

KING (CHINOOK) SALMON SPAWNING ESCAPEMENT IN THE UPPER TRINITY RIVER, 1963

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by
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INTRODUCTION

Surveys of the Upper Trinity River, made in 1955 and 1956, showed that approximately 47 and 58 percent, respectively, of the king salmon (Oncorhynchus tshawytscha) spawning took place above Lewiston Dam site (Gibbs, 1956 and Gibbs' unpublished manuscript).

In 1958, during the construction of Trinity and Lewiston dams, a weir and temporary trapping facility were constructed about 1 mile below Lewiston Dam site. In 1958 and 1959, salmon were trapped at this facility, transported above the Trinity Dam construction area and released (Murray, 1959, 1961). In 1960, 1961, and 1962, ripe fish were spawned at the trapping site. The resulting eggs were hatched in incubators and the swim-up fry released into the Trinity River at Lewiston (Murray, 1962a, 1962b, 1964).

By the fall of 1963, Trinity and Lewiston dams were in operation. Stream flow was regulated and summer temperatures were reduced for several miles below Lewiston Dam. In late September, a ladder was completed over the weir at the now abandoned trapping facility. This allowed fish to move upstream and enter the new Trinity River Hatchery located immediately below Lewiston Dam.

In view of the changes that had occurred in the Trinity River, a third spawning bed survey was conducted in the fall of 1963. The following information was desired:

1. Estimate the number of spawning salmon.
2. Composition of the spawning escapement.
3. Determine if any changes had occurred in the areas utilized by the spawning salmon.

METHODS

The Trinity River between Lewiston Dam and the mouth of the North Fork of the Trinity at Helena was divided into sections to determine relative use by spawning fish (Figure 1, Table 1). The divisions were the same as those used in the previous surveys (Gibbs, 1956, and Gibbs' unpublished manuscript). Five tributaries were also surveyed.

The survey of the main stem of the Trinity River was conducted by two teams of two men, with one man from each team walking along each shore of the stream. One man was able to survey a given length of a tributary stream. The first 50 fish tallied each day by each man were measured to the nearest inch, fork

length. The remaining fish were not measured, but were recorded by sex and as larger or smaller than 23-7/8 inches, fork length. (The legal size limit for commercially-caught king salmon is 26 inches total length; 23-7/8 inches is the corresponding fork length.) The completeness of spawning of each female was recorded. Females were considered spent if only a few hundred eggs remained in the body cavity. All of the carcasses examined were cut in two to avoid duplication of data.

Aerial counts of redds were made to obtain additional information on the relative use made of the spawning areas.

Because of overlap in their spawning times, no attempt was made to distinguish between the fall and spring runs.

RESULTS

Between October 22 and November 29, three complete and three incomplete survey runs were made on the Trinity River between Lewiston Dam and the North Fork at Helena. Three runs were made on Rush Creek; two runs on Brown's Creek, Canyon Creek and the North Fork; and one run on Reading Creek.

A total of 11,341 salmon carcasses was examined on the Trinity River and five tributaries (Table 3). These consisted of 5,782 males, 5,335 females and 224 skeletons. In the total carcass recovery, 33.2 percent were large males, 18.8 percent small males, 46.7 percent large females, and 1.3 percent small females.

A total of 2,105 males and 2,020 females was measured. Their mean fork lengths were 25.75 and 27.75 inches, respectively (Table 2 and Figure 2).

Most of the spawning occurred between Lewiston Dam and Douglas City. We recovered 20.8 percent of the carcasses between Lewiston Dam and the Old Lewiston Bridge, and 65.5 percent between Lewiston and Douglas City. The two sections between Douglas City and Helena were lightly used, with only 13.6 percent of all carcasses recovered in this 22 mile area. Nearly one-half of the spawning in these latter areas occurred within the first mile below Douglas City.

Of the females examined, 97.4 percent were found to be spent (Table 3). Although records were not kept of the spawning success of the males, casual observations indicated comparable success.

Aerial counts of redds were made on October 8 and 28. On the first flight, the fish were just beginning to spawn and only 100 redds were observed, all above Douglas City. The second flight was made when the fish were approaching the peak of spawning. On this flight 1,760 redds were estimated between Lewiston Dam and Helena.

Extensive crowding of fish on certain favored areas made aerial counts of redds difficult. This was particularly true in two areas: the riffle between the bridges at Lewiston and the riffle at the mouth of Grass Valley Creek. In general, the proportions of the estimated redds and the carcasses recovered in the various stream sections were similar (Table 4).

Although no attempt was made to distinguish between spring- and fall-run salmon on the spawning grounds, the number of spring-run fish handled at the hatchery

in 1963 was estimated at 500. Previously reported numbers of spring-run king salmon handled at the trapping facility varied from 284 to 556 since 1958 (Murray, 1959, 1961, 1962a, 1962b).

DISCUSSION

Distribution of fish on the spawning grounds in 1963 was similar to that found in 1955 and 1956, below the Lewiston Dam site. The most noticeable departure was an increase in the proportion of fish spawning between Lewiston and the dam. This may be attributable to concentration of fish below the weir at the old trapping site before completion of the ladder or to lower water temperatures below Lewiston Dam for a few miles.

There was a noticeable difference in the proportions of males and females at the Trinity River Hatchery and in Section 4, the river section nearest the hatchery (Table 5). Of the 6,735 fish handled at the hatchery, large males made up 23.3 percent; small males 37.7 percent, and females 39.0 percent. The 2,221 carcasses examined in Section 4 were 36.6 percent large males, 7.3 percent small males, and 56.1 percent females. For some unknown reason, almost all of the small males moved through Section 4 into the hatchery.

Recovery of carcasses in 1963 is assumed to have been as efficient as it was in 1956 when a 14.7 percent recovery of tagged fish was made on the spawning grounds (Gibbs' unpublished manuscript). The assumption of similarity in carcass recovery is based upon similar river flows and nearly identical recovery efforts for each of the two years.

During the carcass recovery period, river flows at Lewiston averaged 416 cfs. in 1956, with a range of 203 to 785 cfs. In 1963, flows ranged from 298 to 545 cfs. with a mean of 351 cfs. These differences in water level and velocity were not great enough to materially affect carcass recovery.

Assuming a recovery of 15 percent, the 11,341 carcasses counted in 1963 represent an estimated population of 76,000 (75,607) spawning fish. The additional 6,735 fish counted at the hatchery makes a total estimated Trinity River spawning population of 82,000 (82,342) king salmon in 1963.

Although 97.4 percent of all females were successful in spawning, there was a significant difference between large and small fish (fish over and under 23-7/8 inches fork length). Only 87.9 percent of the small females had spawned, compared with 97.6 percent of the large females. A chi-square test indicated that this was a significant difference and not to be expected from sampling differences.

It was also noticed during the carcass recovery that most of the small unspawned females were bright, silvery fish. This was true for only a few of the larger females.

ACKNOWLEDGMENTS

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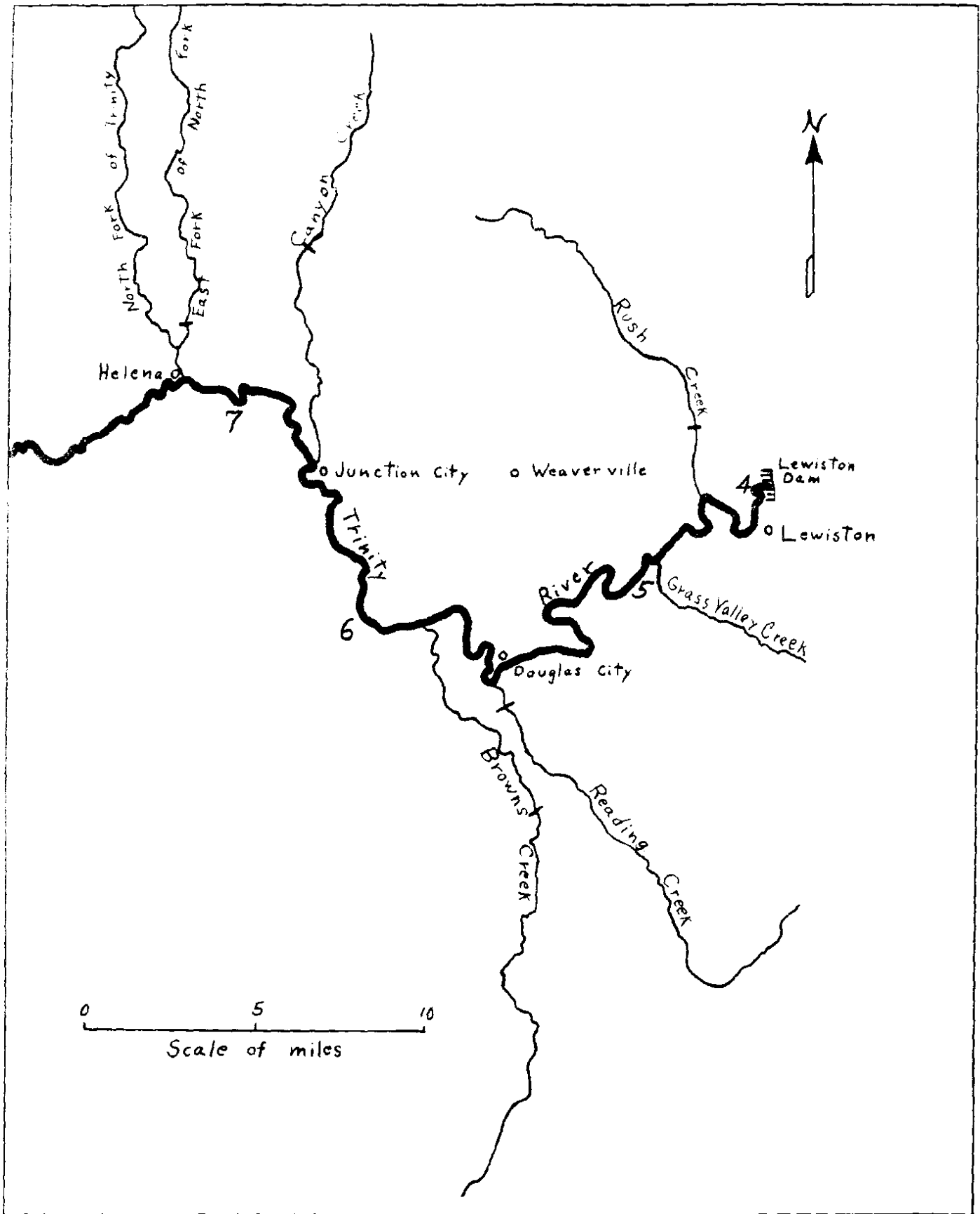


FIGURE 1. Trinity River and major tributaries between Lewiston Dam and the North Fork of the Trinity River.

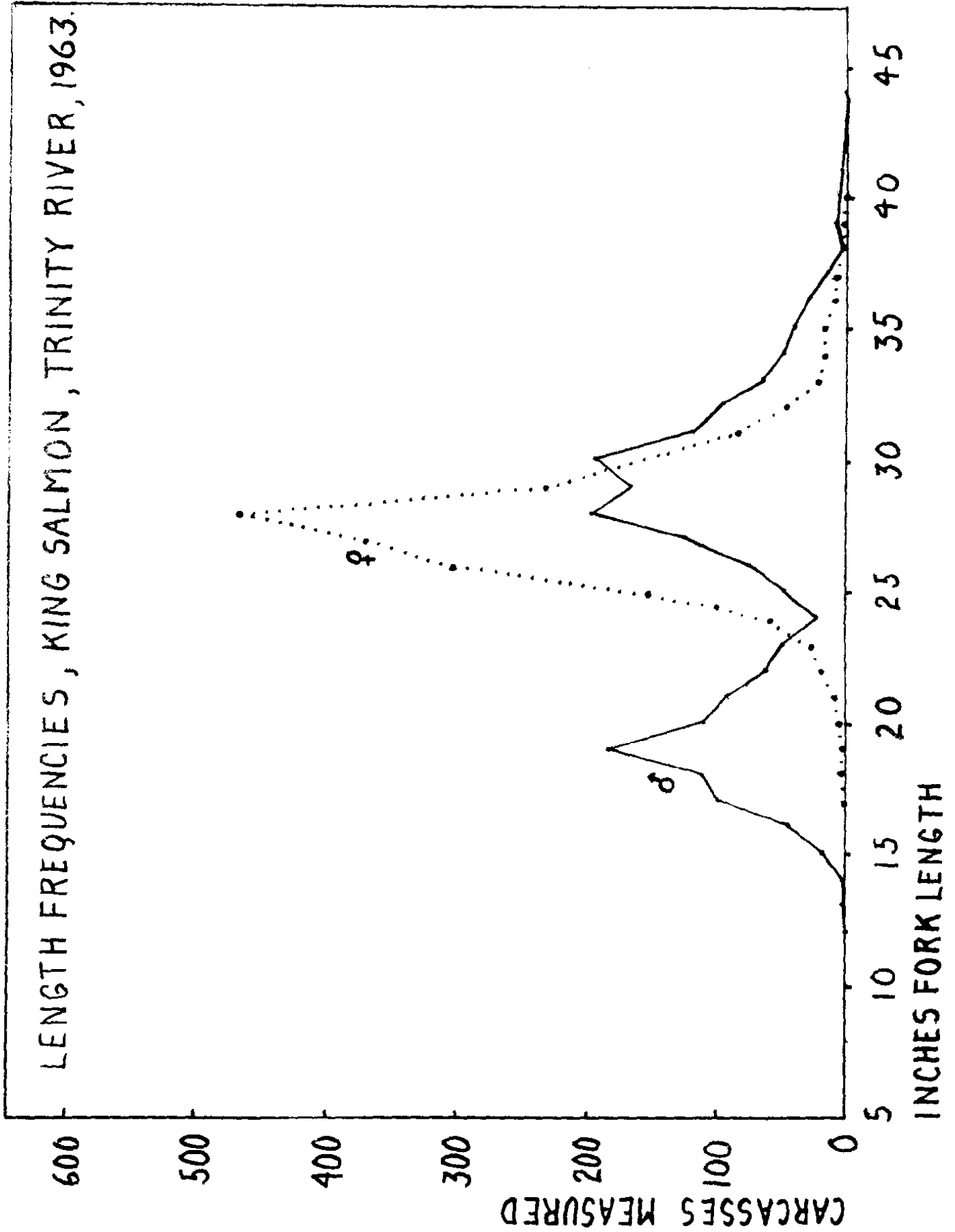


TABLE 1

NUMBER OF SALMON CARCASSES EXAMINED ON THE TRINITY RIVER, 1963

Area	Section	Distance in Miles	Oct. 22	Oct. 30	Nov. 6	Nov. 14	Nov. 20	Nov. 27	TOTAL
			Oct. 29	Nov. 5	Nov. 13	Nov. 19	Nov. 27	Nov. 29	
Lewiston Dam to Old Lewiston Bridge	4 ^{1/}	2	438	502	654	404	161	90 ^{4/}	2,249
Lewiston to Douglas City Bridge	5	16	991	1,961	1,824	1,163	838	320 ^{5/}	7,097
Douglas City to Canyon Creek	6	15	163	504	402	88 ^{3/}	146		1,303
Canyon Creek to North Fork	7	7	0	63	56 ^{2/}		51		170
	Rush Creek	2	83	77			4		164
	Reading Creek	1		3					3
	Brown's Creek	8	110		27				137
	Canyon Creek	8	75	102					177
	North Fork	2	20	21					41
TOTAL		61	1,880	3,233	2,963	1,655	1,200	410	11,341

^{1/} River sections are the same as used in 1955 and 1956, except that Section 4 was 11 miles in 1955-56.

^{2/} Upper 4 miles only.

^{3/} Upper 4 miles only.

^{4/} Lower 1/2 mile only.

^{5/} Upper 6 miles only.

TABLE 2
 LENGTH FREQUENCIES OF KING SALMON CARCASSES EXAMINED
 TRINITY RIVER AND TRIBUTARIES, 1963

Fork Length in inches	FREQUENCY		
	Males	Females	Total
13	2		2
14	4		4
15	20		20
16	48		48
17	102		102
18	114	2	116
19	187	1	188
20	112	3	115
21	97	6	103
22	67	17	84
23	53	23	76
24	26	59	85
25	52	153	205
26	80	302	382
27	127	371	498
28	198	466	664
29	170	231	401
30	196	193	389
31	120	83	203
32	98	46	144
33	67	20	87
34	51	15	66
35	46	15	61
36	31	7	38
37	15	3	18
38	3	2	5
39	7	1	8
40	6	1	7
41	3		3
42	2		2
43	1		1
Totals	2,105	2,020	4,125
Mean lengths	25.75	27.75	26.73

TABLE 3

KING SALMON CARCASSES MEASURED AND EXAMINED FOR SPAWNING SUCCESS, TRINITY RIVER, 1963

Sex	Size	River Sections				Rush Creek	Reading Creek	Brown's Creek	Canyon Creek	North Fork	TOTALS	Percent
		4	5	6	7							
Male	Over 23-7/8 inches	812	2,225	407	61	58	0	40	76	10	3,689	33.2
	Under 23-7/8 inches	163	1,537	278	41	31	0	9	27	7	2,093	18.8
	Total Male	975	3,762	685	102	89	0	49	103	17	5,782	
Female	Over 23-7/8 inches											
	Spent	1,183	3,053	544	55	68	3	75	69	21	5,071) 46.7
	Ripe	16	86	13		2			1		123	
	Under 23-7/8 inches											
	Spent	44	62	12		1		2	2	1	124) 1.3
	Ripe	3	10	3				1			17	
Total Female	1,246	3,211	577	55	71	3	78	72	22	5,335		
Total, Sex Determined		2,221	6,973	1,262	157	160	3	127	175	39	11,117	100.0
Sex not determinable, (Skeletons)		28	124	41	13	4	-	10	2	2	224	
GRAND TOTALS		2,249	7,097	1,303	170	164	3	137	177	41	11,341	

TABLE 4

COMPARISON OF AERIAL REDD COUNTS WITH CARCASS RECOVERIES,
TRINITY RIVER, 1963

River Section	Aerial Count ^{1/}		Carcass Recovery ^{2/}	
	Redds	Percent	Carcasses	Percent
4	230	13.1	1,755	20.1
5	1,065	60.5	5,614	64.1
6	370	21.0	1,215	13.9
7	95	5.4	170	1.9
TOTALS	1,760	100.0	8,754	100.0

^{1/} Average of two observers on October 28 flight.
^{2/} Total of three complete and one nearly complete run.

TABLE 5

KING SALMON SPAWNING POPULATION STRUCTURE, TRINITY RIVER, 1963

	Total Carcass Recovery		Section 4		Trinity River Hatchery	
	Number	Percent	Number	Percent	Number	Percent
Large Males	3,689	33.2	812	36.6	1,569	23.3
Small Males	2,093	18.8	163	7.3	2,539	37.7
Females	5,335	48.0	1,246	56.1	2,627	39.0
TOTAL	11,117	100.0	2,221	100.0	6,735	100.0