook salmon were observed negotiating the Daguerre Point Dam fish ladder in May and June. No surveys or estimates were made of spring run.

Fall Run. The 1982 Yuba River spawning stock estimate of 39,367 was the fourth highest since carcass surveys began in 1953 and 285% of the previous 10-year average.

Five weekly surveys were conducted from 22 October to 19 November from Parks Bar Bridge to the Marysville Dump. Subsequent trips were cancelled after 19 November due to extremely poor carcass recovery conditions; i.e., high, muddy water. River flow and water clarity during the survey period are tabulated below.

Date	Above Daguerre Point Dam	Below Daguerre Point Dam	Water clarity
10/21-22 10/28-29 11/4-5 11/11-12 11/18-19	56.6 m ³ /s (2,000 cfs) 56.6 m ³ /s (2,000 cfs) 57.9 m ³ /s (2,500 cfs) 57.9 m ³ /s (2,500 cfs) 76.5/78.8 m ³ /s (2,300/ 3,400 cfs)	42.9 m ³ /s (1,850 cfs) 42.9 m ³ /s (1,850 cfs) 53.9 m ³ /s (2,300 cfs) 53.9 m ³ /s (2,300 cfs) 71.8/74.1 m ³ /s (3,100/ 3,200 cfs)	0.6-0.9 m (2-3 ft) 1.5 m (5 ft) 0.6 m (2 ft) 1.5 m (5 ft) 0.3 m (1 ft)

During the 5-week survey period, 9,913 adult salmon were estimated (using the Schaefer Method) to have spawned between Parks Bar Bridge and Marysville Dump (Schaefer 1951, Taylor 1974b) (Table 6). This year only adults (≥ 60.7 cm FL or 23.9 inches) were used for mark-recapture estimates. The number of grilse was determined from the ratio of grilse/adults (284/419 or 0.678) among the fresh carcasses observed.

TABLE 6. Population Estimate of Adult Chinook Salmon Based on Tag and Recovery Data for the Yuba River from Parks Bar (Hwy. 20 Bridge) to Marysville Dump, Using Schaefer's Method, 1982.

Recovery		Taggin	g period	(i)	Number tagged	Total number carcasses (Cj)*	Population
period (j)	Oct. 21/22	Oct. 28/29	Nov. 4/5	Nov. 11/12	observed (Rj)		estimate (N)
Oct. 28/29	2				2	289	2,505
Nov. 4/5	1	8			9	413	1,984
Nov. 11/12		14	26		40	552	2,494
Nov. 18/19			1	8	. 9	224	3,277
Total tagged fish recovered (Ri)	3	22	27	8			10,260+
Total fish tagged (Mj)	26	95	125	127			

+ Includes tagged fish recovered.

Total tagged fish from second week on must be subtracted 10,260 - 347 = 9,913.

Population estimate (N) = $\langle \text{Rij} \cdot \frac{\text{Mi}}{\text{Ri}} \cdot \frac{\text{Cj}}{\text{Rj}} \rangle - \langle \frac{1}{2} \text{Mi} \rangle$

To account for the period after 19 November when surveys had to be terminated, it was assumed escapement was half completed, therefore the 9,913 figure was doubled resulting in an estimated adult escapement of 19,826. An additional 15.5% of the river run spawned above Park Bar Bridge increasing the run to 23,463. This figure for the adult population was expanded by 40% to account for grilse resulting in a total escapement estimate of 39,367.

Based on past surveys, salmon spawn until mid-December in the Yuba River. It was estimated that 50% of the total run spawned after the 19 November survey, resulting in an estimate of 19,826 adult fish for the entire spawning season in the Yuba River below Parks Bar. Assuming 15.5% of the entire river run spawn's above Parks Bar (based on observations made during the 1966-1971 surveys), the 19,826 figure was expanded to 23,463 adult salmon. If there were 23,463 adults, then there were 15,904 grilse also spawning, giving a total river escapement of 39,367.

The 39,367 estimate was less reliable than previous year's estimate due to poor survey conditions and limited data to derive an estimate using the Schaefer Method. In support of the estimate, the density of redds observed during area surveys was much higher than last year, and a local river guide using a fish-finder sonar device observed the largest number of fish in 5 years of use of the instrument.

Spawning distribution by section was not possible to calculate this year because of the poor fish finding conditions and low numbers of fish tagged/recaptured.

From the 703 fresh carcasses examined, 27.7% were male adults (≥ 60.7 cm FL or 23.9 inches), 31.9% were female adults, 28.3% were male grilse (< 60.7 cm FL or 23.9 inches), and 12.1% were female grilse.

One coded-wire tagged salmon was recovered below Daguerre Point on 5 November. The fish was coded-wire tagged 6-58-17, a fall-run salmon of Feather River Hatchery origin. Because fresh carcasses examined made up 703/39,367 or 1/56, each coded-wire tagged fish recovered represents 56 fish.

American River - by Mike Meinz, Region 2

<u>Fall Run</u> - In 1982, an estimated 33,000 chinook salmon spawned in the American River from Nimbus Racks to Grist Mill Dam Access and another 10,898 entered Nimbus Hatchery, bringing the total to 43,898. This is about 94% of the previous 10-year average. The weekly carcass count surveys began 2 November 1982 and were terminated 4 weeks later when river flows consistantly exceeded 142 m³/s (5,000 cfs). River conditions during the carcass survey were poor and only 10% of the tagged carcasses were recovered. Flows ranged from 42 to 142 m³/s (1,500 to 5,000 cfs), and Secchi disc readings were always less than 1.2 m (4 ft).

The Schaefer Method (Schaefer 1951, Taylor 1974b) is normally used to estimate run size; however, 1982 carcass data were insufficient to use this method. Escapement estimates for 1982 are based on past carcass count surveys in the American River. The magnitude of American River chinook salmon escapements can be predicted from an overview of weekly carcass counts, i.e., when carcass counts are high, escapement is high (Table 7). Weekly carcass numbers in 1982 were low, but comparable to counts made in 1976, 1978, and 1979. Those escapement estimates ranged from 12,230 in 1978 to 32,639 salmon in 1979. Observations by Nimbus Hatchery personnel and by personnel conducting the American River angler survey indicate that the 1982 escapement was more similar to that of 1979 or about 33,000 fish.

TABLE 7. American River Carcess Counts and Escapement 1973-82*

Year												
Week	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982		
1	431	53	5	16	14	331	70	24	211	60		
2	1,524	407	420	135	101	407	539	106	1,264	-		
3	416	1,138	813	386	689	493	586	223	1,874	747		
4	-	1,253	927	553	888	424	594	859	-	405		
5	2,753	1,270	1,270	759	1,745	408	481	1,406	-	-		
6	1,520	2,022	1,139	714	1,604	277	191	1,250	1,239	-		
7	2,017	1,470	864	430	877	-	· _	1,589	235	-		
8	2,136	1,031	748	332	1,051	. –	-	1,358	-	-		
9	-	596	-	184	178	-	-	1,439	-	-		
10	-	917	-	-	-	-	-	615	-	-		
11	· _	-	. –	-	-	-	-	230	-	-		
Estimated River Run	81,600	52,491	30,930	22,810	41,016	12,230	32,639	32,057	. 32,057	43,462		

* Does not include salmon entering Nimbus Hatchery or salmon spawning in the Nimbus Basin above the racks.

A total of 10,898 chinook salmon entered Nimbus Hatchery. No estimate was made of salmon spawning above Nimbus Racks because high flows forced the removal of the racks early in November. Combining the river estimate with the hatchery count yielded a total spawning escapement of 43,898 fish.

Of the 267 carcasses fresh enough to sex, 45% were male adults (≥ 60.7 cm FL or 23.9 inches); 42% were female adults; and 13% were grilse of both sexes; (<60.7 cm FL or 23.9 inches).

One salmon with a missing adipose fin was found (70-cm FL or 28-inch female) and the coded wire tag number was 6-58-17.

CHINOOK SALMON POPULATIONS FOR THE SAN JOAQUIN RIVER

Salmon spawning populations in the San Joaquin River tributaries were estimated by counting carcasses, redds, live fish, and hatchery returns. High flows permitted only partial surveys in Cosumnes, Calaveras, Stanislaus, Tuolumne, and Merced rivers, and prevented any surveys on Mokelumne River (Figure 4).

> Cosumnes River to Calaveras River by Mike Meinz Region 2

Cosumnes River

Fall Run - In 1982, chinook salmon were seen in the Cosumnes River but no escapement estimates were made. River flows were unusually high during November and December, making a carcass survey difficult. Various observations during that time indicated the run was small:

- 1) During a carcass survey between Michigan Bar and Highway 16 on 11 November, one dead salmon and no live salmon were observed.
- 2) Nine redds upstream of Highway 16 and 14 redds downstream of Highway 16 were identified during an aerial redd count on 13 November.
- 3) Local residents observed a lower than normal abundance of salmon in the river during 1982.

Mokelumne River

Fall Run - In 1982, an estimated 9,372 chinook salmon either entered the Mokelumne River Fish Installation or spawned in the river between Mackville Road and the Installation. This is 500% of the previous 10-year average. No carcass count survey was conducted because river flows were dangerously high (equal to or greater than 56.6 m³/s or 2,000 cfs). The escapement estimate was made using a relationship between the number of salmon entering the Mokelumne River Fish Installation and the estimated annual escapement from past carcass surveys. Based on data collected since 1972 (1977 excluded because the hatchery ladder was closed), a linear relationship with a correlation coefficient of 0.8824 exists between the two parameters (Figure 5). The line describing this relationship was used to extrapolate the 1982 Mokelumne River escapement:

Y = 416.292 + 3.345 X

where, Y = Escapement estimate

X = Number of salmon entering hatchery



FIGURE 4. San Joaquin River tributaries.

FIGURE 5. Mokelumne River Escapement in Relation to the Number of Chinook Salmon Entering the Mokelumne River Fish Installation (1972-1981).



The estimated escapement is an extrapolation because the number of salmon entering the hatchery in 1982 (2,766) was nearly twice as large as any of the values used to develop the relationship (Table 8).

TABLE 8. Mokelumne River Chinook Salmon Spawning Stock Data 1972-1982.

Year	Number entering hatchery	Escapement	estimate	
1972	353	1,100		
1973	408	3,000		
1974	220	1,400		
1975	300	1,900		
1976	74	500		
1977	Ladder closed	300		
1978	484	1,100		
1979	507	1,500		
1980	639	3,200		
1981	1,386	4,954		
1982	2,677	9,372		

Only data collected since 1972 were used in making the 1982 escapement estimate because:

- 1) Mark and recapture methods were used exclusively in estimating escapement.
- 2) The only salmon entering the hatchery did so via the fish ladder at the Mokelumne River Fish Installation.
- 3) The ladder at the hatchery operated continuously throughout the spawning season.

The great increase in the number of salmon entering the Mokelumne River Fish Installation (almost double the previous high count) strongly indicates a very large run and supports the high estimate. The 9,372 estimate is the highest since regular annual surveys were started in 1953; larger estimates (12,000 spawners) were made for two years between 1940-50.

Of the 2,766 salmon that entered the hatchery, 900 (600 adult males and 300 adult females) were placed into the spawning channel. The remaining 1,866 were returned to the river after clipping the upper portion of the caudal fin.

Calaveras River

<u>Winter Run</u> - In 1982, chinook salmon were seen in the Calaveras but no escapement was made. Personnel working at New Hogan Reservoir and at Bellota Weir observed adult salmon but none was observed by Department of Fish and Game personnel.

On July 9, 1982, seining was done near New Hogan Dam and at Jenny Lind Bridge but no young salmon were caught. Seining was again attempted in November and December, but river flows were too high to efficiently operate a seine.

Stanislaus River to Merced River

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Maurice Fjelstad Region 4

Stanislaus River

<u>Fall Run</u> - Flows averaged about 28.3 m^3/s (1,000 cfs) during all of November and December. The combination of depths and excessive turbidity made it impossible to see the bottom in most areas. During one float trip from Knights Ferry to Orange Blossom Bridge in late November, only five redds, one live salmon, and one carcass were observed. No estimate of the 1982 run size was made.

Tuolumne River

Fall Run - An estimated 7,126 chinook salmon spawned in the Tuolumne River during the 1982 fall spawning period. This is about one-half the 1981 run estimate, but still 243% of the previous 10-year average.

High flows in the Tuolumne River (to 84.9 m^3/s or 3,000 cfs) and lower San Joaquin rivers during October allowed early adult migration. When flows dropped in November, evidence of early spawning activity was verified during the first survey trip by the large number (421) of carcasses observed stranded on banks and in vegetation. Flows during most of November were about 11.3 m^3/s (400 cfs) with good visibility (greater than or equal to 2.1 m or 7 ft); during the last survey trip on 29 November, visibility had reduced to about 1.2 m (4 ft). After this date, flood control releases of 56.6 m^3/s (2,000 cfs) and greater along with increased turbidity forced termination of the surveys. Three complete trips were made in the following traditionally surveyed areas (Figure 4):

About 91.4 m (300 ft) above old La Grange Bridge downstream to Basso Bridge (4.8 km or 3 miles).

Basso Bridge to Turlock Lake State Recreation Area (12.1 km or 7.5 miles).

Turlock Lake State Recreation Area to Reed Rock Plant near Waterford (12.9 km or 8 miles).

The Schaefer Method (Schaefer 1951) as modified by Taylor (1974<u>b</u>) was used to estimate run size for the 11 November through 29 November period. Carcasses were tagged by attaching a small colored plastic ribbon to the jaw with a hog ring and then releasing the carcass into moving water for future recovery. The color of the tag indicated date of release. A total of 2,135 carcasses was observed; of these, 293 were tagged and 123 were later recovered. Based on the Schaefer Method, 4,120 salmon spawned during the survey period (Table 9).

Recovery	Та	lgging perio	ođ (i)	Number tagged	Total number	Population	
period (j)	Nov. 8-11	Nov. 15-17	Nov. 22-23	ob serve đ (Rj)	carca sse s (Cj)*	estimate (N)	
Nov. 8-11				0	421		
Nov. 15-17	43			43	919	2,077	
Nov. 22-23	6	42		48	665	1,625	
Nov. 29	1	3	2 8	32	244	59 8	
Total tagged fish recovered (Ri)	50	45	28			4,300+	
Total fish tagged (Mi)	113	111	69				

TABLE 9. Tuolumne River Estimate of Chinook Salmon Based on Tag Recovery Data from Approximately Old La Grange Bridge to Reed Rock Plant Using Schaefer's Method, 1982.

* Includes tagged fish recovered.

+ The number of fish tagged from the second week on must be substracted 4,300 - 180 = 4,120.

Population estimate (N) = ξ (Rij $\cdot \frac{\text{Mi}}{\text{Ri}} \cdot \frac{\text{Cj}}{\text{Rj}}) - \xi_2^i$ Mi

The 4,120 figure was combined with the estimated 1,003 salmon that spawned prior to the survey season, and the 578 salmon that spawned above Old La Grange Bridge for a total of 5,701. An estimated 20% more salmon spawned after surveys had to be terminated, which results in a total estimated escapement of 7,126. Spawning surveys were started the week of 8 November 1982. A total of 421 carcasses was counted on the first survey which represented an unknown fraction of salmon that spawned prior to 8 November. Ricker's (1975) formula 3.5_7 as described below was used to estimate that population:

$$N = \frac{MC}{R}$$

where: N = size of population spawning prior to first survey

M = number of carcasses tagged during survey season

C = number of carcasses observed during first week surveyed

R = number of tags recovered during survey season

Actual computations were: $N = \frac{(293)(421)}{123} = \frac{1,003}{1000}$ (population which spawned prior to first survey).

Due to the relatively large run for recent years, the survey was extended upstream from the Old La Grange Bridge to La Grange Dam (about 2.4 km or 1.5 miles). The number of spawners in this upstream section was estimated by the following procedure:

Estimated number of spawners in upstream section Estimated number of Maximum redd count in newly Maximum redd count in X surveyed upstream section Section I

Actual computations were: $578 = \frac{3,178}{440} \times 80$

Combining estimates for the upstream section (578), with the fish that spawned prior to 11 November (1,003) and the fish that spawned in the traditional surveyed areas (4,120) produces a total of 5,701. To account for escapement that occurred in December when high flows prevented survey efforts, the portion of the run spawning during that time was determined by examining past years' patterns of escapement. From this examination, it was assumed about 20% of the spawning activity occurred in December during 1982. The 5,701 estimated escapement was then expanded to 7,126.

From the 417 fresh carcasses sexed, 58.3% were female adults (>60.7 cm FL or 23.9 inches), 1.2% were female grilse (<60.7 cm FL or 23.9 inches), 36.4% were male adults, and 4.1% were male grilse.

Merced River

Fall Run - An estimated 3,263 chinook salmon spawned in the Merced River from Crocker-Huffman Dam to Cressy in 1982, including fish counted into Merced River Fish Facility. This is approximately one-third of the 1981 estimate but still 118% of the previous 10-year average.

An unknown number of salmon spawned in the Merced River during high flows prior to the start of the surveys. Also, several hundred salmon ascended tributaries to the San Joaquin River upstream from the confluence with the Merced River. This loss was due to small hydro projects diverting water from the Merced River then releasing it into the San Joaquin River upstream from the confluence of the two rivers, resulting in salmon being attracted up the San Joaquin River into areas unsuitable for spawning. Spawning surveys began on 11 November and were terminated on 6 December when flood control releases prevented further surveys. Turbidity, along with wind and rain, hampered carcass recovery.

In 1982, surveys were conducted from Crocker-Huffman Dam downstream to Highway 59 Bridge. Due to limited manpower available the portion of river from Highway 59 Bridge downstream to Cressy was not surveyed.

To estimate run size, fresh carcasses were tagged by attaching a small colored plastic streamer to the jaw with a hog ring and then releasing the carcass into running water for later recovery. A total of 773 carcasses was observed. Of these, 126 were tagged and 44 were later recovered. Observations on the river and at the Merced River Fish Facility indicated that the run was essentially completed by 6 December 1982.

The following formula from Ricker (1975) was used to estimate the run for the area surveyed:

$$\frac{N = MC}{R}$$

where: N = size of run in section surveyed

M = number of carcasses tagged

C = number of carcasses examined

R = number of tags recovered

Actual computations were: N = (126)(773) = 2,21444

Analysis of the spawning concentrations during 8 years (1971-1981) when surveys could be carried out downstream to Cressy indicated that 72% of the average yearly spawning effort occurs above the Highway 59 Bridge. Based on this assumption, the 2,214 estimate was expanded to 3,074. Combining the 189 spawners which entered the Merced River Fish Facility, an estimated 3,263 salmon entered the Merced River in 1982.

Of the 189 salmon entering the Merced River Fish Facility, 35.4% were adult females: (>53.1 cm FL or 20.9 inches), 47.6% were adult males, and 17.0% were male grilse (53.1 cm FL or 20.9 inches); there were no female grilse. A total of 282,745 eggs was taken from the female adults.

Of the 736 fish sexed during the river survey, 66.7% were female adults, 0.1% were female grilse, 31.2% were male adults, and 2.0% were male grilse.

The number of tagged fish spawning naturally was estimated by multiplying the ratio of total numbers of spawners to fresh carcasses by the number of tags observed. Two tags were recovered. One was from tag group 6-46-12 and the other from tag group 6-48-14. Each tag recovered represented 2214/736 spawners or three fish.

SUMMARY

During 1982, the California Department of Fish and Game conducted its 30th annual chinook salmon spawning stock inventory of the Sacramento-San Joaquin River system.

This report deals with the four races of chinook salmon recognized in the Central Valley: late-fall, winter, spring, and fall runs.

In the San Joaquin River system and the Sacramento River system downstream from Red Bluff, spawning stock estimates were made by the Department of Fish and Game. These estimates were based on carcass counts, aerial redd counts, and live fish counts. Estimates for the Sacramento River system above Red Bluff were based primarily on U. S. Fish and Wildlife Service counts of fish passing Red Bluff Diversion Dam and on Department of Fish and Game sampling at the Dam.

The estimated 1982 Central Valley chinook salmon spawning escapement was 268,397 (Table 10). This was down from the 1981 run but still exceeds recent years' average. The most dramatic increases occurred in the Yuba and Mokelumne rivers: the latter had the largest run since regular surveys were started in 1953. The fall run in the Feather River slightly exceeded the 1981 estimate. Fall runs in the American, Tuolumne, and Merced rivers were down from last year.

The fall spawning escapement of 70,518 above Red Bluff Diversion Dam is far below the 1964-69 average of 129,000 observed prior to the construction of the Dam. This has been only partially offset by increased runs below the dam where 23,833 spawned in 1982. which greatly exceeds the 1964-69 average of 8,000 fish. The late-fall and winter runs in the upper Sacramento River were only a fraction of recent years' average escapement.

Salmon counts at Red Bluff Diversion Dam and sport catches above the Dam are shown in Appendix Tables 1 and 2, respectively. Spawning populations for all Central Valley streams are summarized in Appendix Tables 3-5. Fin mark and coded wire tag recoveries are presented in Appendix Tables 6 and 7.

Spawning area	Late-fall run	Winter run	Spring run	Fall run	Total
Sacramento main stem	3,981	1,233	23,156	42,885	71,255
Sacramento tributaries	2,918		4,734	169,176	176,828
San Joaquin tributaries				19,761	19,761
TOTALS	6,899	1,233	27,890	231,822	267,844

TABLE 10. Sacramento-San Joaquin System Chinook Salmon Spawning Population, 1982.

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APPENDIX TABLE 1. Red Bluff Diversion Dam Adjusted Salmon Counts 1 November 1981 through 1 January 1982.

			Adjust	ed								
			salmon	Number	Late-fa	all run	Winter	run	Sprin	ng run	Fall	run
	Week		count	sampled	Percent	Number	Percent N	lumber	Percent	: Number	Percent	Number
1981												
Nov.	1-Jan.	2,	'82 1	Runs in Prog	ress	4,113*		29*				ì
1000												
1982	2	٥	116		70 1 a	/ 102	20 a/	A A				
Jan.	10-	16	240		100.0	2/0	29.9-	44				•
	10-	22	121	13	77 0	24J 03	23.0	28				
	24-	30	218	83	50 6	110	49 4	108				
	27-	50	210	05	50.0	110	47.4	100				
	31-Feb.	6	76	16	43.8	33	56,2	43				
Feb.	7-	13	169	3	100.0	, 169	0.0 5/	0				
	14-	20		no sample	$52.3\frac{D}{h}$	/,	47.7 <u>0</u> /					
	21-	27	14	17 FT	45.8 <u>-</u>	6	54.2	8				
		-		-	an ab	1 10	a = b/					
	28-Mar.	6	32	no sample	57.3-	18	42./=	14				
Mar.	7-	13	26	4	25.0	6	75.0	20				
	14-	20	29	2	50.0	14	50.0	15				
	21-	27	56	2	0.0	0	100.0	56				
	28-Apr.	3	49	1	0.0	0	100.0	49				
Ar	4-	10	63	6	0.0	0	83.3	52	16.7	11		
-	11-	17	105	3			66.7	70	33.3	35		
	18-	24	137	15	· · · · · · · · · · · · · · · · · · ·	4,913	6.7	9	93.3	128		
	25-May	1	9 3	4			0.0	0	100.0	93		
Mau	2_	Q	94	٨			25 0	23	75.0	71		
may	2 9	15	137	16			25.0	34	75.0	103		
	16-	22	348	2			50.0	174	50.0	174		
	23-	29	330	4			0.0	0	100.0	330		
	23		550	•				•				
	30-June	5	167	6			33.3	56	66.7	111		
June	6-	12	267	25			44.0	117	56.0	150		
	13-	19	516	27			3.7	19	96.3	497		
	20-	26	416	36			16.7	69	83.3	347		
	27-July	3	366	52			25.0	91	75.0	275		
Julv	4-	10	594	47			4.3	26	95.7	568		
1	11-	17	2,238	147			2.7	61	83.7	1,873	13.6	304
	18-	24	573	42			4.8	27	21.4	123	73.8	423
	25-	31	578	15			0.0	0	33.3	192	66.7	386 (

(continued on next page)

APPENDIX TABLE 1 (cont.). Red Bluff Diversion Dam Adjusted Salmon Counts November 1, 1981 through January 1, 1982.

			Adjusted	Number	Late-fall run Winter run			Spring	Spring run		run	
	Week		count	sampled	Percent	Number	Percent N	Tumber	Percent	Number	Percent	Number
					• • • • • • • • • • •							
<u>1982</u>								_		• • •	- • •	
Aug.	1-	7	687	51			0.0	0	45.1	310	54.9	377
	8-	14	1,773	198			·		58.6	1,039	41.4	734
	15-	21	1,554	103				,242	73.8	1,147	26.2	407
	22-	28	2,738	152					54.6	1,495	45.4	1,243
	29-Sept	. 4	3,694	149					57.7	2,131	42.3	1,563
Sept	. 5-	11	9,249	130					60.0	5,549	40.0	3,700
-	12-	18	7,611	286					48.3	3,676	51.7	3,935
	19-	25	6,793	152					27.0	1,834	73.0	4,959
	26-Oct.	2	6,236	124					12.1	755	87 .9	5,481
œt.	3-	9	6,195	44					6.8	421	93.2	5,774
	10-	16	5,809	78							100.0	5,809,
	17-	23	5,202	288	6.6	343				23,438	93.4	4,859 a
	24-	30	3,921	14	14.3	561			<u> </u>		85.7	3,360 <u>u</u>
ю.	1-	6	2.338	15	6.7	157					93.3	$2,181\frac{d}{d}$
	7-	13	2,019	110	40.0	808					60.0	1,211
	, 14-	20	1,130	68	38.2	432					61.8	698
	21-	27	1,015	8	75.0	761					25.0	254
	8-Dec.	4	684	20	35.0	239					65.0	445
Dec.	5-	11	912	44	77.3	705	2.3	21			20.4	186
	12-	18	1,107	150	96.0	1,063	0.0	, 0			4.0	, 44
	19-	25	299 1	no sample	62.0-	<u>c/</u> 185	5.4 ^C	/ 16			32.6-	-/ <u>98</u>
	26-Jan.	1	672	13	100.0	672	0.0	0			0.0	0
											C	48,431
То	tal 1982											
<u>(C</u>	alendar	year)	79,845	2,803		6,726	•	1,250		23,438		48,431

* Portion of run passing RBDD during 1981, and expected to spawn during 1982. For a weekly breakdown of numbers, see 1981 Central Valley Spawning Stock Estimates, (Reavis 1983).

____ Indicates the size of the salmon run passing RBDD with the potential of spawning during calendar year 1982.

 \underline{a}^{\prime} Based on a 6-year average (1976-81).

' Based on a 6-year average (1976-81).

 \underline{c}' Based on a 6-year average (1976-81).

 \underline{d} / Includes a total of 1,086 fish trucked to Tehama-Colusa Fish Facility.

APPENDIX	TABLE	2.	Estimated Monthly Chinook Salmon Sport Catch in the
			Sacramento River Between Keswick Dam and Red Bluff
			Diversion Dam, Divided into Landings from the Four
			Runs that Spawned There in 1982, Based on Their
			Percentages (Occurrence) in the Counts at Red Bluff
			Diversion Dam.

			Late-fal	l run	Winter	run	Spring	run	Fall	run
Year	Month	Catch	Percent	Catch	Percent	Catch	Percent	Catch	Percent	Catch
1981	Oct.	116					3.5	4	96.5	112
	Nov.	54	23.2	13					76.8	41
	Dec.	1	72.9	1	1.1	0			26.0	0
1982	Jan.	_					- <u>-</u>	-	<u> </u>	<u> </u>
	Feb.	_								4 - 1
	Mar.	_								
	Apr.	_		14						
	May	-								
	June	33			20.3	7	79.7	26		
	July	81			2.9	2	69.2	56	27.9	23
	Aug.	187				9	59.1	111	40.9	76
	Sept.	176				· · · ·	41.5	73	58.5	103
	Oct.	778	4.3	33			2.0	16	93.7	729
	Nov.	206	33.2	68					66.8	138
	Dec.	-								
1982 ' (Cale	Total ndar year)	1,461		101	<u> </u>	9	<u>, , , , , , , , , , , , , , , , , , , </u>	282		1,069
	2									

 \approx Total catch from run that spawned in 1982.

	Late-fall	Winter	Spring	F all	
	run	run	run	run	Total
Keewick Dam to Red Bluff*					
a/	ab/	1 000	00.15/	10 orac/	/ 7 / 00
Sacramento River Main Stem-	3,981-	1,233	23,156	19,052	47,422
Battle Creek (Total)	<u>a/</u>	<u>a</u> /	<u>u</u> /	(26,795)	10 500
Coleman Hatchery	43	<u>d</u> /	<u>d</u> /	19,525	19,000
Below Hatchery	d/	<u>a</u> /	<u>d</u> /	7,270	1,270
Clear Creek	8/5				1,000
Cottonwood Creek				700	700
Paynes Creek					
TOTAL Keswick Dam to Red Bluff	4,899	1,233	23,156	47,362	76,650
Red Bluff to Princeton Ferry					
Sacramento River Main Stem (To	tal) a/	d./	47	(23,833) ^{e/}	
Red Bluff to Tehama		<u> </u>	<u> </u>	16,730	16,730
Tehama to Woodson Bridge				3,391	3,391
Woodson Bridge to Princeton	Ferry			2,487	2,487
Tehama-Colusa Spawning Cham	nel			1,225	1,225
Salt Creek				20	20
Antelope Creek			d/	162	162
Craig Creek			_	90	90
Dye Creek				25	25
Mill Creek	d/	d/	700	1,290	1,990
Toomes Creek		<u> </u>		15	15
Deer Creek			1,500	480	1,980
TOTAL Red Bluff to Princeton Fe	rry		2,200	25,915	28,115
Butte Creek to American River					
Butte Creek	a/	<i>a</i> /	534	a./	534
Feather River	(2.000)	<u>u</u> /	(2,000)	(55,519)	(59 519)
Hatchery	402		1,910	7.563	9,875
Below Hatchery	1 598		90	47,956	49,644
Yuba River	1,550		d/	39,367	39,367
American River				(43,898)	(43,898)
Hatchery				10,898	10,898
Below Hatchery				33,000	33,000
TOTAL Butte Creek to					
American River	2,000		2,534	138,784	143,318
GRAND TOTAL					
Sacramento River System	6,899	1,233	27,890	212,061	248,083

APPENDIX TABLE 3. Summary of Chinook Salmon Population Estimates for the Sacramento River System, 1982.

Includes other tributaries except Battle, Clear, Cottonwood, and Paynes creeks.
a/ Spawning populations equals total run (adjusted Red Bluff Dam counts) minus the sport catch and estimates of surveyed tributaries. Includes salmon hauled from Keswick and Red Bluff Diversion dams to other locations.

b/ Includes 247 trapped at Keswick Dam and hauled to Coleman Hatchery.

C/ Includes 235 trapped at Keswick Dam and hauled to Coleman Hatchery and 1,086 trapped at Red Bluff Diversion Dam and hauled to Tehama-Colusa Spawning Channel.

d/ No estimate.

e/ Includes spring run.

Area	Winter run	Fall run	Total
Cosumnes River		<u>a/</u>	
Mokelumne River		(9,372)	
Hatchery		2,677	2,677
Below Hatchery		6,695	6,695
Calaveras River	a/		
Stanislaus River	-	<u>a</u> /	
Tuolumne River		7,126	7,126
Merced River		(3,263)	
Fish Facility		189	189
Below Fish Facility		3,074	3,074
TOTALS		19,761	19,761

APPENDIX TABLE 4. Summary of Chinook Salmon Spawning Population Estimates for San Joaquin River System, 1982.

a/ No estimate.

	Sacramento River system			en		Sacramento										·
	abo	we Red B	luff,		Battle	main stem	tem Feather		Yuba	American	Cosumnes	Mokelumne	Stanislaus	Tuolumne	Merced	a). a/
	exclu Leter	ding Bat	tle Gree	ek.	creek	below Ked Bluff	River	<u> </u>	Kiver	Kiver	Kiver	Kiver	Kiver	Kiver	Kiver	All races
Year	fall	Winter	Spring	Fall	Fa11	Fall	Spring	Fall	Fall	Fall	Fall	Fall	Fall	Fall	Fall	combined
1964	<u>b</u> /	<u>b</u> /	<u>b</u> /	150 ^{c/}	16	6	3	38 <u>c</u> /	35	59 ·	2	2	4	2	0.04	7
1965	<u></u> b/	<u>b</u> /	<u></u> b/	_107 <u>¢</u> /	9	2	0.7	23 <u>c</u> /	10	39	0.8	1.3	2	3	0.09	2
1966	<u>b</u> /	<u>b</u> /	<u>b</u> /	124 <u>c</u> /	3	3	0.3	21 <u>c/</u>	8	27	0.6	0.7	3	5	0.04	1
1967	<u>b</u> /	<u>b</u> /	<u>b</u> /	84 <u>c</u> /	5	9	0.1	12 ^{c/}	24	23	0.5	3	12	7	0.6	1
1968	<u>b/</u>	<u>ь</u> /	<u>b</u> /	116 <u>c</u> /	6	12	0.2	18 <u>c</u> /	7	31	1.5	1.7	6	9	0.5	2
1969	<u>b</u> /	<u>ь</u> /	20	130	6	18	0.3	61 <u>c/</u>	Ś.	47	4	3	12	32	0.6	5
1970	<u>b</u> /	<u>ь</u> /	4 .	70	7	6	0.2	62 <u>c</u> /	13	37	0.6	5	9	18	5	5
1971	17	53	6	59	5	23	0.5	47 <u>c</u> /	6	52	0.5	5	14	22	4	5
1972	33	28	7	36	5	15	0.3	47 <u>c</u> /	9	25	1.6	1.1	4	5	3	3
1973	22	23	7	44	8	17	0.2	74 <u>c</u> /	24	95	0.9	3	1.2	2	1.1	6
1974	6	19	4	49	4	28	0.2	66	18	62	0.3	1.4	0.8	1.1	2	8
1975	18	23	10	55	5	36	0.7	43	6	40	0.7	1.9	1.2	1.6	2.4	15
1976	16	33	25	57	5	36	0.7	62	4	28	0	0.5	0.6	1.7	1.9	1
1977	9	16	13	40 <u>d</u> /	<u>b</u> /	46	0.2	46	9	48	° O	0.3	0	0.4	0.4	13
1978	12	25	6	35	4	48	0.2	38	7	21	0.1	- 1.1	0.05	1.3	0.6	3
1979	10	2	3	48	13	67	0.25	33	12	48	0.15	1.5	0.11	1.2	2.1	2
1980	9	1	9	22 [•]	14	30	0.7	35	13	50	0.2	3.2	0.1	0.5	2.8	2
1981	7	20	21	29	17	43	1.0	53	13	64	<u>b</u> /	5.0	1.0	14.3	10.4	10
1982	5	1	23	20	27	24	2.0	58 ^{e/}	39	44	b/	9	<u>b</u> /	7	3	5

APPENDIX TABLE 5. Sacramento-San Joaquin Valley Chinook Salmon Spawning Stock Estimates, 1964-1982, in Thousands of Fish. Spawning Stock Estimates from 1953-1963 Can Be Found in Taylor (1974a),

a/ This includes streams which a few hundred chinook salmon enter most years (e.g., Mill, Deer, and Dye creeks) as well as streams which chinook salmon enter only in wet years (e.g., Dry and Singer creeks and the Calaveras River).

- \underline{b}' No estimate. \underline{c}' Some spring- \underline{d}' Includes Bati
- $\frac{C}{T}$ Some spring-run fish may have been included in the fall-run estimate.
- d/ Includes Battle Creek.
- e/ Includes 2,000 latè-fall run.

			Number	of recoveries by	location		
Code	Hatchery of origin	Coleman	Battle Creek	Red Bluff DD	Tehama-Colusa	Other	Total
H5-01-03	Tehama-Colusa	1			4	1	6
H5-02-02	Coleman	1			10		11
H5-02-03	TT	1			5		6
Н5-02-06	11	3			-		3
H5-03-01	Coleman	21	1 (2)				22
H5-03-02	**	13	5(12)				18
H5-03-03		3	$\frac{1}{1}$ (2)		1		5
H5-03-04	11	1	- (2)	•	-		1
H5-03-05	**	13	3 (0)		з		19
Н5-03-06	11	8	1 (1)				9
H6-01-01	Coleman	8					8
H6-01-02	11	1					1
H6-01-03	*1	ĩ			1		2
H6-01-05	TT	6			-		6
H6-01-06	11	0			1		1
6-41-07	Feather	1					1
6-48-14	Mokelumne	1			4		5
6-48-16	11			1			1
6-58-16	Feather	1			4	3	8
6-58-17		2	1 (2)		18		21
6-58-18	11	3			5		8
6-58-19	81				1		1
6-58-21	**				5		5
6-58-25	11				1		1
6-60-16	Coleman	48	2 (2)				50
6-60-17	11	36			6		42
6-60-18	11	16			1		17
6-60-19	11	11					11

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APPENDIX TABLE 6. Coded-Wire-Tags from Chinook Salmon Carcasses Recovered in Central Valley Stream North of the Feather River and at Coleman Hatchery, 1962.1/

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APPENDIX TABLE 6 (cont). Coded-Wire-Tags from Chinook Salmon Carcasses Recovered in Central Valley Streams North of the Feather River and at Coleman Hatchery, 1982.

			Number	of recoveries by	location		
Code	Hatchery of origin	Coleman	Battle Creek	Red Bluff DD	Tehama-Colusa	Other	Total
6-60-20	Coleman	4			4		8
5-60-21	F1	1			4		5
6-60-22	31	22					22
6-60-23	H	30					30
5-60-24	**	1					1
6-60-25	*1	1					1
5-62-09	Feather				1		1
5-62-11	**	1			4		5
5-62-12	11				6		6
5-62-14	**				1		1
5-62-15	**				1		1
Jnknown	2/	53					53
TOTALS		313	14	1	91	4	423

Numbers in parenthesis are tag expansion values.

All fish in this group had Adipose fin clips. Most did not have a coded wire tag or the tag was lost after removal.

APPENDIX TABLE 7.	Coded Wire Tags from Chinook Salmon Carcasses	
	Recovered in Central Valley Streams and Hatcheries	
	from the Feather River and South, in 1982. \pm /	

					Number	of recoverie	es by loc	ation		
	Hatchery	Feather	Nimbus	Mokelumne	Merced	Feather	Yuba	American	Merced	
Code	of origin	R. Hry.	Hry.	R.F.I.	F.F.	R.	R.	R.	<u>R.</u>	Total
H5-02-06	Coleman	5								5
H5-02-07	ŧ	2								2
		_								-
H5-03-04	n	1								1
H6-01-02	**	1								1
6-41-05	Feather			1						٦
6-41-06	"	1		-	1					2
6-41-07	89	-		1	Ŧ					1
6-41-08	11	1		*	1					2
• • • • • •		± .			7					4
6-46-11	Merced				1					1
6-46-12	11				4				1(3)	ŝ
6-46-14	81				1				L (J)	1
6-46-15	**				6					6
6-46-16	n			1	Ũ					1
				-						*
6-48-11	Mokelumne			50						50
6-48-12	II .		7	5				1		13
6-48-13	"	5	1	-				· 1		
6-48-14	11	4	8	3	1			_	1(3)	17
6-48-15				19					2,0,	19
6-48-16	**	3	1	6				1		11
6-48-17	**	1		4				-		5
				-						5
6-58-16	Feather	1	1			2 (2)				4
6-58-17	17	64	10	10		1 8 (109) 1(56)) 7		110
6-58-18		14	4	16	2	1(14)	(30)	3(124)	10
6-58-19		74			1	5(18)				40 80
6-58-21		50	4	2		3(42)		6		65
6-58-22	n	34		1		2 (15)		ĩ		38
6-58-23	63	6		—		1(1)		-		7
-						-(1)				•

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APPENDIX TABLE 7 (cont.) Coded-Wire-Tags from Chinook Salmon Carcasses Recovered in Central Valley Streams and Hatcheries from the Feather River and South, in 1982.

	Hatchery	Feather	Nimbus	Mokelumne	Merced	Feather Y	uba	American	Merced	
Code	of origin	R. Hry.	Hry.	R.F.I.	F.F.	<u>R.</u>	R	R.	<u>R.</u>	Total
6-58-24	Feather	4		1						5
6-58-25	II II	3	1	1						5
6-58-26		4	_	1						5
6-58-27	81	3								3
6-60-09	Coleman	1								1
6-60-21	**	1								1
6-61-12	Trinity	1								1
6-62-06	Feather	4				1(1)				5
6-62-07	91	48			`	6(19)				54
6-62-08	11	81	6		1	11(76)		8		107
6-62-09	11	120	2	1		14(118)		2		139
6-62-10	11	65				2(40)				67
6-62-11	Ħ	41	1			5(44)		2		49
6-62-12	11	87	4	2	1	11(89)		2		107
6-62-14	11	2								2
6-62-15	11	37		2				1		40
Unknown	2/	107	9	32	1					149
TOTALS		876	59	159	21	82(588)	1(56)	35 <u>3</u> /	2	1,240

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Number of recoveries by location

 $\frac{1}{2}$ Numbers in parenthesis are tag expansion values.

All fish in this group had Adipose fin clips. Most did not have a coded-wire-tag or the tag was lost after removal.

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 $\frac{3}{2}$ Of the total, 34 of the CWT recoveries were from angler-caught fish.