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A SPAWNING ESCAPEMENT SURVEY OF ANADROMOUS SALMONIDS IN THE UPPER TRINITY RIVER, 1971

by

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Region 1, Inland Fisheries

Anadromous Fisheries Branch

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ABSTRACT

In the fall of 1971 a salmon and steelhead tag and recovery program was conducted on the upper Trinity River. From September 8 through November 11, 1,163 chinook salmon, Oncorhynchus tshawytscha; 54 coho salmon, O. kisutch; and 142 steelhead, Salmo gairdneri gairdneri, were trapped during their spawning migration and tagged with numbered spaghetti tags. Later, samples were taken on the spawning grounds and at Trinity River Hatchery to determine abundance of these tagged fish. A total of 15,507 chinook salmon was examined, 69 were tagged chinooks recaptured within the study area. Forty-seven coho salmon were collected at the hatchery, only 4 of these were previously tagged. Only 2 tagged steelhead were recaptured from a sample of 309.

Chinook salmon spawning escapement was estimated to be 166,510, of which 43% were spring-run fish.

The estimated coho salmon spawning escapement was 509 spawners.

Insufficient data prevented an estimation of the size of the steelhead run.

The mean fork length for male chinook salmon was 66.5 cm; females averaged 68.8 cm. The male-to-female ratio was 1:1.04.

The upper 29 km of the 64.3-km study area received 85% of the salmon spawning activity.

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INTRODUCTION

This was the ninth salmon spawning survey conducted on the Trinity River and the sixth since construction of Trinity and Lewiston Dams. The first three, one by the U. S. Fish and Wildlife Service (Moffett and Smith 1950) and the other two by the Department of Fish and Game (Gibbs 1956 and Weber 1965), were preproject evaluations of the salmon resources of the Trinity River prior to dam construction. The last five (La Faunce 1965, 1968; Rogers 1970, 1973; and Smith 1975) and this survey were conducted to evaluate the fishery resources in relation to post project changes in the river and to proposed water development farther downstream (Helena Project). They also served as a mechanism to provide data input for establishing current management practices. The present survey was conducted to evaluate the salmon and steelhead resources within the upper Trinity River for possible mitigation for lost fisheries habitat as a result of downstream water development and to determine the effects of the Trinity Project on anadromous fish runs, particularly steelhead.

METHODS

From September 8 to November 11, 1971, salmon and steelhead were trapped and tagged near Del Loma on the Trinity River (Figure 1). Details of trap construction and operation as well as the tagging method were the same as described by Smith (1975), except spaghetti tags were used in place of Floy dart tags.

The fish ladder at Trinity River Hatchery was opened on August 24 and fish began entering the hatchery. Both tagged and untagged salmon and steelhead were recovered. The last salmon was taken on November 19, 1971, but steelhead continued to enter the hatchery until April 23, 1972 (Bedell 1972). Steelhead were also recovered in Manzanita Creek from January 21 to April 3, 1972 (H. Newhouse, Humboldt State University, pers. commun.).

The length of every fish entering the hatchery was measured to the nearest inch. Since salmon tagging in the river did not begin until September 8, tagged salmon had not yet become distributed within the spawning population. Therefore, chinook salmon trapped at the hatchery during the 5-week period (August 24 through September 27) were added to those estimated to have spawned in the ensuing 8 weeks (September 27 through November 18).

From October 18 through November 18, salmon were recovered on the spawning grounds using the same techniques as in previous surveys (La Faunce 1965, 1968; Rogers 1970, 1973; and Smith 1975). The area surveyed during this study was located between the North Fork Trinity River and the Lewiston Dam. This area corresponds to survey areas 4, 5, 6, and 7 referenced in preproject surveys (Gibbs 1956). Survey areas 1, 2, and 3 became inundated once the Trinity and Lewiston dams were completed and filled.

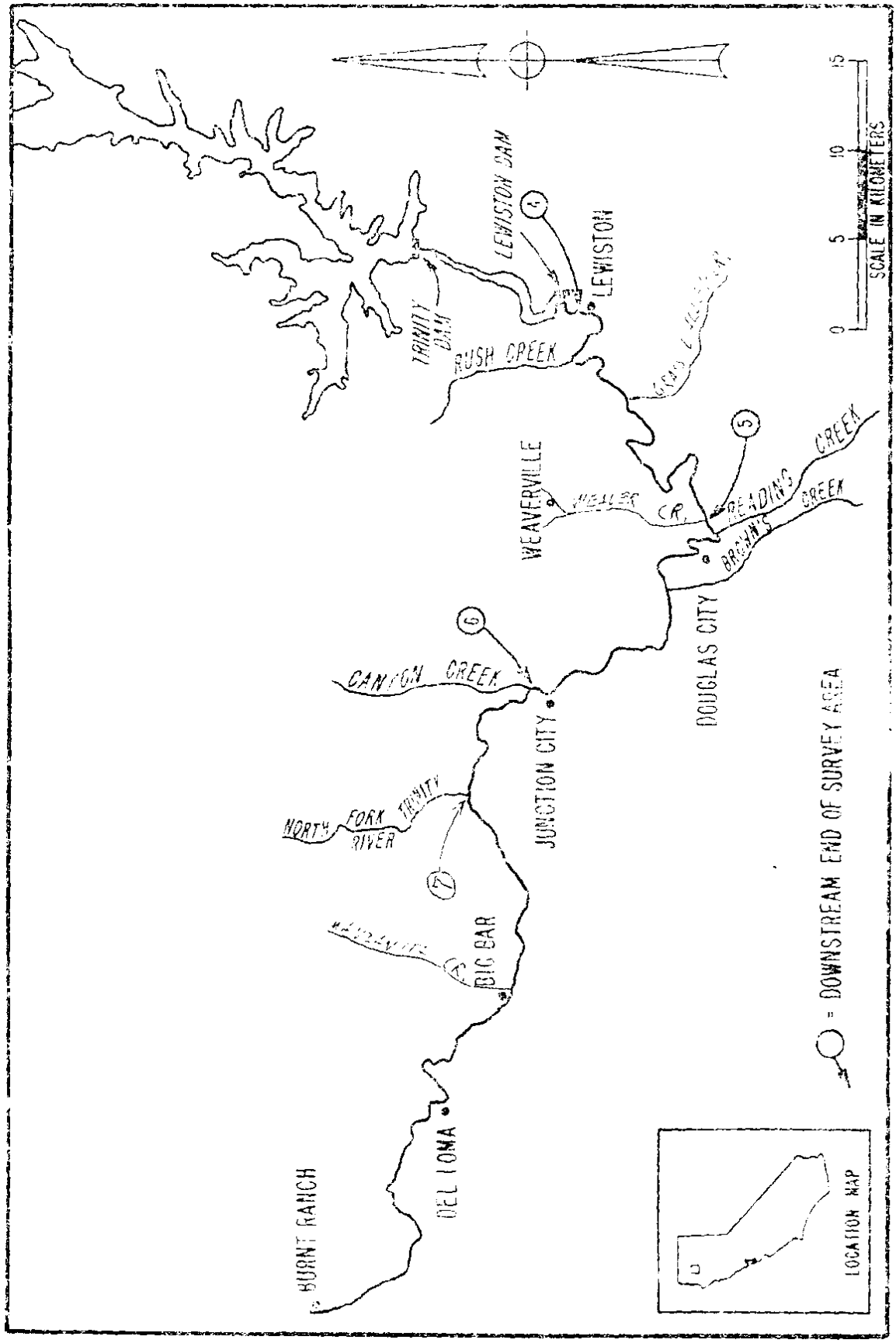

FIGURE 1. Upper Trinity River sections and tributary streams surveyed. Numbered river sections established in earlier surveys and used here for comparison. Sections 1, 2 and 3 were inundated when Lewiston and Trinity dams filled.

The estimate of chinook salmon spawning escapement was calculated by the method of Schaefer (1951) from tagging data collected from September 8 through November 11 and from hatchery recovery data collected from September 27 through November 18. The tags from chinook salmon returned by anglers and those known to have spawned and died below the study area were not used to estimate spawning escapement. The fish spawning below the study area, if considered, would be in addition to the estimated spawning escapement for the upper river. Tagged fish which died as a result of tagging were also deleted from analysis.

The Bailey variation of the Peterson method was used to estimate coho salmon and steelhead spawning escapements (Ricker 1958). P 127

An aerial count of redds provided supplemental data on the relative use of spawning areas by salmonids.

Results

From September 8 through November 11, 1,163 chinook salmon, 54 coho salmon, and 142 steelhead were trapped and tagged (Table 1).

A total of 15,507 chinook salmon was examined, 9,221 at the hatchery and 6,286 on the spawning grounds. Of those recovered on the spawning grounds, 2,165 were females, 2,078 were males, and 2,043 were skeletons (Table 2). The male-to-female ratio was 1:1.04. Mean fork lengths for males and females were 66.5 cm and 68.8 cm, respectively (Figure 2).

Only 134 of the tagged chinook salmon were accounted for: 11 died as a result of tagging, 26 were caught by anglers, 28 spawned and died below the study area, 50 were recovered at Trinity River Hatchery, and 19 were recovered on the spawning grounds.

All the sampling effort for tagged coho salmon was concentrated at Trinity River Hatchery where 47 were taken because the carcasses on the spawning grounds were impossible to identify. Of the 54 cohos tagged, 4 were taken at the hatchery and 1 died as a result of tagging.

A total of 242 steelhead was collected at the hatchery and 67 in Manzanita Creek. One of the 142 tagged steelhead was recovered at the hatchery, 1 was caught by the Humboldt State University Fishery Cooperative Unit in Manzanita Creek, and 14 were caught by anglers.

As indicated by the carcasses on the spawning grounds, 85% of the spawning activity occurred in the 29 km between Douglas City and Lewiston Dam. Almost 42% of the spawning occurred in the upper 3.2 km of this section. Only 0.9% of the spawners utilized the tributaries (Table 3).

An aerial redd count on November 18, revealed 1,039 redds in the study area. Of these, 613 (59%) were counted above Douglas City (Table 3). An additional 475 redds were counted below the study area.

TABLE 1. Summary of Tagging and Tag Recoveries, Trinity River, 1971

Species	Number tagged	Angler tag returns	Mortalities		Sample size		Tag recoveries	
			Tagging	Other	Hatchery	Spawning ground	Hatchery	Spawning ground
Chinook salmon	1,163	26	11	28	9,221	6,286	50	19
Coho salmon	54	-	1	-	47	-	4	-
Steelhead	142	14	-	-	242	67	1	1

TABLE 2. Number of Chinook Salmon Carcasses Examined on The Trinity River and its Tributaries, 1971

Area	Kilometers surveyed	Males	Females	Skeletons	Totals
Lewiston Dam to Old Lewiston Bridge	3.2	679	871	1,086	2,636
Old Lewiston Bridge to Douglas City Bridge	25.7	990	957	761	2,708
Douglas City Bridge to Canyon Creek	24.1	347	282	136	765
Canyon Creek to N.F. Trinity River	11.3	46	47	27	120
Rush Creek	3.2	4	4	20	28
Grass Valley Creek	1.6	2	1	1	4
Weaver Creek	8.0	1	0	0	1
Browns Creek	6.4	2	0	0	2
Canyon Creek	12.9	7	2	8	17
N.F. Trinity River	3.2	0	1	4	5
TOTALS	99.6	2,078	2,165	2,043	6,286

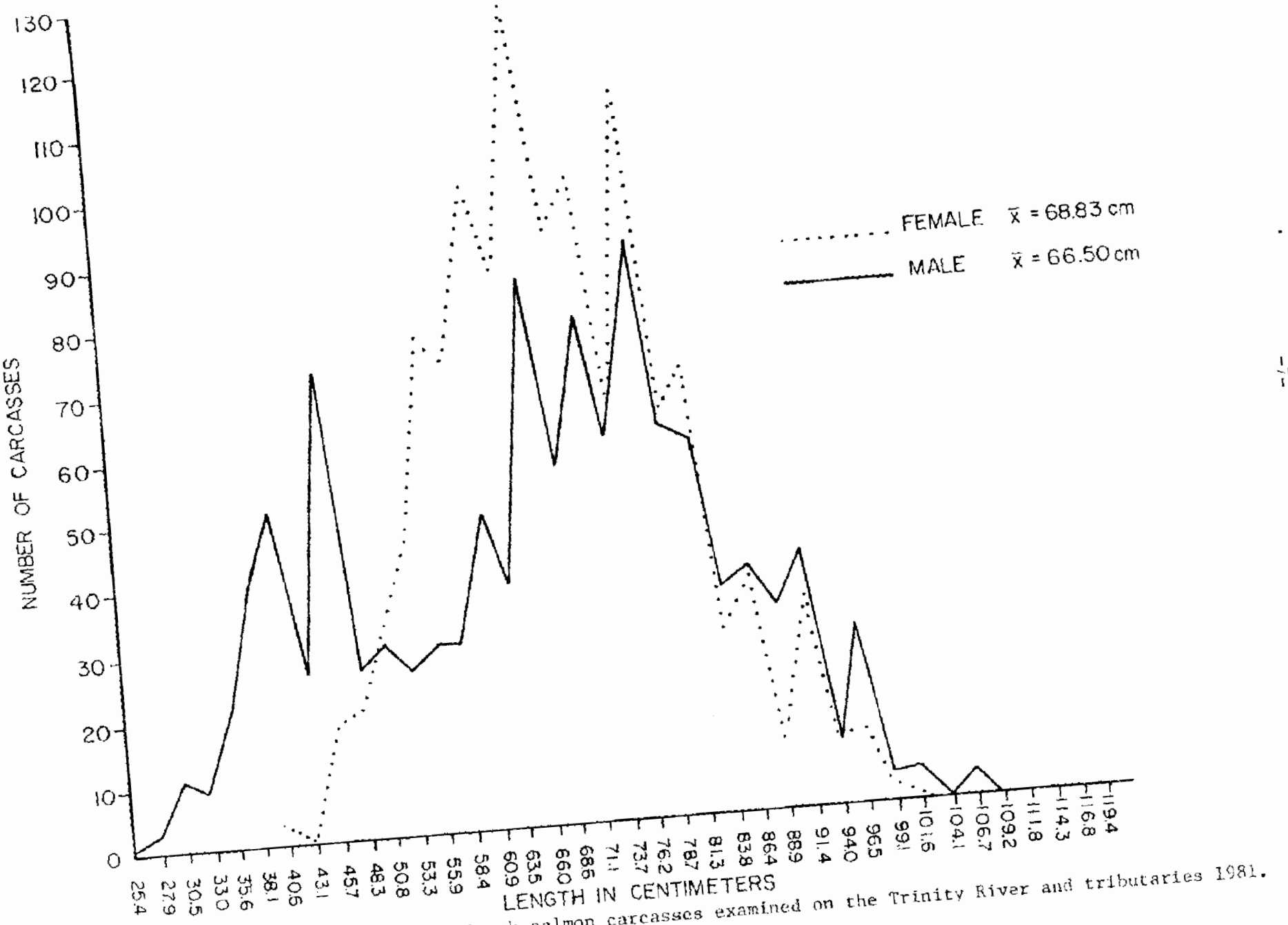

FIGURE 2. Length frequencies of chinook salmon carcasses examined on the Trinity River and tributaries 1981.

TABLE 3. Comparison of Aerial Redd Counts With Carcasses Recovered, Trinity River 1971

Survey area[a/]	River section	Kilometers	Aerial counts		Carcasses recovered		Number carcasses/ redd
			Redds	Percent	Number	Percent	
4	Lewiston Dam to Old Lewiston Br.	3.2	220	21.2	2,636	41.9	11.98
5	Old Lewiston Br. to Douglas City Br.	25.7	393	37.8	2,708	43.1	6.89
6	Douglas City Br. to Canyon Cr.	24.1	373	35.9	765	12.2	2.05
7	Canyon Cr. to N.F. Trinity R.	11.3	53	5.1	120	1.9	2.26
	Tributaries	35.3	-	-	57	0.9	-
TOTALS		99.6	1,039	100.0	6,286	100.0	

[a/] Areas 1, 2 and 3 inundated when Trinity and Lewiston dams completed and filled. Numbering of survey areas maintained for comparison to preproject surveys--Gibbs (1956).

DISCUSSION

Previous surveys of salmon spawning escapement conducted on the Trinity River used the Peterson method, or some variation of it, to measure the number of spawners. This method assumes the tagged fish are evenly distributed throughout the population and the withdrawn sample is random and represents the entire population. In actuality, the tagging and sampling occur over a period of several weeks and complete mixing cannot be assured because while some fish are migrating to the spawning areas, others have already spawned and died.

The present study used a method which considered these errors and computed spawning escapement of chinook from data collected during the last 8 weeks of a 13-week sampling period and all 10 weeks of the tagging period. This manipulation was necessary because tagging did not start until the third week of the sampling period and none of the tags appeared in the sample until the 6th week.

A total of 5,158 chinook salmon was collected at the hatchery during the first 5 weeks of the sampling period. These were added to the 161,352 fish computed from data collected in the last 8 weeks of the study, giving a total estimated spawning escapement of 166,510 chinook salmon. Of these, 70,933 (42.6%) were judged to be spring-run fish because of their deteriorated condition when they either entered the hatchery or when carcasses were found on the spawning grounds. The estimated spawning escapement is higher than the actual number of spawners because some unknown number of tagged fish probably died outside the recovery area as a result of tagging and were never accounted for, and the ability of the recovery crew to recognize tagged fish was imparied by the condition of the carcasses and working conditions. Nevertheless, chinook salmon were abundant in the river in 1971 and more entered the hatchery than in any previous year.

Comparing the number of carcasses recovered to the total number of redds within each study area reveals an interesting relationship (Table 3). A larger number of salmon used the redds located upstream (Areas 4 and 5) then those downstream (Areas 6 and 7). Eighty-five percent of the carcasses were collected on the upper 59% of the redds.

The steelhead spawning escapement was calculated in the same manner as for coho salmon. The Bailey modification of the Peterson method produced a spawning escapement estimate of 13,226 $\pm$ 12,898 (95% confidence interval). Since only two marked fish were recaptured the data were insufficient to arrive at a usable statistic.

During the last 4 years there has been a decline in mean length of chinook salmon measured on the spawning grounds (Table 4). It is not known whether this is part of a natural phenomenon or the result of man's manipulation of the fishery. Formerly, about half of the chinook salmon caught in the ocean troll fishery were 4 years old and the other half was made up of 3- and 5-year-old fish. Now 3- and 4-year-olds each comprise about half of the catch, with a corresponding decrease in the average size (Frey 1971). Another contributing

factor to this decrease is the Indian gillnet fishery on the lower Trinity and Klamath rivers where 7.25- to 7.5-in. mesh nets are more or less standard. Also, the operation of Trinity River Hatchery has increased the size of the spring chinook salmon runs. Spring-run chinooks have 4 to 6 months less ocean growth than the fall-run and are correspondingly smaller.

TABLE 4. Mean Lengths of Chinook Salmon Observed on the Spawning Grounds from 1968 to 1971

Year	Mean lengths	
	Male	Female
1968	72.9	75.2
1969	69.3	73.2
1970	70.4	71.9
1971	66.5	68.8

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