

Statistical Analysis of Adult Chinook
Salmon Spawned at Rowdy Creek Fish Hatchery, 1980

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INTRODUCTION

Rowdy Creek fish hatchery (Smith River, California), is the only private, non-profit anadromous fish hatchery in California. The hatchery is located on Rowdy Creek, a tributary of the Smith River system, and is operated for the purpose of enhancing the salmon and steelhead resources of the Smith River. All operating funds for the hatchery are obtained through public and private donations of time, labor and materials and local fund raising events.

The 1980 winter season noted the first significant return of adult chinook salmon to the hatchery. Some 178 chinooks returned to the hatchery via the fish ladder. Another 133 chinooks were trapped in the main Smith River and spawned at the hatchery. The number of adult chinooks spawned at Rowdy Creek hatchery were statistically analyzed for the purpose of providing information to better operate the hatchery program.

SAMPLING METHOD AND STATISTICAL ANALYSIS

Scale samples were taken from each adult chinook salmon spawned and used to age the individual fish. The total length, weight and sex was determined for each chinook and recorded on the scale sample envelopes. Total length was measured to the nearest half inch and weight to the nearest half pound.

The chinook salmon spawned at the hatchery were divided into two major categories: those chinook captured in the main Smith River (termed "main river") and those chinook that entered the hatchery up the fish ladder (termed "up ladder"). These fish were kept separate in holding tanks and during the spawning process.

Both major categories of chinooks were statistically analyzed (range, mean and percent of return) for total length and weight of each age class and sex. Analysis was attempted only in age classes where significant numbers of fish were sampled (three or more fish); allowing more than one statistical degree of freedom.

During the aging of the fish by scale samples, it was noted that the early growth stages (freshwater) of the hatchery chinooks showed identifiable differences in the circuli spacing of the scales when compared to the native chinooks. It was therefore possible to separate hatchery fish and native fish for growth and age analysis. Any fish scales that had unidentifiable differences in circuli were categorized as native fish.

RESULTS

Total Length and Weight

Table 1 lists the range and mean total lengths and weights of 3 and 4 year old female chinooks that entered the hatchery (up ladder), or were captured in the Smith River (main river). The age class statistics are also listed as native or hatchery fish.

Table 2 lists the range and mean total lengths and weights of 2, 3 and 4 year old male chinook salmon that entered the hatchery or were captured in the Smith River. The age class statistics are also listed as native or hatchery fish.

Percent of Return

The percent of return of chinook salmon was compared for several categories: age class, male vs. female, native vs. hatchery, up ladder vs. main river and hatchery mark returns. These percent of returns are presented because they may show some future "trends" in chinook returns. The "percent of return" mentioned in this analysis represents the actual percent of returning fish, not the standard percent return of salmon smolts released.

Up Ladder vs. Main River -

The netting method for capturing adult chinooks in the Smith River had numerous biases for percent of return statistics. These biases included water depth, fish densities, escapement during netting, netting time and

Age Class	UP LADDER						MAIN RIVER					
	Length (inches)		Weight (pounds)		No. of Fish		Length (inches)		Weight (pounds)		No. of Fish	
	mean	range	mean	range			mean	range	mean	range		
3 year old - Hatchery	30.0	29-32	13.3	11.5-16.5	5		29.4	27-32	11.1	9.5-13.5	8	
3 year old - Native	33.8	31-37	18.9	14.5-23.5	6		34.9	31-39	19.4	14-27	50	
4 year old - Hatchery	33.5	25-39	18.8	8-29.5	30				not analyzed		0	
4 year old - Native		not analyzed	not analyzed		0		41.3	40-44	32.1	30.5-35	4	

Table 1: The range and mean total length and weight of female chinook salmon spawned at Rowdy Creek hatchery in 1980.

Age Class	UP LADDER					MAIN RIVER				
	Length (inches)		Weight (pounds)		No. of Fish	Length (inches)		Weight (pounds)		No. of Fish
	mean	range	mean	range		mean	range			
2 year old - Hatchery	19.0	15-24	2.8	1.5-4.5	92	21.3	21-22	4.4	4-5	4
2 year old - Native		not analyzed			0	21.9	18-28	4.7	2.5-8.5	17
3 year old - Hatchery	30.4	23.5-35	12.5	5-18.5	13	30.8	26-34	12.1	8-16	12
3 year old - Native	36.2	33-38.5	22.0	15-28.5	3	35.3	30-39	18.5	12.5-26	22
4 year old - Hatchery	35.5	34-38	19.4	16.5-27	11	33.4	30-35	14.9	10.5-18	5
4 year old - Native		not analyzed			0	38.6	37-41	27.0	24-32	7

Table 2: The range and mean total length and weight of male chinook salmon spawned at Rowdy Creek hatchery in 1980.

river netting location. Therefore, the percent of returns for age class, sex and hatchery marks (none) were not determined for the "main river" fish.

The percent of native vs. hatchery fish captured during the netting process, however, was estimated from scale readings. Two nettings occurred about two weeks apart. The first chinooks netted were distinctively an earlier run (darker fish) than the chinooks in the second netting (very bright fish).

The following statistics resulted from the two nettings:

1st netting - 53 chinooks captured; 9 fish were determined as possible hatchery origin (17%).

2nd netting - 80 chinooks captured; 22 fish were determined as possible hatchery origin (27.5%).

Total fish captured - 133 chinooks

Possible Hatchery Origins - 31 (23.3%).

The possible hatchery origin of the 31 chinooks was determined by significant growth differences in the scale circuli that occur during the hatchery freshwater stage.

Some 178 chinooks entered the hatchery up the fish ladder and it was determined by scale readings that 13 of these fish were of native origin (7.3%).

Age Class -

"Up ladder" chinooks (165) were analyzed for percent of return by their sex ratio. Some 35 females (21.2%) and 130 males (78.8%) returned up the fish ladder. However, if you eliminate the jacks (precocious males) and count only the adult chinooks, the sex ratio changes drastically: 35 females (59.3%) and 24 males (40.7%).

Marked Returns -

Fourteen 2 year old chinooks returned to the hatchery with adipose fin clips. This represented a 13.2 percent of return of marked 2 year olds. The 14 marked jacks were sent to the California Department of Fish and Game lab for analysis of the coded wire tags (CWT) located in their heads. Only one of these fish did not have a CWT. This represented a CWT retention of 92.8%.

Five 4 year old chinooks returned to the hatchery with a left ventral fin clip (LV). This represented a 12.2 percent of return of marked 4 year olds.

DISCUSSION

Separating the hatchery and native run chinooks by scale analysis indicated several occurrences. First, analysis of the mean lengths and weights of female and male chinooks (Tables 1 and 2) showed a significant size difference between returning hatchery and native fish. It appeared that three and four year old hatchery chinook returned much smaller than the native run of fish for both sexes.

Second, the hatchery chinooks appeared to have a small return of three year old fish (about 10%), yet the native run fish trapped in the river had a much higher percentage of three year olds (72%). Some of this difference can be accounted for by the biases in the river netting methods. However, it appears that three year old chinooks may not be a dominant year class for hatchery returns.

Third, the number of hatchery identified (scale) three year old chinooks "up the ladder" (18 fish) and "trapped in the river" (20 fish) were about equal. Yet the number of four year old ^{hatchery} chinooks up the ladder (41 fish) was much larger than those trapped in the river (5 fish). Netting methods may account for much of this difference, but there may also be a significant difference in return time for three and four year old hatchery chinooks. If the three year old

hatchery fish are returning earlier, then there may be more of a tendency for them to stray up the Smith River system if low water conditions occur in Rowdy Creek.

The three occurrences mentioned above are not conclusive. Several years of chinook returns are needed to show true hatchery fish trends. These observations are mentioned here only to indicate possible future hatchery fish trends.

The ability to separate hatchery fish from native run fish was a result of scale growth differences. However, the author believes that the hatchery fish scales taken at Rowdy Creek Hatchery should be further analyzed by another experienced scale reader to verify and substantiate the apparent growth differences in the scale samples.

A salmon smolt marking program should be continued at Rowdy Creek Hatchery for one more year to provide a substantial number of marked adults returning to the hatchery. This would provide two generations of marked chinook salmon returning to the hatchery for 3 or 4 years.

Rowdy Creek Hatchery should analyze, through a marking program, its "time of release" methods for chinook salmon stocks. The early release (July) fish should be compared with late release (November) fish for percent returns of adult 2, 3, 4 and 5 year old fish.

A marked (LV clip) four year old female chinook salmon was found on the Winchuck River (just below the south fork) in late December, 1980. A local fisherman also reported catching two more of these LV clipped fish the week prior to this discovery. These fish are believed to be Rowdy Creek fish that had strayed up the Winchuck River.

The Winchuck is approximately seven miles north of the Smith River. The south fork of the Winchuck River has the same ridge drainage as Rowdy Creek. Therefore, it is possible that these fish strayed up the Winchuck because the attracting waters are similar to Rowdy Creek's.

A live fish and carcass count stream survey for chinooks will be conducted every two weeks on the south fork of the Winchuck River in 1981. This survey will indicate if there is any significant straying of Rowdy Creek fish to that watershed.